Alice Claim – Water Distribution Model

Hydraulic Modeling Design Elements Report

Prepared for:
King Development Group, LLC

Prepared by:
Stantec Consulting Services Inc.

Water System No: 22011

Water System Name:
Park City Municipal Water

DDW File No: N/A

August 29, 2017

Sign-off Sheet

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Prepared by ______________________________________

(Signature)

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Abbreviations

DIP	Ductile Iron Pipe
DIPS	Ductile Iron Pipe Size
DR	Dimension Ratio
El.	Elevation
EX	Existing
ft/s	Feet per second
gpd	Gallons per day
gpm	Gallons per minute
HDPE	High Density Polyethylene
HGL	Hydraulic Grade Line
ID	Inside Diameter
IFC	International Fire Code
OF	Overflow
PCFD	Park City Fire District
PCMC	Park City Municipal Corporation
PR	Proposed
PRV	Pressure Reducing Valve
psi	Pounds per square inch
PWS	Public Water System Number
UDDW	Utah Division of Drinking Water

1.0 INTRODUCTION

Stantec has completed water system distribution modeling as part of the Alice Claim nine home development project. The modeling was completed to size water lines and to evaluate system pressures per Utah Division of Drinking Water (UDDW) and Park City Fire District (PCFD). In addition to evaluating compliance with UDDW standards, Stantec has also performed calculations to evaluate expected fire sprinkler pressures based on building pad elevations, expected flow rates, and top floor ceiling elevations. This evaluation was conducted for lot 1 of the proposed Alice Claim Development. The following discusses the work completed and results of the Alice Lode Water System modeling.

1.1 SYSTEM INFORMATION

The Alice Claim Subdivision is located in Park City south of King Road and below Park City's existing 500,000 gallon Woodside Tank. Nine lots are proposed for development.. The proposed water system will consist of two new fire hydrants and laterals to each house. It is anticipated that the homes will be equipped with fire sprinklers as required by Park City's building department.

Based on a meeting held with PCMC Staff on December 17, 2014, it was discussed that Park City's old town primarily consists of older structures, many of which do not have fire sprinklers. For that reason, the non-sprinkled fire flow demand is 3,000 gpm. During this discussion, it was confirmed that the residences equipped with fire sprinklers are allowed a 50% reduction in fire flow.

1.1.1 MODELING GOALS

The following are the goals of the water modeling project:

- Size water lines and service laterals
- Confirm system pressures meet UDDW rules for public drinking water systems (R309-105-9 Minimum System Pressures).
- Compare advantages and disadvantages of providing a system that will serve 1,500 gpm for hydrant flow with interior fire sprinklers against providing 3,000 gpm for fire flow with no interior fire sprinklers. This was discussed in the staff meeting that was completed with Stantec on December 17, 2014.
- Evaluate Fire Sprinkler Pressures for lot 1 based on top floor ceiling.

1.2 EXISTING SYSTEM DESCRIPTION

The existing Park City System (PWS No. 22011) is comprised of several sources, treatment plants, booster pump stations, storage tanks, water lines, and pressure reducing valve stations:

- **Sources:** PCMC has several water sources including underground wells, an interconnect with Jordanelle Special Service District, and two water treatment plants (one surface water treatment plant and one groundwater treatment plant).

- **Storage:** Though there are several tanks that are part of Park City's system, the 500,000 gallon Woodside Tank and storage above the tank will provide potable water and fire flow water for Alice Claim.

- **Distribution:** There are many miles of water lines in the PCMC water system. The pipeline that will supply water to Alice Claim is a recently constructed 16" DR 13.5 DIPS HDPE water line with an internal diameter of 14.7".

- **Existing Demands:** Existing City-wide demands for the City are irrelevant to this project. Only the demands that relate to the Woodside Tank and the area that it serves are relevant. Stantec has requested the exact demand information from the City. As a comparison, we have also back calculated existing demands based on the size of existing infrastructure. Please note, storage to the Woodside Tank Zone was previously supported by the Empire Tank that has since been repurposed to the secondary water system. For this reason, demand potential was completed assuming the Empire Tank was still in potable operation. This yields higher existing demands and is conservative. Table 1, below summarizes the existing demands that were calculated for this portion of Park City's existing water system.

Table 1 - Existing Water System Demands

Demand Criteria	Value
Existing Storage Available[1]	1,500,000 gallons
Assumed Fire Flow	3,000 gpm for (3) hours
Assumed Fire Flow Storage	540,000 gallons
Available Average Day Storage for Domestic Use	960,000 gallons
Peak Day Flow Based on Available Storage	1,333 gpm
Peak instantaneous Indoor[2]	1,009 gpm
Peak Instantaneous Outdoor[2]	1,333 gpm
Total Peak Instantaneous	2,343 gpm

Notes:

1. Total Volume for Woodside and Empire Tanks.
2. Assumed that existing demand is comprised of 50% indoor demands and 50% outdoor demands.
3. Existing demands have been rounded up to the nearest 50 gpm for this model.
4. Demands calculated per R309-510.

1.3 PROPOSED ADDITIONS TO THE SYSTEM

Alice Claim will add nine connections to the system and (2) new fire hydrants. No new water mains are required to serve the current site plan. Meter sizing must be completed on a case by case basis during final design. It is anticipated that lower Alice Claim lots will have adequate pressure when serviced by a single 1-1/2" meter. Dedicated fire sprinkler laterals should be evaluated with final design for the higher lots (applies to fire sprinkler scenarios).

2.0 WATER DEMAND CRITERIA

Water demands for Alice Claim were calculated based on UDDW guidelines.

2.1 ERC EVALUATION

The Alice Claim system will serve nine homes. No provisions have been evaluated for servicing additional units.

2.2 INDOOR WATER USE DEMAND

The following discusses the indoor unit demands for average day, peak day, and peak instantaneous demands:

- Average Day Demand (storage demand): 500 gallons per unit, 4,500 gallons total.
- Peak Day Demand (source demand): 1,000 gpd/unit, 6.25 gpm total.
- Peak Instantaneous Demand per UDDW standards and required equation (line sizing demand): 33 gpm for the system.

2.3 OUTDOOR WATER USE DEMANDS

Limited outside irrigation is anticipated for the lots and for the landscaped retaining wall at the entry. It is anticipated that approximately 1 acre +/- could be irrigated or an average of 0.11 acres per lot. Park City is in Utah Irrigation Zone 2. The following summarizes demands for average day, peak day, and peak instantaneous outdoor demands:

- Average Day Demand (storage demand): 1,980 gallons total.
- Peak Day Demand (source demand): 2.75 gpm total.
- Peak Instantaneous Demand:: 5.5 gpm for the system.

