

Water System Analysis

Cottonflower Marketplace

SWC of Cotton Lane and Yuma Road
Goodyear, Arizona

May 2008

Prepared for:
Diversified Partners
5635 N. Scottsdale Road, Suite 150
Scottsdale, AZ 85250

Prepared by:
Kimley-Horn and Associates, Inc.
1255 W. Baseline Road, Suite 258
Mesa, AZ 85202
191235013

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TABLE OF CONTENTS

1.0 INTRODUCTION 2

 1.1 INTENT AND SCOPE 2

 1.2 GENERAL THEORY 2

 1.3 INTERNATIONAL FIRE CODE, 2003 2

2.0 HYDRAULIC CALCULATIONS..... 3

 2.1 PROJECT DESCRIPTION 3

 2.2 OFFSITE WATER INFRASTRUCTURE..... 3

 2.3 ONSITE WATER INFRASTRUCTURE 3

 2.4 FIRE FLOW DEMAND 3

 2.5 DOMESTIC DEMAND..... 4

 2.6 METHODS 5

 2.7 RESULTS 5

 2.8 RECOMMENDATIONS 6

APPENDICES 6

 Appendix A: IFC Appendix B

 Appendix B: Fire Flow Test

 Appendix C: Backflow Preventor Cut Sheet

 Appendix D: Proposed Water System Exhibit

 Appendix E: WaterCAD Fire Flow Reports

1.0 INTRODUCTION

1.1 INTENT AND SCOPE

The intent of this document is to evaluate the potable water infrastructure in the vicinity of the proposed “Cottonflower Marketplace” development, located at the SWC of Yuma Road and Cotton Lane, in the City of Goodyear, Arizona. This analysis will determine if the proposed potable water infrastructure is capable of satisfying the calculated water demands for the development in accordance with the City of Goodyear Engineering Design Standards and Policies Manual and the International Fire Code, 2003 (“IFC”).

1.2 GENERAL THEORY

The water system servicing the proposed development was modeled using a program developed by Hestead Methods, WaterCAD. The water system modeling program uses the fluid mechanic headloss theory known as the Hazen-Williams method. This is the typical method used for purposes of evaluating water distribution systems.

1.3 INTERNATIONAL FIRE CODE, 2003

According to the Goodyear Fire Department, the 2003 IFC is currently the governing ordinance with respect to fire water system requirements. The IFC evaluates building construction type, occupancy descriptions, and square footage in order to set minimum fire flow with regards to a particular development.

2.0 HYDRAULIC CALCULATIONS

2.1 PROJECT DESCRIPTION

The proposed development includes eight retail/commercial buildings, all of which are to be built in one phase of construction. Major A contains 45,000 square feet, Shops A contains 19,000 square feet, Shops B contains 13,000 square feet, Shops C contains 6,850 square feet, Pad A contains 4,600 square feet, Pad B contains 12,900 square feet, Pad C contains 3,500 square feet, and Pad D contains 3,500 square feet.

2.2 OFFSITE WATER INFRASTRUCTURE

This project is bordered by an existing residential development, Cottonflower Unit 2, to the west, an existing Elks Lodge to the south, Yuma Road to the north, and Cotton Lane to the east. There is an existing 24-inch Ductile Iron (DI) water main adjacent to the site in Yuma Road. A 12" water main is proposed in Yuma Road in conjunction with the development to the north. No offsite water main infrastructure improvements are being proposed with this project.

2.3 ONSITE WATER INFRASTRUCTURE

Two 12-inch Pressure Class 150 DI public water mains will connect to the proposed 12-inch DI water main in Yuma Road and run south, extending into the PUE on the south side of the street. Refer to 'Appendix D' for the Water Model Exhibit which shows the locations and layout of the proposed water main connections. A private 8-inch PVC fireline loop will be provided from these water main extensions. The private fireline loop will run through the site and supply each building with adequate fire protection. At both of the public water main and private fireline connection points an 8-inch double check valve assembly (FEBCO Model 850 or approved equal) will be installed.

2.4 FIRE FLOW DEMAND

All of the proposed buildings in this development are Construction Type V-B, except Major A which is Construction Type III-B. Per the 2003 IFC, a maximum 50% reduction of the required fire flow is allowed for these construction types provided that each of the buildings are equipped with an interior fire suppression sprinkler system. The minimum fire flow requirements for each building per the IFC 2003 are shown in Table 1. A minimum fire flow of 1,500 GPM is required for each building regardless of its size. In Table 1, the reduction percentage has been adjusted to the amount necessary to meet this minimum flow requirement for each building. See 'Appendix A' for IFC 2003 fire flow requirements.

Table 1: Required Building Fire Flows

Building	Building Construction Type	Building Area [SF]	Required Fire Flow per IFC 2003 [GPM]	Reduction [%]	Required Fire Flow w/ Reduction [GPM]
Major A	III-B	45,000	4,500	50	2,250
Shops A	V-B	19,000	3,750	50	1,875
Shops B	V-B	13,000	3,000	50	1,500
Shops C	V-B	6,850	2,250	33	1,500
Pad A	V-B	4,600	1,750	14	1,500
Pad B	V-B	12,900	3,000	50	1,500
Pad C	V-B	3,500	1,500	0	1,500
Pad D	V-B	3,500	1,500	0	1,500

2.5 DOMESTIC DEMAND

The domestic water demands for the proposed development were calculated using methods stipulated in the Goodyear Engineering Design Standards and Policies Manual (DS&PM). From Table 5-1 of the DS&PM, the Average Day Water Demand for Commercial land use is 0.9 GPD per square foot of building. The DS&PM also defines the Maximum Day Demand as being two times the calculated Average Day demand and the Peak hour demand as being four times the calculated Average Day demand. The calculated Average Day, Maximum Day plus Fire Flow, and Peak Hour plus Fire Flow demands for each building are shown in Table 2.

Table 2: Building Domestic Water Demands

Building	Square Feet [SF]	Average Day Water Demand [GPM]	Required Fire Flow [GPM]	Max Day Demand Plus Fire Flow [GPM]	Peak Hour Demand Plus Fire Flow [GPM]
Major A	45,000	28.1	2,250	2,306	2,363
Shops A	19,000	11.9	1,875	1,899	1,923
Shops B	13,000	8.1	1,500	1,516	1,533
Shops C	6,850	4.3	1,500	1,509	1,517
Pad A	4,600	2.9	1,500	1,506	1,512
Pad B	12,900	8.1	1,500	1,516	1,532
Pad C	3,500	2.2	1,500	1,504	1,509
Pad D	3,500	2.2	1,500	1,504	1,509

2.6 METHODS

Through the use of WaterCAD, the proposed water main and fireline system was modeled. Residual and static pressures were obtained from a flow test performed by E J Flow Tests on October 22, 2007 on two existing fire hydrants along Yuma Road. (See 'Appendix B' for flow test results.) The reduced residual and static pressures from the flow test are included in Table 2 below.