2.4 FIRE FLOW REQUIREMENTS

Based on conversations with Scott Adams, PCFD Fire Marshal, a fire flow of 1,500 gpm for two hours is adequate to meet hydrant flow requirements when residential structures are equipped with fire sprinklers for Alice Claim. This is consistent with the IFC based on building square footage and presence of fire sprinklers within each home.

Based on the December 17, 2014 review meeting with PCMC staff, Stantec evaluated an alternative fire flow scenario at 3,000 gpm. Under this scenario, interior residential fire sprinklers would not be required. Allowance for the 3,000 gpm fire flow is at PCMC's discretion.

2.5 FIRE SPRINKLER FLOW REQUIREMENTS

Based on coordination with PCFD, it was determined that fire sprinkler flow and residual pressures would be evaluated for a range of fire sprinkler flows (i.e. 16 – 100 gpm).

2.6 DEMAND VERSUS EXISTING CAPACITY

Demands on the system are small with respect to existing demands on the system. It is understood that City impact fees include costs for storage.

3.0 METHODOLOGY AND ANALYSIS

3.1 HYDRAULIC MODEL USED

Modeling was completed using WaterCAD V8i modeling software. The model was constructed to include proposed water line alignments for the Alice Claim and existing infrastructure for the Park City water system from the Woodside Tank north to King Road.

Modeling was completed using a steady state simulation. A steady state simulation is a snap shot based on the setup of the model, system elevations, and system demands. Steady State analyses are ideal for evaluating peak (worst case) scenarios.

3.2 HYDRAULIC MODEL INPUT

WaterCAD requires input for several parameters in order to adequately model existing and proposed systems. The following discusses the inputs used as well as the logic and assumptions associated with each input (See Figure 1 for graphic representations of the two system alternatives):

3.2.1 Junctions

The following inputs were used for each junction:

- **Elevation:** Elevation for each node was taken from existing aerial contours. Elevations were assigned to junctions as ground surface elevations. Main floor elevations were taken from the grading plan completed by the design team.
- **Demand:** Demands were assigned to the Alice Claim system based on water demand calculations described in section 2.2. Demands were assigned to the existing Park City system as described in Table 1, above.
- **Zone:** Zones are not required in order to model the system, but they make it easier to evaluate model results when separating nodes by zones. However, based on the elevations of Alice Claim, all nodes are in one Zone.

3.2.2 Pipes

The following inputs were used for pipes:

- **Diameter:** True internal diameters were assigned based on published information from respective water line manufacturers.

- **Hazen-Williams Coefficient:** Per PCMC requirements, the $C_{Hazen\text{-}Williams}$ = 110 for all water line materials (this is conservative).
    - **Minor Losses:** In addition to the conservative friction factors, k values (minor loss factors) were added for tees, valves, and the existing tank valve vault.
- **Length:** Length is automatic given that this model was created to scale via AutoCAD integration. Table 2 summarizes the total pipe lengths included in the model by diameter.

Table 2 - Summary of Pipe Length

Pipe Material	ID (in)	Length (ft)
2" Lateral	2	340
EX 12" DIP	12.4	25
EX 16" DR 13.5 HDPE (DIPS)	14.7	1150

Notes:
1. Only additions to the system include fire laterals and water laterals. No new water mains are required.

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Legend

Color Coding Legend
Pipe: Diameter (in)
<= 2.0
<= 10.6
<= 12.4
<= 14.7
Other

Notes

1. NODES WITH ASTERISKS HAVE BEEN GIVEN MODIFIED ELEVATIONS SO THAT THEY DO NOT CONTROL SCENARIO EVALUATION.
2. NODES WITH LABELS THAT INCLUDE "()" DENOTE CONNECTION NODES AND FIRE HYDRANT NODES. CONNECTIONS ARE DENOTED BY A NUMBER CORRESPONDING TO THE LOT NUMBER(S). FIRE HYDRANTS INCLUDE AN "FH" IN THE PARENTHESES.

Revision		By	Appd.	YY.MM.DD
5	MODEL UPDATES FOR NEW SITE PLAN	PMD	PMD	16.02.08
4	INCORPORATING CITY COMMENTS	PMD	PMD	16.04.10
3	INCORPORATING CITY COMMENTS	PMD	PMD	15.03.10
2	INCORPORATING CITY COMMENTS	PMD	PMD	15.01.22
1	PCMC REVIEW	PMD	PMD	14.09.29
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Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

Client/Project
KING DEVELOPMENT GROUP, LLC

ALICE LODE DEVELOPMENT

PARK CITY, UT

Title
ALICE LODE WATER SYSTEM DISTRIBUTION MODEL

Project No.
205303057

Scale 0 50' 100'

Figure No.
1

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3.2.3 Woodside Storage Tank

For steady state models, volume is not a relevant data point. Water surface elevation is critical for the model. Stantec performed a field survey investigation on September 22, 2014 to confirm the elevation of Woodside Tank:

- **HGL:** To be conservative, varying elevations were used based on survey and record drawing information for the Woodside Tank.
    - Tank HGL (Peak Day) = 7' below overflow elevation.
    - Tank HGL (Peak Instantaneous) = 12' below overflow elevation.
    - Tank HGL (Fire Flow) = Tank Finish Floor elevation

3.3 FIELD CALIBRATION METHODOLOGY

No field calibration was completed for this modeling. It should be noted that the site is in close proximity to the storage tank.

3.4 HYDRAULIC MODEL ANALYSIS

UDDW has specific requirements that apply to system pressures for public water systems. *Rule R309* of *The Utah Administrative Code* covers water system standards and requirements. *Rule R309-105-9* requires that public water systems must meet the following pressure requirements:

- 20 psi during a Peak Day + Fire Flow demand scenario
- 30 psi during a Peak Instantaneous demand scenario
- 40 PSI during a Peak Day demand scenario

3.4.1 Hydraulic Model Scenarios

Based on UDDW requirements and PCMC input, Stantec set up several model scenarios to evaluate this system. The following provides a description of the models that were evaluated:

- Peak Day: Onsite and offsite peak day demands. Must meet pressure requirements discussed in Section 3.4.
- Peak Instantaneous: Onsite and offsite peak instantaneous demands. Must meet pressure requirements discussed in Section 3.4.
- Peak Day + Fire Flow: Must meet peak day demand + Fire Flow and the requirements listed in section 3.4. This category was broken up into several sub-scenarios, as follows:

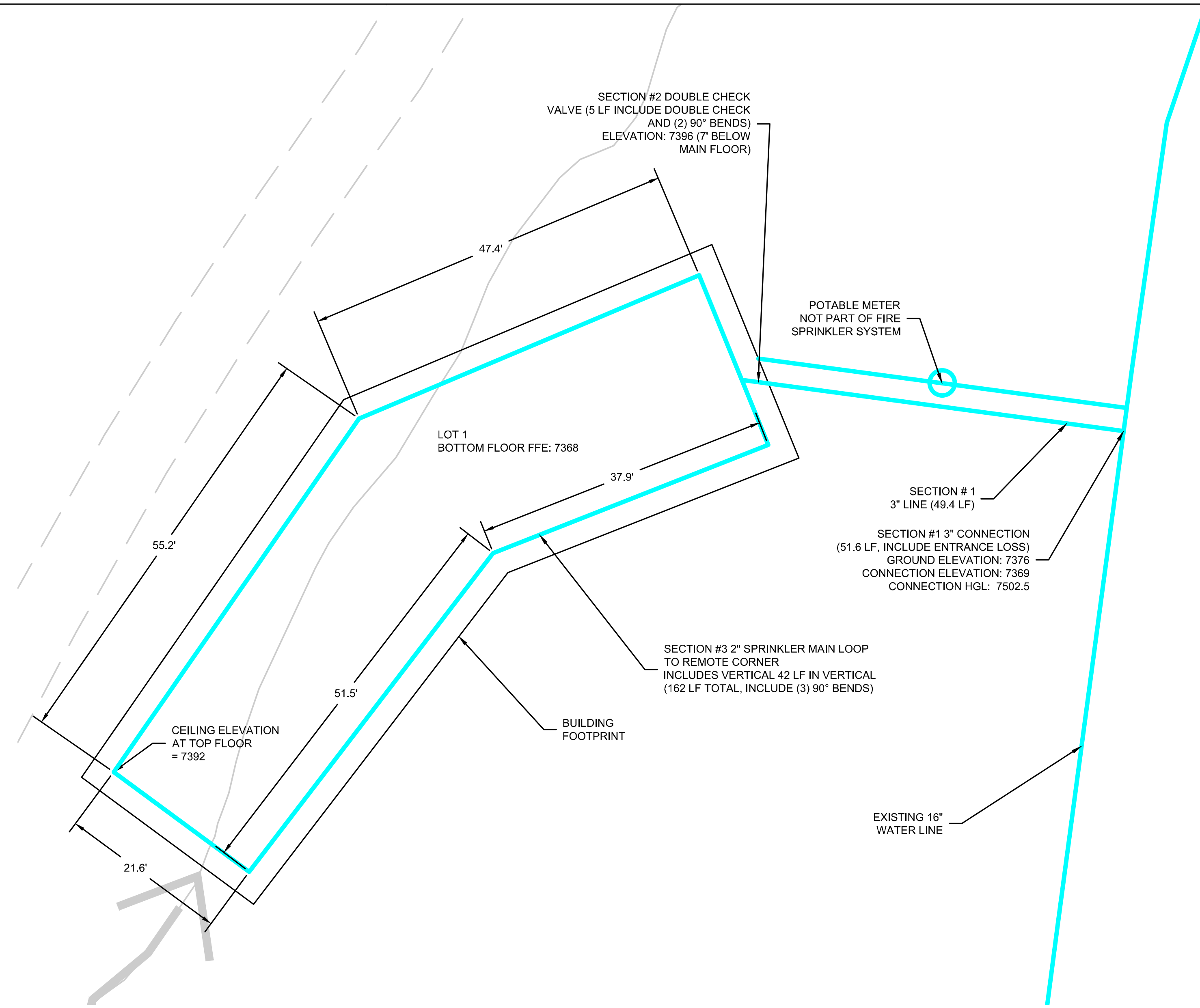
  - Peak Day + Offsite Fire Flow (3,000 gpm): This scenario was completed to illustrate Alice Claim System Pressures during an offsite fire flow.
  - Peak Day + Local Fire Flow (1,500 gpm): This scenario assumes interior fire sprinklers.
  - Peak Day + Local Fire Flow (3,000 gpm): This scenario assumes no interior fire sprinklers, and thus, no reduction in hydrant flow. This scenario was completed to illustrate a potential option to requiring fire sprinklers.

3.4.2 Additional Hydraulic Evaluations

Section 3.4.1., above, discusses the UDDW required model scenarios. In addition to these scenarios, Stantec completed additional hydraulic analyses to illustrate expected pressures at the Alice Claim Homes. Please note, the point of compliance for the UDDW required modeling scenarios is at the meter or at the hydrant. Additional evaluation was completed from the meter to the house to evaluate head loss in the lateral. This evaluation should be confirmed and finalized with final civil and building design approval.

- Peak Day + Sprinkler Flow: This was completed for lot 1 only as this is the highest lot in the project. It should be noted that PCFD requires fire sprinklers to provide service during egress of the residence during a fire event. Per conversations with PCFD, this equates to 10 minutes of flow. This flow does not overlap with hydrant flow and was modeled at the Peak Day HGL elevation. These scenarios were completed to support the final design of the residences by providing pressure at the point of connection during a sprinkler flow event
  - These scenarios compare single meter/single lateral and a single meter with separate unmetered fire lateral. The unmetered fire lateral was discussed with PCMC through previous project review meetings. Meter loss and lateral loss has been evaluated based on hand calculations and published data.
  - A fire sprinkler flow of 100 gpm was used. This value is conservative. Per Appendix D, residential fire sprinkler flow has a minimum flow requirement of 16 gpm.

The spreadsheet model was also used to evaluate the top floor ceiling residual pressure at the most remote fire sprinkler. Major losses have been accounted for based on diameter and a Hazen Williams C = 110. Minor Losses have been included for bends, tees, and the meter assembly. Figure 2 on the following page, summarizes the fire sprinkler evaluation.