Table 3: Fire Hydrant Flow Rate Test Results

Testing Conditions	Flow Rate [GPM]	Measured Pressure [PSI]
Static	0	58
Residual	1986	52

From the static and residual pressures obtained during the flow test, the maximum operating flow was calculated to be 5,355 GPM at 20 PSI. The static, residual, and maximum operating flow were used to create a three point pump curve which modeled the existing conditions of the water main in Yuma Road.

In addition, the head losses attributed to the fireline and domestic service line backflow preventors were modeled as "general purpose valves" with a head loss based upon manufacturer specifications. See 'Appendix C' for the backflow preventor cut sheets and the head loss data used in the model.

2.7 RESULTS

Table 3 below provides the anticipated available fire flow and residual pressures for the fire hydrants and building fire risers at peak hour system demands based upon the flow test data. The following table also presents the expected pressures at these junctions for the various peak hour plus fire flow demands. See 'Appendix D' for the water model layout which identifies the location of each of these junctions. Also see 'Appendix E' for more detailed results from the WaterCad model.

Table 3: Results of Peak Hour Demand Fire Flow Analysis

Node Location	Peak Hour Demand Plus [GPM]	Provided Fire Flow @ 20 psi [GPM]	Provided Pressure for [PSI]
FH1	1500	2397	40
FH2	1500	2382	39
FH3	1500	2383	37
FH4	1500	2383	37
FH5	1500	2383	37
FH6	1500	2384	35
FH7	1500	2385	36
FH8	1500	2381	38
FH9	1500	2381	37
FH10	1500	2381	27
FH11	1500	2341	41
Major A Fire	2363	2384	36
Pad A Fire	1502	2400	26
Pad B Fire	1532	2366	38
Pad C Fire	1509	2380	34
Pad D Fire	1509	2381	36
Shops A Fire	1923	2383	32
Shops B Fire	1533	2385	25
Shops C Fire	1517	2419	41

2.8 RECOMMENDATIONS

The proposed on-site water system as outlined by this analysis appears sufficient to meet the required fire flow and domestic demands for the proposed buildings in the “Cottonflower Marketplace” development.

APPENDIX A

IFC Appendix B

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142 or the *International Urban Wildland Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by fire walls without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet (344.5 m²) shall be 1,000 gallons per minute (3785.4 L/min). Fire flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5 m²) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire flow of 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.

Exception: A reduction in required fire flow of up to 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Fire Code*. Where buildings are also of Type I or II construction and are a light-hazard occupancy as defined by NFPA 13, the reduction may be up to 75 percent. The resulting fire flow shall not be less than 1,500 gallons per minute (5678 l/min) for the prescribed duration as specified in Table B 105.1.

SECTION B106 REFERENCED STANDARDS

ICC	IBC	International Building Code	B104.2, Table B105.1
ICC	IFC	International Fire Code	B105.2
ICC	IUWIC	International Urban- Wildland Interface Code	B103.3
NFPA	1142	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

**TABLE B105.1
MINIMUM REQUIRED FIRE FLOW AND FLOW DURATION FOR BUILDINGS^a**

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute) ^c	FLOW DURATION (hours)
Type IA and IB ^b	Type IIA and IIIA ^b	Type IV and V-A ^b	Type IIB and IIIB ^b	Type V-B ^b		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	3
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

- a. The minimum required fire flow shall be permitted to be reduced by 25 percent for Group R.
- b. Types of construction are based on the *International Building Code*.
- c. Measured at 20 psi.

APPENDIX B

Fire Flow Test



Flow
Tests

WATER SUPPLY CONSULTANTS

FLOW TEST SUMMARY

Project: Cotton / Yuma

Project Number: A07185

Address: SWC of Cotton Lane & Yuma Road - Goodyear, AZ.

Raw Test Data:

Date & Time of Test: 10/22/07 @ 09:30AM
Data is current and reliable until: 4/22/07

Static Pressure: 64
(measured in pounds per square inch = psi)

Residual Pressure: 58
(measured in pounds per square inch = psi)

Pitot Pressure: 35
(measured in pounds per square inch = psi)

Fire Hydrant Orifice Diameter: 2-1/2" (2)
(measured in inches)

Coefficient of Discharge: (.9 = smooth/round outlet;
.8 square/sharp outlet; .7 square/raised): .9

Flowing (measured in gallons per minute): 1,990

Data with 10 % Safety Factor:

Static Pressure: 57.6
(measured in psi)

Residual Pressure: 51.6
(measured in psi)

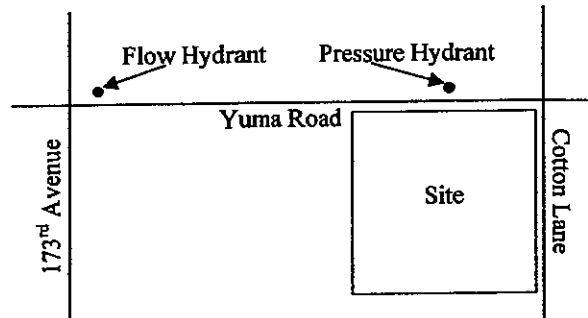
Approximately 764' between hydrants,
served by a 24" main. Water flowed for 3 minutes.