LOT 1 PRELIMINARY FIRE SPRINKLER RESIDUAL DEDICATED FIRE LATERAL

Alice Claim Development
Lateral and Fire Sprinkler Evaluation - Lot 1 (Dedicated Fire)

Section #1 Main to Double Check

Start	Main		#	K
Stop	Double Check Inlet			
Length	49	Entrance	1	0.8
ELEV	7368 (MAIN ELEVATION)			
HGL	7502.5 DYNAMIC			

Section #1 Main to Double Check

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
49	16	3.00	110	0.05	0.7	0.1	0.8	0.9	7501.7	57.9
49	30	3.00	110	0.05	1.4	0.2	0.8	1.0	7501.5	57.8
49	50	3.00	110	0.05	2.3	0.6	0.8	1.4	7501.1	57.7
49	60	3.00	110	0.05	2.7	0.8	0.8	1.6	7500.9	57.6
49	80	3.00	110	0.05	3.6	1.4	0.8	2.2	7500.4	57.3
49	90	3.00	110	0.05	4.1	1.7	0.8	2.5	7500.0	57.2
49	100	3.00	110	0.05	4.5	2.1	0.8	2.9	7499.7	57.0

Section #2 - Double Check

Start	Double Check Inlet		#	K
Stop	Double check Outlet			
Length	5	90-deg bend	2	0.63
ELEV	7368	Double Check (Chart Take Off)	0	0
HGL	VARIES, SEE SEC. #1			

Section #2 - Double Check

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
5	16	3.00	110	0.05	0.7	0.0	9.7	9.7	7491.9	53.7
5	30	3.00	110	0.05	1.4	0.0	11.1	11.1	7490.4	53.0
5	50	3.00	110	0.05	2.3	0.1	12.1	12.2	7489.0	52.4
5	60	3.00	110	0.05	2.7	0.1	12.4	12.5	7488.4	52.2
5	80	3.00	110	0.05	3.6	0.1	12.7	12.9	7487.5	51.8
5	90	3.00	110	0.05	4.1	0.2	13.3	13.4	7486.6	51.4
5	100	3.00	110	0.05	4.5	0.2	13.6	13.8	7485.9	51.1

Section #3 Interior Fire Loop.

Start	Double check Outlet		#	K
Stop	HOUSE			
Length	130	90-deg bend	3	0.63
ELEV	7403			
HGL	VARIES, SEE SEC. #2			

Section #3 Interior Fire Loop.

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
162	16	2.00	110	0.0	1.6	1.6	0.1	1.7	7490.2	37.8
162	15	2.00	110	0.0	1.5	1.5	0.1	1.5	7488.8	37.2
162	25	2.00	110	0.0	2.6	3.7	0.2	3.9	7485.0	35.5
162	30	2.00	110	0.0	3.1	5.2	0.3	5.5	7482.9	34.6
162	40	2.00	110	0.0	4.1	8.9	0.5	9.4	7478.1	32.5
162	45	2.00	110	0.0	4.6	11.1	0.6	11.7	7474.9	31.1
162	50	2.00	110	0.0	5.1	13.5	0.8	14.3	7471.6	29.7

NOTES:
1. Section 1 assumes single pipe.
2. Section 2 assumes single pipe.
3. Section 3 splits to interior Fire Sprnkler Loop

LOT 1 PRELIMINARY FIRE SPRINKLER RESIDUAL DEDICATED FIRE LATERAL

Alice Claim Development
Lateral and Fire Sprinkler Evaluation - Lot 1 (1 Meter)

Section #1 Main to Meter

Start	Main		#	K
Stop	Tee in Meter box			
Length	5	TEE BRANCH	1	1.14
ELEV	7368 (MAIN ELEVATION)			
HGL	7502 DYNAMIC			

Section #1 Main to Meter

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
5	16	2.00	110	0.02	1.6	0.1	0.05	0.1	7502.2	58.2
5	30	2.00	110	0.02	3.1	0.2	0.17	0.3	7502.0	58.1
5	50	2.00	110	0.02	5.1	0.4	0.46	0.9	7501.4	57.8
5	60	2.00	110	0.02	6.1	0.6	0.66	1.2	7501.1	57.7
5	80	2.00	110	0.02	8.2	1.0	1.18	2.2	7500.1	57.3
5	90	2.00	110	0.02	9.2	1.2	1.50	2.7	7499.6	57.0
5	100	2.00	110	0.02	10.2	1.5	1.85	3.3	7499.0	56.7

Section #2 - Meter

Start	US METER		#	K
Stop	DS METER			
Length	7	90-deg bend	5	0.63
ELEV	7368	Meter chart takeoff	0	0
HGL	VARIES, SEE SEC. #1			

Section #2 - Meter

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
7	16	1.50	110	0.01	2.9	0.3	0.15	0.9	7501.3	57.8
7	30	1.50	110	0.01	5.4	0.9	0.53	2.3	7499.7	57.1
7	50	1.50	110	0.01	9.1	2.4	1.46	5.9	7495.5	55.3
7	60	1.50	110	0.01	10.9	3.3	2.10	8.2	7492.9	54.1
7	80	1.50	110	0.01	14.5	5.6	3.73	14.0	7486.2	51.2
7	90	1.50	110	0.01	16.3	7.0	4.73	18.7	7480.9	48.9
7	100	1.50	110	0.01	18.2	8.5	5.84	23.6	7475.4	46.5

Section #3 Meter to House

Start	DS METER		#	K
Stop	HOUSE			
Length	23	Tee Branch	1	1.14
ELEV	7368			
HGL	VARIES, SEE SEC. #2			

Section #3 Meter to House

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
37	16	2.00	110	0.02	1.6	0.4	0.05	0.4	7500.9	57.6
37	30	2.00	110	0.02	3.1	1.2	0.17	1.4	7498.4	56.5
37	50	2.00	110	0.02	5.1	3.1	0.46	3.5	7492.0	53.7
37	60	2.00	110	0.02	6.1	4.3	0.66	5.0	7487.9	52.0
37	80	2.00	110	0.02	8.2	7.4	1.18	8.5	7477.6	47.5
37	90	2.00	110	0.02	9.2	9.1	1.50	10.6	7470.3	44.3
37	100	2.00	110	0.02	10.2	11.1	1.85	13.0	7462.4	40.9

Section #4 House to Most Remote Sprinkler

Start	HOUSE		#	K
Stop	FIRE SPRINKLER			
Length	130	90-deg bend	3	0.57
ELEV	7403			
HGL	VARIES, SEE SEC. #3			

Section #4 House to Most Remote Sprinkler

Length (ft)	Q (gpm)	Dia (in)	C_{H-W}	Area (ft^2)	V ft/s	$h_{L\ pipe}$ (ft)	$h_{L\ fit}$ (ft)	$h_{L\ Total}$ (ft)	HGL (ft)	P_{DS} (psi)
162	8	2.00	110	0.02	0.8	0.5	0.02	0.5	7500.4	42.2
162	15	2.00	110	0.02	1.5	1.5	0.06	1.5	7496.9	40.7
162	25	2.00	110	0.02	2.6	3.7	0.17	3.9	7488.1	36.9
162	30	2.00	110	0.02	3.1	5.2	0.25	5.5	7482.4	34.4
162	40	2.00	110	0.02	4.1	8.9	0.44	9.4	7468.2	28.3
162	45	2.00	110	0.02	4.6	11.1	0.56	11.7	7458.6	24.1
162	50	2.00	110	0.02	5.1	13.5	0.69	14.2	7448.2	19.6

NOTES:
1. Section 1 assumes single pipe.
2. Section 2 assumes single pipe.
3. Section 3 assumes single pipe.
4. Section 4 assumes looped fire sprinkler system.