Flowing GPM: 1,990
GPM @ 20 PSI: 5,355.3

Conducted by/Witnessed by/City Forces Contacted:
Al Davis/E J Flow Tests
Beckett Aguirre/ E J Flow Tests

Test Vicinity Map (no scale)

North



E J Flow Tests, LLC

5748 North 31st Ave. • Phoenix, Arizona 85017
602.636.0100 x114 office • 602.999.7637 cell • 602.973.2287 fax
e-mail - al@ejflowtests.com • website - www.ejflowtests.com

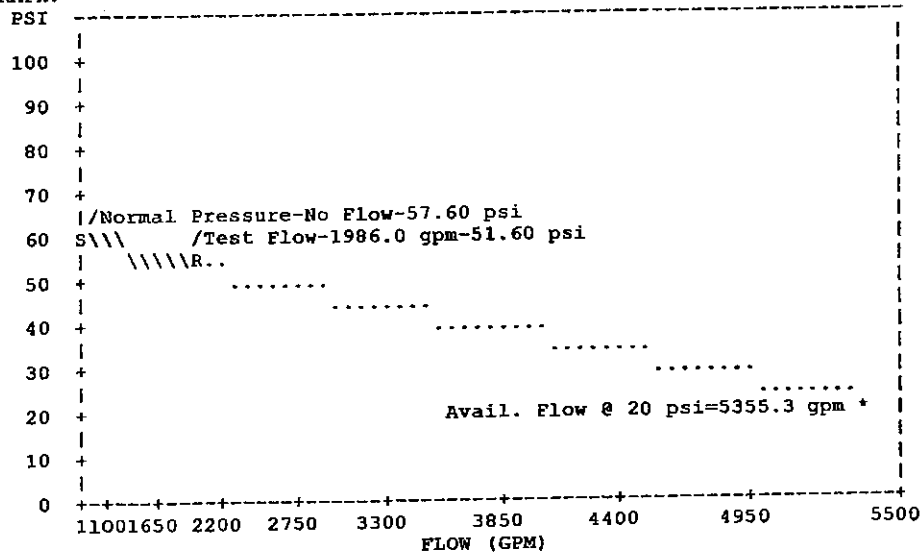
LOCATION: Cotton / Yuma
SWC Cotton Ln & Yuma Rd - Goodyear, AZ.

DATE: 10/22/07
TIME: 09:30AM

Static Hydrant Number:	1	Flowing Hydrant Number:	2
Elevation:	0	Elevation:	0
Dist. Between Hydrants:	764		
Diameter of Main:	24		
Outlet Diameter:	2.50 in	Number flowing: 2	Coeff.: 0.90
Static pressure:	57.60 psi	Residual pressure:	51.60 psi
Pitot Reading:	35.00 psi	Flow:	1986.0 gpm

Flow at 20 psi: 5355.3 gpm

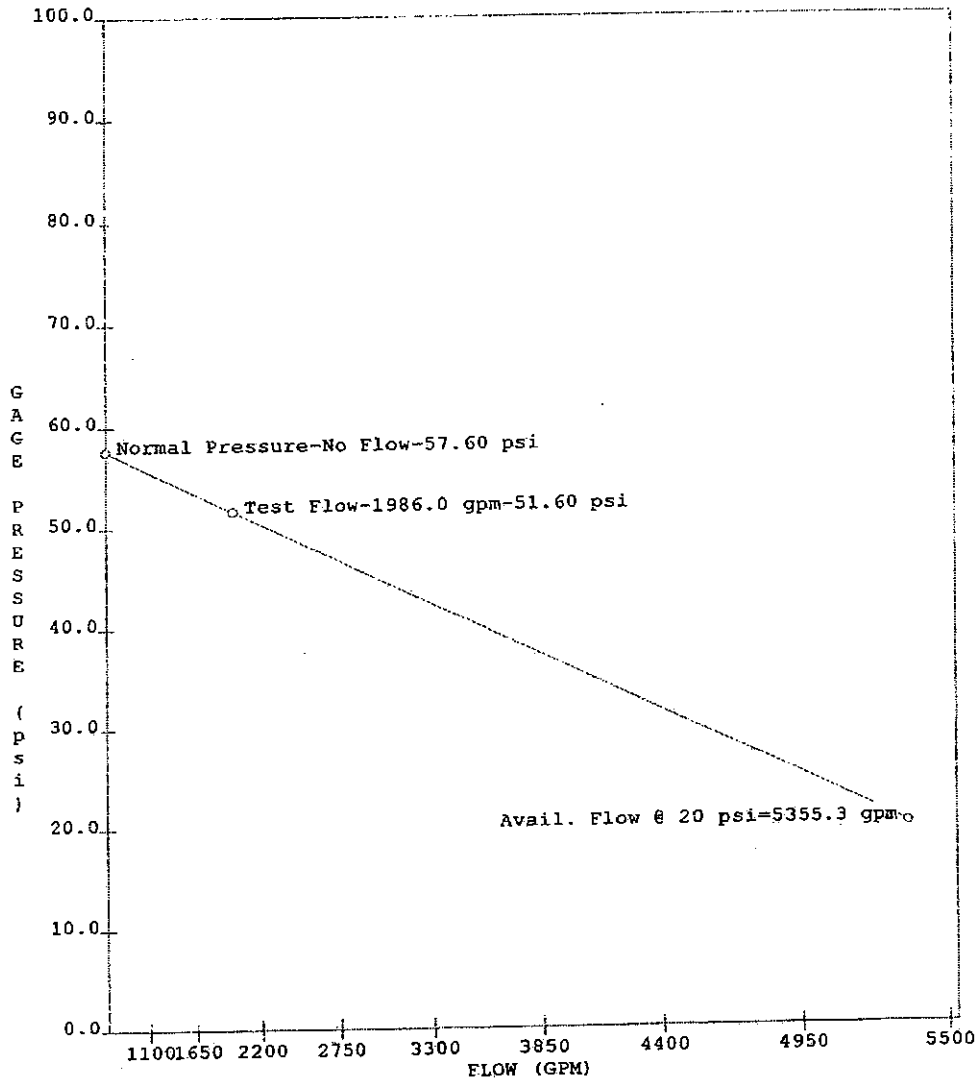
GRAPH:



NOTES:

- (1) Flowing hydrant is assumed to be on a circulating main or downstream of the pressure test hydrant on a dead-end system.
- (2) Flow analysis assumes a gravity flow system with no distribution pumps and having no demand, other than the test flow.
- (3) Distance between hydrants, elevations & main diameter are for information only.

FLOW TEST SUMMARY REPORT page2



APPENDIX B

Fire Flow Test

APPENDIX C

Backflow Preventor Cut Sheet



DOUBLE CHECK ASSEMBLY

Characteristics

Physical Properties

Size of Mainline	2½", 3", 4", 6", 8", 10"
Max. Working Pressure	175 PSI (1200 KPa)
Hydrostatic Test Press.	350 PSI (2400 KPa)
Temperature Range	32° F to 140° F (0° C to 60° C)
End Connections	Flanged ANSI B16.1 Class 125

Materials

Main Valve Body	Ductile iron Grade 65-45-12
Coating	Fusion epoxy coated internal and external, AWWA C550-90
Shut Off Valves	NRS resilient wedge gate valves AWWA C509
Trim	Bronze
Elastomer Discs	EPDM
Spring	Stainless steel
Clamp	AWWA 606

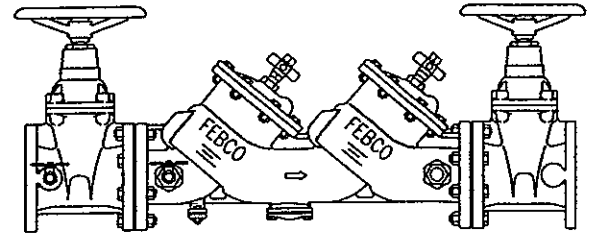
Application

Non-Health Hazard

Options

- UL/FM OS&Y RW Gate Valves
- Wye - Strainer

U.S. Patent No. 4,989,635

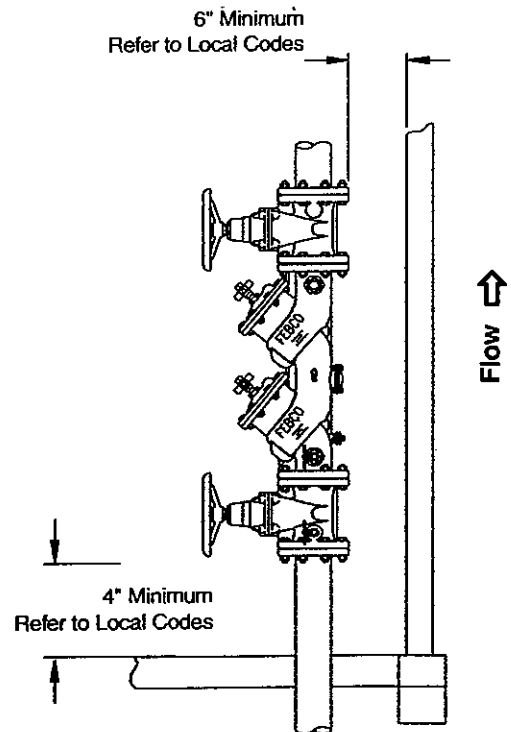
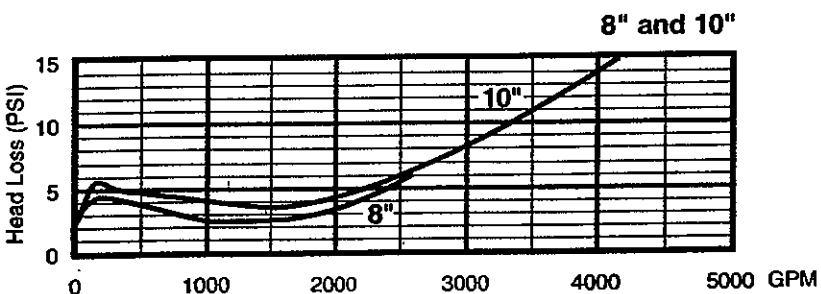
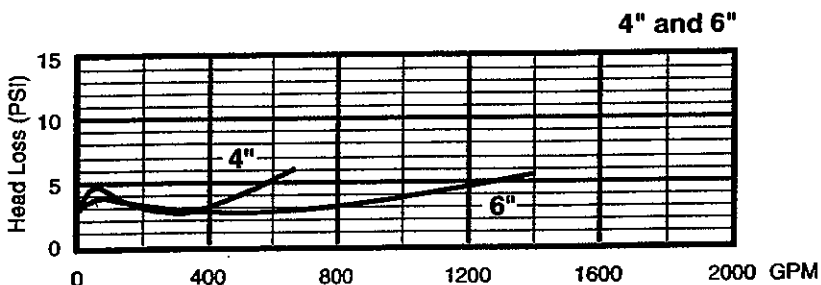
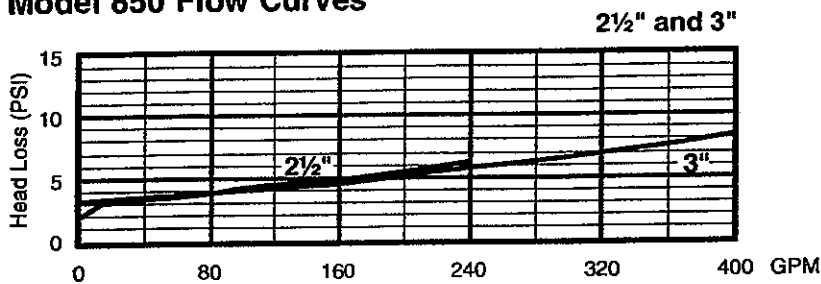


MODEL 850 DOUBLE CHECK ASSEMBLY

Agency Compliance

- Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. - 2½" - 8" (Horizontal & Vertical Up)
 - ASSE (Std. 1015) - 2½" - 8" (Horizontal & Vertical Up), 10" (Horizontal)
 - ANSI/AWWA (C510-89) - 2½" - 8" (Horizontal & Vertical Up), 10" (Horizontal)
 - CAN/CSA (B64.5) - 2½" - 8" (Horizontal & Vertical Up)
 - cUL - 2½" - 8" (Horizontal & Vertical Up)
 - FM Approved* - 2½" - 8" (Horizontal & Vertical Up)
 - UL Listed* - 2½" - 8" (Horizontal & Vertical Up)
- * Less gates not FM approved. Less gates not UL listed unless installed with UL listed gate valves.