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Notes

1. LINE SIZES IN THE METER BOX ARE ASSUMED TO BE 1.5"-DIA. THIS IS CONSERVATIVE.
2. METER LOSSES ARE BASED ON SENSUS OMNI R2 WITH STRAINER.
3. CONNECTION HGL BASED ON A SPRINKLER FLOW OF 100 GPM FROM THE TANK TO THE CONNECTION AT THE MAIN IN ADDITION TO PEAK DAY DEMANDS.

Revision — By — Appd. — YY.MM.DD

		By	Appd.	YY.MM.DD
5	MODEL UPDATES FOR NEW SITE PLAN	PMD	PMD	16.02.08
4	INCORPORATING CITY COMMENTS	PMD	PMD	15.04.01
3	INCORPORATING CITY COMMENTS	PMD	PMD	15.03.10

Issued — By — Appd. — YY.MM.DD

File Name: — Dwn. — Chkd. — Dsgn. — YY.MM.DD

Permit-Seal

Client/Project
KING DEVELOPMENT GROUP, LLC

ALICE LODE DEVELOPMENT

PARK CITY, UT

Title
ALICE LODE WATER SYSTEM
PRELIMINARY FIRE SPRINKLER ANALYIS

Project No. 205303057

Scale 0 10' 20'

Figure No. 2

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Revision 0

ORIGINAL SHEET - ANSI D

4.0 ANALYSIS RESULTS AND CONCLUSIONS

4.1 HYDRAULIC MODEL RESULTS

As discussed in Section 3.4, Peak Day, Peak Instantaneous, and Peak Day + Fire Flow Scenarios were completed for the analysis. The following discusses key results for each scenario. Complete results for all model runs are in the appendix.

4.1.1 Peak Day Results

Table 3, below, shows the lowest three connection pressures during the Peak Day scenario. Table 4, below, shows the lowest 3 lot pressures at the building. It should be noted that the UDDW governs pressure at the point of connection to the water main. Home pressures are provided for future design purposes. Complete model results are available in the appendix.

Table 3 - Peak Day – Minimum Connection Pressures (Lowest 3 Nodes)

Minimum Pressure (psi)	Location of Minimum Pressure	Description
61.8	(FH-1-6)	Proposed Hydrant and Connection for Lot 1 & Lot 6
63.9	(2-7)	Proposed Connection for Lot 2 & Lot 7
67.3	(FH-3-8)	Proposed Hydrant and Connection for Lot 3 & Lot 8

Table 4 - Peak Day – Minimum Home Pressures (Lowest 3 Nodes)

Minimum Pressure (psi)	Location of Minimum Pressure	Description
58.3	Lot-1	Main Floor
59.6	Lot-6	Main Floor
63.0	Lot-7	Main Floor

Peak Instantaneous Results

Table 5, below, shows the lowest three connection pressures during the Peak Instantaneous scenario. Table 6, below, shows the lowest 3 lot pressures at the building. It should be noted that UDDW governs pressure at the point of connection. Home pressures are provided for future design purposes. Complete model results are available in the appendix.

Table 5 - Peak Instantaneous – Minimum Connection Pressures (Lowest 3 Nodes)

Minimum Pressure (psi)	Location of Minimum Pressure	Description
57.9	(FH-1-6)	Proposed Hydrant and Connection for Lot 1 & Lot 6
59.8	(2-7)	Proposed Connection for Lot 2 & Lot 7
63.1	(FH-3-8)	Proposed Hydrant and Connection for Lot 3 & Lot 8

Table 6 - Peak Instantaneous – Minimum Home Pressures (Lowest 3 Nodes)

Minimum Pressure (psi)	Location of Minimum Pressure	Description
54.4	Lot-1	Main Floor
55.7	Lot-6	Main Floor
58.9	Lot-7	Main Floor

4.1.2 Peak Day + Off Site Fire Flow (3,000 gpm)

Two fire flow scenarios were considered for the evaluation of this project. This fire flow assumes that the system is providing fire flow to a point downstream of Alice Claim. The fire flow of 3,000 gpm was added to the existing peak day demands. Table 7 illustrates the lowest three Alice Claim system pressures at the point of connection during this scenario. Complete results are available in the appendix.

Table 7 - Peak Day + Off Site Fire Flow (3,000 gpm)

Minimum Pressure (psi)	Location of Minimum Pressure	Description
47.2	(FH-1-6)	Proposed Hydrant and Connection for Lot 1 & Lot 6
48.6	(2-7)	Proposed Connection for Lot 2 & Lot 7
51.6	(FH-3-8)	Proposed Hydrant and Connection for Lot 3 & Lot 8

4.1.3 Peak Day + Local Fire Flow (1,500 gpm)

In addition to the offsite fire flow scenario, the onsite scenario was also evaluated based on the fire flow discussed with the fire marshal (i.e. 1,500 gpm). Table 8, shows the results for the local fire flow scenario. It should be noted, that as many as three fire hydrants are anticipated at this time. These hydrant locations have been used for the model. Actual fire hydrant locations must be approved by the fire marshal during final design. Complete results are available in the appendix.

Table 8 - Peak Day + Local Fire Flow (1,500 gpm)

Fire Flow Location	Residual Pressure At Hydrant (psi)	Location of Minimum Pressure	Minimum System Pressure During Fire Flow (psi)
(FH-1-6)	51.8	J-32*	37.3
(FH-3-8)	56.9	J-32*	37.3

4.1.4 Peak Day + Local Fire Flow (3,000 gpm)

As mentioned throughout this report, a second fire flow scenario was evaluated using a fire flow demand of 3,000 gpm. This flow is proposed as an option to fire sprinklers and requires PCMC approval. This scenario was evaluated based on Stantec's meeting with PCMC staff on December 17, 2014. Table 9 shows the minimum residual and system pressures during a 3,000 gpm fire flow event.