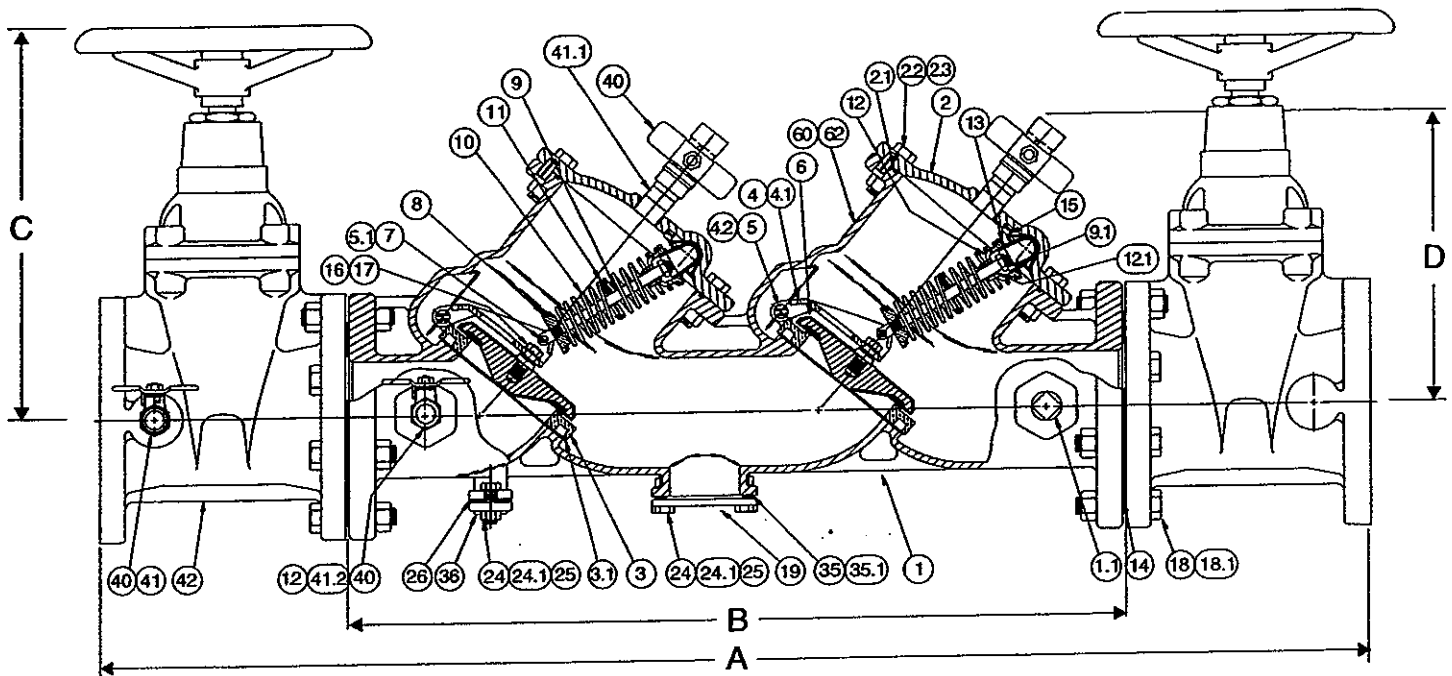
Model 850 Flow Curves



MODEL 850
VERTICAL INSTALLATION

MASTED
series

Model 850



Dimensions and Weights

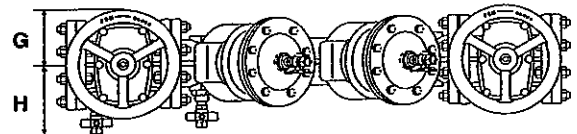
(U.S. - Inches)

SIZE	A	B	C*	D	G	H	NET (lbs.) NRS	NET (lbs.) OS&Y
2 1/2"	40 3/4	25 1/2	12 5/8	10 1/4	4 1/2	7 1/8	199	203
3"	41 7/8	25 5/8	12 7/8	10 1/4	4 1/2	7 3/8	211	213
4"	46 1/4	28	14 3/8	10 1/4	5 1/2	8 1/8	288	312
6"	56	34 3/4	18 7/8	13	6 1/2	9 7/8	450	494
8"	65	41 3/4	23 1/2	15 5/8	7	11 1/8	711	773
10"	72 5/8	46 5/8	27 1/2	15 5/8	9	12 3/8	980	1080

(Metric - MM)

SIZE	A	B	C*	D	G	H	NET (kg) NRS	NET (kg) OS&Y
65	1035.05	647.70	320.68	260.35	114.30	180.98	90	92
80	1063.63	650.88	327.03	260.35	114.30	187.33	96	97
100	1174.75	711.20	365.13	260.35	139.70	206.38	131	142
150	1422.40	882.65	479.43	330.20	165.10	250.83	204	224
200	1651.00	1060.45	596.90	396.88	177.80	282.58	323	351
250	1844.68	1177.93	698.50	396.88	228.60	314.33	445	490

850 Top View



* With NRS Gate Valves

Note: Dimensions are nominal. Allowances must be made for normal manufacturing tolerances.

Materials of Construction

ITEM	DESCRIPTION	MATERIALS	ITEM	DESCRIPTION	MATERIALS	ITEM	DESCRIPTION	MATERIALS
1	Body	A536 GR 65-45-12	7	Load Pin	304 SS	24.1	Washer	Plated Steel
1.1	Pipe Plug	Galv. Steel	8	Lwr Spring Retr	B584 Alloy C83600	25	Bolt	Plated Steel
1.2	Bushing (2 1/2 - 4 only)	Brass	9	Spring Stem	304 SS	26	Gasket	EPDM ASTM D2000
2	Cover	A536 GR 65-45-12	9.1	Elastic Stop Jam Nut	18-8 SS	35	O-Ring	EPDM ASTM D2000
2.1	O-Ring	EPDM ASTM D2000	10	Spring	A313 Type 631 SS	35.1	Back-Up Ring	Acetal Resin
2.2	Cap Screw	Plated Steel	11	Spring Guide	B130 Alloy C22000	36	Cover	B584 Alloy C83600
2.3	Hex Nut	Plated Steel	12	Upr Spring Retr	B584 Alloy C83600	36	Gate Valve	B584 Alloy C84400
3	Seat Ring	B584 Alloy C83600	12.1	Bushing-Spr. Stem	Acetal Resin	40	Ball Valve	B584 Alloy C84400
3.1	Gasket	EPDM ASTM D2000	13	Pivot Bearing	B585 Alloy C83600	41	Nipple	Brass
4	Arm	B584 Alloy C83600	14	Flange Gasket	Rubber/Fabric	41.1	Nipple	Brass
4.1	Bushing-Swing Pin	Acetal Resin	15	Bearing Socket	Acetal Resin	41.2	Nipple	Brass
4.2	Swing Pin	304 SS	16	Hex Jam Nut	18-8 SS	42	Gate Valve	AWWA C509
5	Retaining Clip	302 SS	17	Washer	302 SS	60	Id Plate	B36 Alloy C26000
5.1	Retaining Clip	302 SS	18	Flange Nut	Plated Steel	62	Drive Screw	SS
6	Check Disk Assy	EPDM Coated GR, 45 Ductile Iron with type 304 SS stem	18.1	Flange Nut	Plated Steel	70	Clamp	AWWA 606
			19	Cover	A36 Stl Epoxy Coated			(10" Only, Not Shown Above)
			24	Bolt	Plated Steel			

FEBCO Backflow Prevention
 P.O. Box 8070 • Fresno, CA 93747-8070
 559 252-0791 • Fax: 559 453-9030 • www.cmb-ind.com

CMB Industries, Inc.
 A United Dominion Company

ISO 9001 Certified

SPECIFICATION SHEET MODEL 860 (1/2" - 2")



REDUCED PRESSURE ASSEMBLY

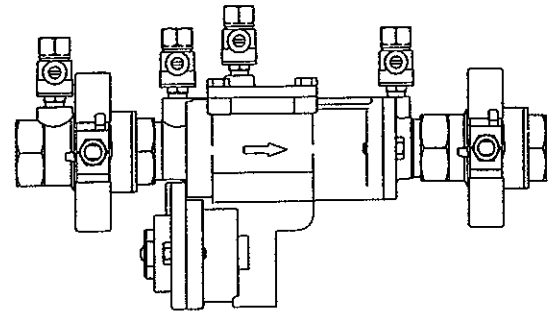
Characteristics

Physical Properties

Size	1/2", 3/4", 1", 1 1/4", 1 1/2", 2"
Max. Working Pressure	175 PSI (1200 KPa)
Hydrostatic Test Press.	350 PSI (2400 KPa)
Temperature Range	32°F to 140°F (0°C to 60°C)
End Connections	Threaded ANSI B2.1

Materials

Valve Body	Bronze
Elastomers	Silicone
Springs	Stainless Steel



MODEL 860 (1/2" - 2") REDUCED PRESSURE ASSEMBLY

Agency Compliance

- ANSI/AWWA Conformance (C511-92)
- ASSE Listed (Std. 1013)
- CSA
- Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.