Table 9 - Peak Day + Local Fire Flow (3,000 gpm)

Fire Flow Location	Residual Pressure At Hydrant (psi)	Location of Minimum Pressure	Minimum System Pressure During Fire Flow (psi)
(FH-1-6)	47.2	J-32*	36.0
(FH-3-8)	55.0	J-32*	36.0

4.1.5 Additional Hydraulic Evaluations

Under the peak day + sprinkler flow scenario, an evaluation of the potential design alternatives from the main to the building was completed. Table 10 shows the benefits of a dedicated fire sprinkler line when compared to a single meter for a sprinkler flow of 100 gpm(See Appendix B.8).

Table 10 - Lateral Design Alternatives

	Location	Pressure at Main Floor (psi)
Dedicated Fire Lateral	Lot - 1	51.1
1 Meter	Lot - 1	40.9

Based on the above results, there is value in using a dedicated fire lateral configuration to service fire sprinklers; however, there appears to be adequate pressure even with the single lateral options. This configuration should be evaluated on a case by case basis during final design.

Table 11, below, illustrates the results for the Lot 1 top floor ceiling fire sprinkler evaluation. The evaluation has been completed for the dedicated fire lateral option only. This evaluation is preliminary and is not based on an actual floor plan. It is expected that a fire sprinkler designer will reevaluate this preliminary design with the final design of the individual homes.

Table 11 - Fire Sprinkler Residual Pressure Evaluation

	Fire Sprinkler Flow (gpm)	HGL @ Main (ft)	HGL @ US Side of Double Check (ft)	HGL @ DS Side of Double Check (ft)	HGL @ Remote Fire Sprinkler (ft)	Top Floor Ceiling Elevation (ft)	Pressure at Remote Sprinkler (psi)
Lot 1	16	7502.5	7501.7	7491.9	7490.2	7403	37.8
	30	7502.5	7501.5	7490.4	7488.8	7403	37.2
	50	7502.5	7501.1	7489.0	7485.0	7403	35.5
	60	7502.5	7500.9	7488.4	7482.9	7403	34.6
	80	7502.5	7500.4	7487.5	7478.1	7403	32.5
	90	7502.5	7500.0	7486.6	7474.9	7403	31.1
	100	7502.5	7499.7	7485.9	7471.6	7403	29.7

4.2 CONCLUSION OF PROJECT IMPACT FROM MODEL RESULTS

Based on the modeling completed, the PCMC water system will be capable of supplying adequate pressure and flow to the proposed Alice Claim nine-homes for the controlling scenarios.

4.3 RULE COMPLIANCE CONCLUSION

With the designed improvements all existing and new water users will be provided the required quantity of water at pressures compliant with UDDW rules (R309-105-9 Administration: General Requirements of Public Water Systems – Minimum Water Pressure). See Appendix C for completed UDDW Checklist for Hydraulic Model Design Elements Report.

4.4 CONCLUSIONS AND RECOMMENDATIONS

As illustrated above, the water system exceeds the minimum pressure requirements of the UDDW for public drinking water systems. Site and building design must incorporate the findings of this report to ensure that adequate pressure is maintained to and within the residential buildings. During design, the developer may elect to complete further investigations with the PCMC Water Department to identify reasonable alternatives for improving the pressures at some lots if possible.

It is understood that, PCMC requires fire sprinklers for all residences. Design of adequate fire sprinkler services must be approved by PCMC during review of the individual home designs. The design of the fire sprinkler systems is outside of the scope of this modeling. For reference, a fact sheet from the *International Residential Code Fire Sprinkler Coalition* that is related to the design requirements for residential fire sprinkler systems is attached in the appendix. This appendix document illustrates the minimum water pressure requirements needed for residential fire sprinkler systems.

Although it is clear that the City's standards require fire sprinklers, it is also clear that the system could meet the needed fire flow for non-sprinkled houses (i.e. 3,000 gpm). Based on the analysis, it appears that either option will accommodate residential development consistent with the current version of the Alice Claim project. The higher fire flow may require additional hydrants to bring the flow to the fire. While the lower fire flow will require more design and coordination with respect to the residential fire sprinklers.

In the event that PCMC prefers to use fire sprinklers for all residences in the Alice Claim project, It is recommended that dedicated fire laterals be considered for the highest three lots a case by case basis. Final design should be coordinated with PCMC.

Appendix A CALCULATIONS

A.1 DEMAND CALCULATIONS

ALICE LODE
WATER DEMAND CALCULATIONS

(PROJECT TOTALS)

ITEM NO.	TYPE OF USE	Average IRRG. PER LOT	TOTAL	UNITS	SOURCE PEAK DAY DEMAND			STORAGE REQUIREMENT UNIT DMD	STORAGE REQUIREMENT TOTAL DMD	PEAK INSTANTANEOUS DMD	ANNUAL WATER RIGHT DEMANDS UNIT DMD	TOTAL DMD	CONSUMPTIVE VALUES	
		(ACRES)			(GPD)	(GPM)	(GPD)	(GAL	(GAL)	(GPM)	(AC-FT)	(AC-FT)	(%)	(AC-FT)
			(a)		(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
	(FORMULAS)				per eru	total	total	(b)/2	(a)*(e)	10.8*(d/800)^0.64	(calc.)	(a)*(h)	(calc.)	(i)*(j)
I. INDOOR														
	RESIDENTIAL USES													
1	SINGLE FAMILY		9	UNITS	1,000	6	9,000	500	4,500		0.560	5.0	20.0%	1.0
	SUBTOTAL RESIDENTIAL INDOOR		**9**			**6**	**9,000**		**4,500**	**33**		**5.0**		**1.0**
II. OUTDOOR														
1	SINGLE FAMILY	0.109	9	UNITS	440	2.75	3,960	220	1,980	5.5	0.13	1.2	50.0%	0.6
	SUBTOTAL RESIDENTIAL OUTDOOR		9			3	3,960		1,980	5		1.2		0.6
	INDOOR AND OUTDOOR SUBTOTAL					**9**	**12,960**		**6,480**	**38.1**		**6.2**		**1.6**
III. FIRE FLOW														
	ASSUMED TO BE 1500 GPM FOR 2 HOURS								**180,000**					
	TOTAL					**9.0**			**186,480**			**6.2**		**1.6**

NOTES:

INDOOR DEMANDS BASED ON UDDW REGULATIONS.