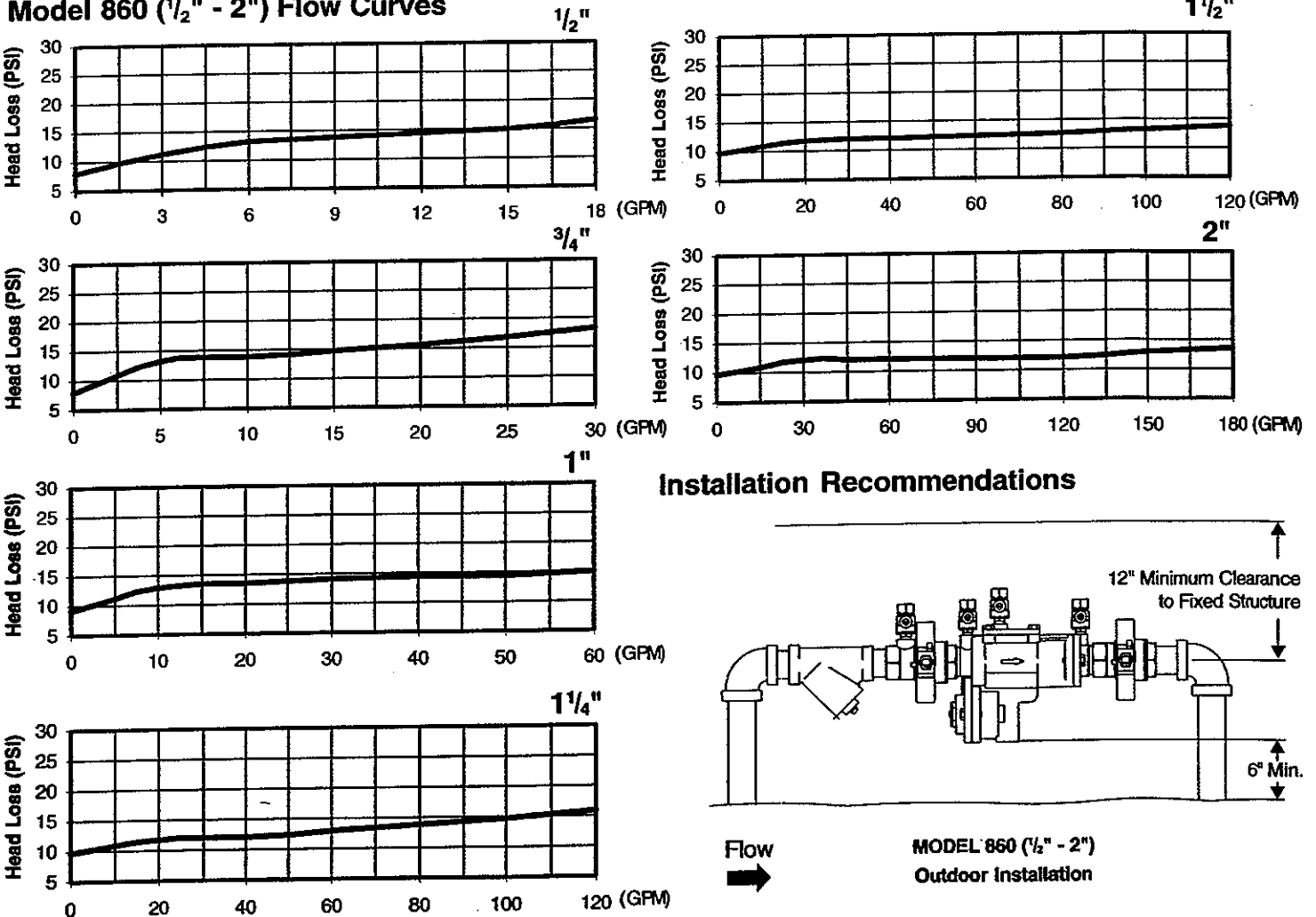
Application

Health Hazard

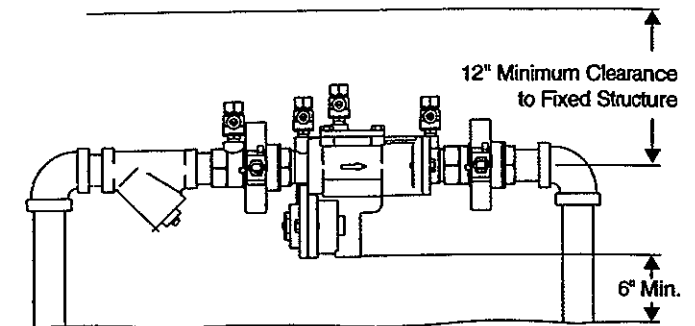
Options

- Wye - Strainer

Model 860 (1/2" - 2") Flow Curves



Installation Recommendations

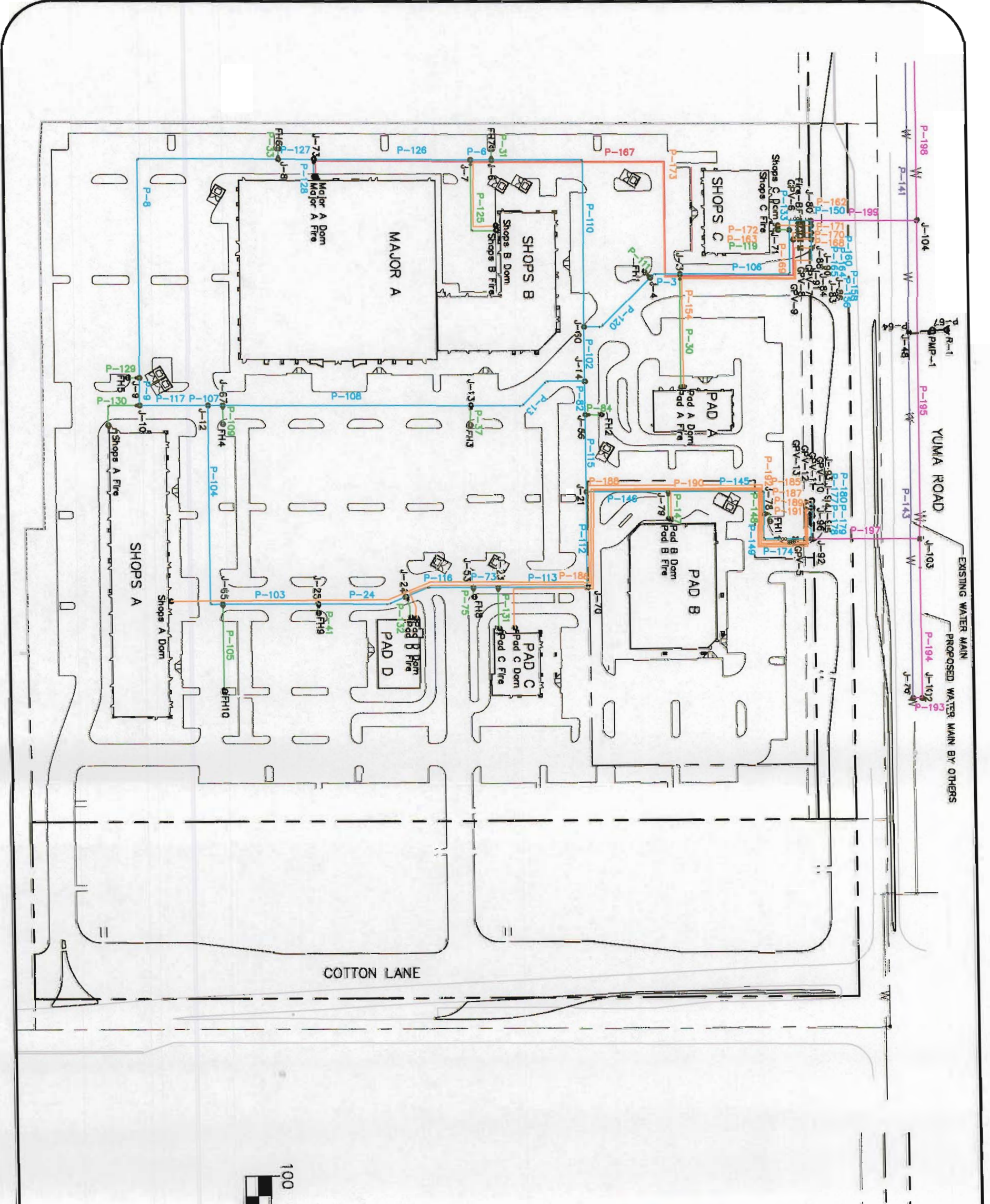


Flow
→

MODEL 860 (1/2" - 2")
Outdoor Installation

APPENDIX D

Proposed Water System Exhibit



- ### LEGEND
- RIGHT-OF-WAY LINE
 - PROPERTY LINE
 - ROAD CENTERLINE
 - PROPOSED FIRE HYDRANT
 - WATER LINE JUNCTION

Color	Link Diameter (in.)
Orange	≤ 2.0
Yellow	≤ 3.0
Green	≤ 6.0
Blue	≤ 8.0
Purple	≤ 12.0
Light Blue	≤ 24.0



WATER MODEL EXHIBIT
 COTTONFLOWER MARKETPLACE
 GOODYEAR, ARIZONA



Kimley-Horn
 and Associates, Inc.

APPENDIX E

WaterCAD Fire Flow Reports

Scenario: Peak Day + Fire
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Constraints?	Needed FF (gpm)	Avail. Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Avail. (gpm)	Res. Pres. (psi)	Calc. Res. Pres. (psi)	Min. Zone Pres. (psi)	Calc. Min. Zone Pres. (psi)	Min. Zone Junc.
FH1	true	1,500.00	2,396.46	1,500.00	2,396.46	20.00	40.33	20.00	20.00	Shops A Dom
FH2	true	1,500.00	2,381.91	1,500.00	2,381.91	20.00	38.77	20.00	20.00	Shops A Dom
FH3	true	1,500.00	2,383.41	1,500.00	2,383.41	20.00	36.54	20.00	20.00	Shops A Dom
FH4	true	1,500.00	2,382.79	1,500.00	2,382.79	20.00	37.01	20.00	20.00	Shops A Dom
FH5	true	1,500.00	2,383.30	1,500.00	2,383.30	20.00	37.41	20.00	20.00	Shops A Dom
FH6	true	1,500.00	2,384.39	1,500.00	2,384.39	20.00	35.19	20.00	20.00	Shops A Dom
FH7	true	1,500.00	2,385.10	1,500.00	2,385.10	20.00	36.20	20.00	20.00	Shops A Dom
FH8	true	1,500.00	2,380.62	1,500.00	2,380.62	20.00	38.03	20.00	20.00	Shops A Dom
FH9	true	1,500.00	2,381.23	1,500.00	2,381.23	20.00	37.42	20.00	20.00	Shops A Dom
FH10	true	1,500.00	2,381.33	1,500.00	2,381.33	20.00	27.33	20.00	20.00	Shops A Dom
FH11	true	1,500.00	2,341.08	1,500.00	2,341.08	20.00	41.38	20.00	20.00	Shops A Dom
Major A Fire	true	2,363.00	2,384.49	2,363.00	2,384.49	20.00	36.15	20.00	20.00	Shops A Dom
Pad A Fire	true	1,506.00	2,399.69	1,506.00	2,399.69	20.00	25.82	20.00	20.00	Shops A Dom
Pad B Fire	true	1,532.00	2,365.73	1,532.00	2,365.73	20.00	38.28	20.00	20.00	Shops A Dom
Pad C Fire	true	1,509.00	2,380.46	1,509.00	2,380.46	20.00	33.84	20.00	20.00	Shops A Dom
Pad D Fire	true	1,509.00	2,380.97	1,509.00	2,380.97	20.00	35.80	20.00	20.00	Shops A Dom
Shops A Fire	true	1,923.00	2,383.16	1,923.00	2,383.16	20.00	31.95	20.00	20.00	Shops A Dom
Shops B Fire	true	1,533.00	2,384.95	1,533.00	2,384.95	20.00	24.64	20.00	20.00	Shops A Dom
Shops C Fire	true	1,517.00	2,419.06	1,517.00	2,419.06	20.00	40.83	20.00	20.00	Shops A Dom

Scenario: Max Day + Fire
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Constraints?	Needed FF (gpm)	Avail. Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Avail. (gpm)	Res. Pres. (psi)	Calc. Res. Pres. (psi)	Min. Zone Pres. (psi)	Calc. Min. Zone Pres. (psi)	Min. Zone Junc.
FH1	true	1,500.00	3,888.57	1,500.00	3,888.57	20.00	22.07	20.00	20.00	Shops A Dom
FH2	true	1,500.00	3,776.64	1,500.00	3,776.64	20.00	20.00	20.00	21.02	Shops A Dom
FH3	true	1,500.00	3,516.02	1,500.00	3,516.02	20.00	20.00	20.00	23.70	Shops A Dom
FH4	true	1,500.00	3,512.38	1,500.00	3,512.38	20.00	20.00	20.00	23.73	Shops A Dom
FH5	true	1,500.00	3,534.43	1,500.00	3,534.43	20.00	20.00	20.00	23.32	J-9
FH6	true	1,500.00	3,362.73	1,500.00	3,362.73	20.00	20.00	20.00	23.01	J-8
FH7	true	1,500.00	3,462.37	1,500.00	3,462.37	20.00	20.00	20.00	23.07	Shops B Fire
FH8	true	1,500.00	3,613.07	1,500.00	3,613.07	20.00	20.00	20.00	22.69	Shops A Dom
FH9	true	1,500.00	3,546.98	1,500.00	3,546.98	20.00	20.00	20.00	22.83	J-25
FH10	true	1,500.00	2,755.08	1,500.00	2,755.08	20.00	20.00	20.00	30.55	Shops A Dom
FH11	true	1,500.00	3,827.02	1,500.00	3,827.02	20.00	23.91	20.00	20.00	Shops A Dom
Major A Fire	true	2,306.00	3,460.91	2,306.00	3,460.91	20.00	20.00	20.00	21.15	J-73
Pad A Fire	true	1,506.00	2,705.59	1,506.00	2,705.59	20.00	20.00	20.00	31.09	Shops A Dom
Pad B Fire	true	1,516.00	3,663.27	1,516.00	3,663.27	20.00	20.00	20.00	22.02	Shops A Dom
Pad C Fire	true	1,504.00	3,208.64	1,504.00	3,208.64	20.00	20.00	20.00	26.61	Shops A Dom
Pad D Fire	true	1,504.00	3,386.93	1,504.00	3,386.93	20.00	20.00	20.00	24.93	Shops A Dom
Shops A Fire	true	1,899.00	3,064.94	1,899.00	3,064.94	20.00	20.00	20.00	27.93	Shops A Dom
Shops B Fire	true	1,516.00	2,629.40	1,516.00	2,629.40	20.00	20.00	20.00	31.58	Shops A Dom
Shops C Fire	true	1,509.00	3,912.56	1,509.00	3,912.56	20.00	24.03	20.00	20.00	Major A Dom

**Scenario: Average Day
Fire Flow Analysis
Fire Flow Report**

Label	Satisfies Constraints?	Needed FF (gpm)	Avail. Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Avail. (gpm)	Res. Pres. (psi)	Calc. Res. Pres. (psi)	Min. Zone Pres. (psi)	Calc. Min. Zone Pres. (psi)	Min. Zone Junc.
Pad A Fire	true	1,500.00	2,605.12	1,500.00	2,605.12	20.00	20.00	20.00	32.56	Major A Dom
FH7	true	1,500.00	3,277.20	1,500.00	3,277.20	20.00	20.00	20.00	22.76	Shops B Fire
Shops B Fire	true	1,500.00	2,542.27	1,500.00	2,542.27	20.00	20.00	20.00	33.89	Major A Dom
FH6	true	1,500.00	3,192.55	1,500.00	3,192.55	20.00	20.00	20.00	22.75	J-8
Shops A Fire	true	1,875.00	2,933.80	1,875.00	2,933.80	20.00	20.00	20.00	30.07	Major A Dom
FH3	true	1,500.00	3,322.12	1,500.00	3,322.12	20.00	20.00	20.00	24.99	J-13
Shops C Fire	true	1,500.00	3,573.18	1,500.00	3,573.18	20.00	23.04	20.00	20.00	Major A Dom
FH9	true	1,500.00	3,354.80	1,500.00	3,354.80	20.00	20.00	20.00	22.58	J-25
Pad D Fire	true	1,500.00	3,217.84	1,500.00	3,217.84	20.00	20.00	20.00	25.45	J-24
Pad C Fire	true	1,500.00	3,061.38	1,500.00	3,061.38	20.00	20.00	20.00	28.83	Major A Dom
FH2	true	1,500.00	3,541.15	1,500.00	3,541.15	20.00	20.00	20.00	23.17	Major A Dom
Pad B Fire	true	1,500.00	3,445.51	1,500.00	3,445.51	20.00	20.00	20.00	24.37	Shops A Dom
Major A Fire	true	2,250.00	3,276.05	2,250.00	3,276.05	20.00	20.00	20.00	21.04	J-73
FH8	true	1,500.00	3,410.97	1,500.00	3,410.97	20.00	20.00	20.00	22.84	J-53
FH10	true	1,500.00	2,659.78	1,500.00	2,659.78	20.00	20.00	20.00	32.95	Major A Dom
FH4	true	1,500.00	3,324.14	1,500.00	3,324.14	20.00	20.00	20.00	24.78	J-67
FH1	true	1,500.00	3,706.23	1,500.00	3,706.23	20.00	20.15	20.00	20.00	Major A Dom
FH11	true	1,500.00	3,718.05	1,500.00	3,718.05	20.00	20.79	20.00	20.00	Shops A Dom
FH5	true	1,500.00	3,344.35	1,500.00	3,344.35	20.00	20.00	20.00	22.99	J-9