OUTDOOR DEMANDS BASED ON UDDW ZONE 2 REQUIREMENTS

1) PEAK DAY INDOOR DEMAND BASED ON PROPOSED SQUARE FOOTAGE WHEN COMPARED TO AN AVERAGE HOME (EG TYPICAL ERU)

2) PEAK INSTANTANEOUS INDOOR BASED ON 10.8(D/800)^.64 - UDDW

3) PLEASE NOTE THAT THE IRRIGATION PER LOT IS AN AVERAGE THAT ACCOUNTS FOR SOME IRRIGATION OF THE LANDSCAPING LOCATED AT THE ENTRY WALL. TOTAL ANTICIPATED IRRIGATION IS 1.0 AC +/-.

V:\2053\Active\205303057\analysis\Water Model\Calcs\[WTR_ DEMANDS_20160208.xls]Total Water Demands

Appendix B - WATERCAD REPORTS

B.1 PEAK DAY

B.2 PEAK INSTANTANEOUS

B.3 PEAK DAY + LOCAL FIRE FLOW (1,500 GPM)

B.4 PEAK DAY + LOCAL FIRE FLOW (3,000 GPM)

B.5 PEAK DAY + OFF SITE FIRE FLOW (3,000 GPM)

B.6 PEAK DAY + SPRINKLER FLOW @ LOT 1

B.7 ALICE CLAIM LATERAL ANALYSIS

B.8 ALICE CLAIM FIRE SPRINKLER ANALYSIS

FlexTable: Junction Table
Active Scenario: Peak Day

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-32*	7,400.00	0	7,504.46	45.2
LOT-1	7,368.00	1	7,502.83	58.3
LOT-6	7,365.00	1	7,502.83	59.6
(FH-1-6)	7,360.00	0	7,502.83	61.8
LOT-7	7,357.00	1	7,502.65	63.0
LOT-2	7,356.00	1	7,502.65	63.4
(2-7)	7,355.00	0	7,502.65	63.9
LOT-3	7,350.00	1	7,502.52	66.0
LOT-8	7,350.00	1	7,502.52	66.0
(FH-3-8)	7,347.00	0	7,502.53	67.3
LOT-4	7,345.00	1	7,502.34	68.1
LOT-9	7,342.00	1	7,502.34	69.4
LOT-5	7,338.00	1	7,502.34	71.1
(4-5-9)	7,336.00	0	7,502.34	72.0
J-2	7,290.00	1,350	7,501.81	91.6

1. Node data for "LOT" nodes are provided for information only. These nodes are past the point of compliance for state regulated water systems. Elevations for these node are main floor elevations.
2. "J" Nodes and "()" nodes are within the public water system.
3. Please note that all nodes meet the requirements of the State for minimum peak day water pressure.

FlexTable: Pipe Table
Active Scenario: Peak Day

Current Time: 0.000 hours

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-28	64	14.7	HDPE	110.0	1,357	2.57	0.003	0.18
P-30	55	14.7	HDPE	110.0	1,355	2.57	0.002	0.13
P-43	26	12.4	Ductile Iron	110.0	1,359	3.61	0.021	0.54
P-44	714	14.7	HDPE	110.0	1,359	2.58	0.002	1.63
P-49	80	14.7	HDPE	110.0	1,353	2.56	0.002	0.18
P-50	236	14.7	HDPE	110.0	1,350	2.56	0.002	0.53
P-52	32	2.0	Copper	110.0	1	0.10	0.000	0.00
P-54	35	2.0	Copper	110.0	1	0.10	0.000	0.00
P-55	49	2.0	Copper	110.0	1	0.10	0.000	0.00
P-56	26	2.0	Copper	110.0	1	0.10	0.000	0.00
P-58	27	2.0	Copper	110.0	1	0.10	0.000	0.00
P-59	31	2.0	Copper	110.0	-1	0.10	0.000	0.00
P-60	71	2.0	Copper	110.0	1	0.10	0.000	0.00
P-62	44	2.0	Copper	110.0	1	0.10	0.000	0.00
P-63	26	2.0	Copper	110.0	1	0.10	0.000	0.00

FlexTable: Tank Table

Active Scenario: Peak Day

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,505.00	7,505.00	7,488.00	1,359

FlexTable: Junction Table

Active Scenario: Peak Instantaneous

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-32*	7,400.00	0	7,498.37	42.6
LOT-1	7,368.00	4	7,493.69	54.4
LOT-6	7,365.00	4	7,493.72	55.7
(FH-1-6)	7,360.00	0	7,493.75	57.9
LOT-7	7,357.00	4	7,493.19	58.9
LOT-2	7,356.00	4	7,493.21	59.4
(2-7)	7,355.00	0	7,493.23	59.8
LOT-3	7,350.00	4	7,492.85	61.8
LOT-8	7,350.00	4	7,492.85	61.8
(FH-3-8)	7,347.00	0	7,492.87	63.1
LOT-4	7,345.00	4	7,492.33	63.7
LOT-9	7,342.00	4	7,492.32	65.0
LOT-5	7,338.00	4	7,492.34	66.8
(4-5-9)	7,336.00	0	7,492.36	67.7
J-2	7,290.00	2,350	7,490.88	86.9

1. Node data for "LOT" nodes are provided for information only. These nodes are past the point of compliance for state regulated water systems. Elevations for these node are main floor elevations.
2. "J" Nodes and "()" nodes are within the public water system.
3. Please note that all nodes meet the requirements of the State for minimum peak instantaneous water pressure.

FlexTable: Pipe Table

Active Scenario: Peak Instantaneous

Current Time: 0.000 hours

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-28	64	14.7	HDPE	110.0	2,379	4.51	0.008	0.52
P-30	55	14.7	HDPE	110.0	2,371	4.49	0.006	0.35
P-43	26	12.4	Ductile Iron	110.0	2,387	6.34	0.064	1.63
P-44	714	14.7	HDPE	110.0	2,387	4.52	0.006	4.63
P-49	80	14.7	HDPE	110.0	2,362	4.48	0.006	0.51
P-50	236	14.7	HDPE	110.0	2,350	4.45	0.006	1.49
P-52	32	2.0	Copper	110.0	4	0.42	0.001	0.03
P-54	35	2.0	Copper	110.0	4	0.42	0.001	0.03
P-55	49	2.0	Copper	110.0	4	0.42	0.001	0.04
P-56	26	2.0	Copper	110.0	4	0.42	0.001	0.02
P-58	27	2.0	Copper	110.0	4	0.42	0.001	0.02
P-59	31	2.0	Copper	110.0	-4	0.42	0.001	0.03
P-60	71	2.0	Copper	110.0	4	0.42	0.001	0.06
P-62	44	2.0	Copper	110.0	4	0.42	0.001	0.04
P-63	26	2.0	Copper	110.0	4	0.42	0.001	0.02

FlexTable: Tank Table

Active Scenario: Peak Instantaneous

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,500.00	7,500.00	7,488.00	2,387

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Peak Day + Local Fire Flow (1,500 gpm)

Current Time: 0.000 hours

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Balanced?	Velocity of Maximum Pipe (ft/s)	Pipe w/ Maximum Velocity
J-32*	1	2	1	2	20.0	38.1	20.0	51.2	LOT-1	51.2	LOT-1	True	3.62	P-43
(FH-1-6)	1,500	1,501	1,500	1,501	20.0	51.8	20.0	37.3	J-32*	37.3	J-32*	True	7.60	P-43
LOT-1	1	2	2	3	20.0	51.2	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(FH-3-8)	1,500	1,501	1,500	1,501	20.0	56.9	20.0	37.3	J-32*	37.3	J-32*	True	7.60	P-43
LOT-6	1	2	2	3	20.0	52.5	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-7	1	2	2	3	20.0	55.9	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-2	1	2	2	3	20.0	56.3	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(2-7)	1	2	1	2	20.0	56.7	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-3	1	2	2	3	20.0	58.8	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-8	1	2	2	3	20.0	58.8	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-4	1	2	2	3	20.0	60.9	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-9	1	2	2	3	20.0	62.2	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-5	1	2	2	3	20.0	64.0	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(4-5-9)	1	2	1	2	20.0	64.8	20.0	64.8	(4-5-9)	38.1	J-32*	True	3.62	P-43
J-2	1	2	1,351	1,352	20.0	84.5	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43

1. Minimum residuals are based a"tank empty" elevation.

FlexTable: Tank Table

Active Scenario: Peak Day + Local Fire Flow (1,500 gpm)

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,488.50	7,488.50	7,488.00	1,359

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Peak Day + Local Fire Flow (3,000 gpm)

Current Time: 0.000 hours

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Balanced?	Velocity of Maximum Pipe (ft/s)	Pipe w/ Maximum Velocity
J-32*	1	2	1	2	20.0	38.1	20.0	51.2	LOT-1	51.2	LOT-1	True	3.62	P-43
(FH-1-6)	1,500	3,000	1,500	3,000	20.0	47.2	20.0	36.0	J-32*	36.0	J-32*	True	11.58	P-43
LOT-1	1	2	2	3	20.0	51.2	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(FH-3-8)	1,500	3,000	1,500	3,000	20.0	51.6	20.0	36.0	J-32*	36.0	J-32*	True	11.58	P-43
LOT-6	1	2	2	3	20.0	52.5	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-7	1	2	2	3	20.0	55.9	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-2	1	2	2	3	20.0	56.3	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(2-7)	1	2	1	2	20.0	56.7	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-3	1	2	2	3	20.0	58.8	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-8	1	2	2	3	20.0	58.8	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-4	1	2	2	3	20.0	60.9	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-9	1	2	2	3	20.0	62.2	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
LOT-5	1	2	2	3	20.0	64.0	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43
(4-5-9)	1	2	1	2	20.0	64.8	20.0	64.8	(4-5-9)	38.1	J-32*	True	3.62	P-43
J-2	1	2	1,351	1,352	20.0	84.5	20.0	38.1	J-32*	38.1	J-32*	True	3.62	P-43

1. Minimum residuals are based a"tank empty" elevation.

FlexTable: Tank Table

Active Scenario: Peak Day + Local Fire Flow (3,000 gpm)

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,488.50	7,488.50	7,488.00	1,359

FlexTable: Junction Table

Active Scenario: Peak Day + Off Site Fire Flow (3,000 gpm)

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-32*	7,400.00	0	7,483.19	36.0
LOT-1	7,368.00	1	7,469.07	43.7
LOT-6	7,365.00	1	7,469.07	45.0
(FH-1-6)	7,360.00	0	7,469.08	47.2
LOT-7	7,357.00	1	7,467.44	47.8
LOT-2	7,356.00	1	7,467.44	48.2
(2-7)	7,355.00	0	7,467.44	48.6
LOT-3	7,350.00	1	7,466.35	50.3
LOT-8	7,350.00	1	7,466.35	50.3
(FH-3-8)	7,347.00	0	7,466.35	51.6
LOT-4	7,345.00	1	7,464.77	51.8
LOT-9	7,342.00	1	7,464.77	53.1
LOT-5	7,338.00	1	7,464.77	54.8
(4-5-9)	7,336.00	0	7,464.77	55.7
J-2	7,290.00	4,350	7,460.12	73.6

FlexTable: Pipe Table

Active Scenario: Peak Day + Off Site Fire Flow (3,000 gpm)

Current Time: 0.000 hours

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-28	64	14.7	HDPE	110.0	4,357	8.26	0.026	1.63
P-30	55	14.7	HDPE	110.0	4,355	8.26	0.020	1.09
P-43	26	12.4	Ductile Iron	110.0	4,359	11.58	0.208	5.31
P-44	714	14.7	HDPE	110.0	4,359	8.26	0.020	14.11
P-49	80	14.7	HDPE	110.0	4,353	8.25	0.020	1.58
P-50	236	14.7	HDPE	110.0	4,350	8.25	0.020	4.65
P-52	32	2.0	Copper	110.0	1	0.10	0.000	0.00
P-54	35	2.0	Copper	110.0	1	0.10	0.000	0.00
P-55	49	2.0	Copper	110.0	1	0.10	0.000	0.00
P-56	26	2.0	Copper	110.0	1	0.10	0.000	0.00
P-58	27	2.0	Copper	110.0	1	0.10	0.000	0.00
P-59	31	2.0	Copper	110.0	-1	0.10	0.000	0.00
P-60	71	2.0	Copper	110.0	1	0.10	0.000	0.00
P-62	44	2.0	Copper	110.0	1	0.10	0.000	0.00
P-63	26	2.0	Copper	110.0	1	0.10	0.000	0.00

FlexTable: Tank Table

Active Scenario: Peak Day + Off Site Fire Flow (3,000 gpm)

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,488.50	7,488.50	7,488.00	4,359

FlexTable: Junction Table

Active Scenario: Peak Day + Sprinkler Flow @ Lot 1

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-32*	7,400.00	0	7,504.38	45.2
LOT-1	7,368.00	101	7,480.78	48.8
LOT-6	7,365.00	1	7,502.52	59.5
(FH-1-6)	7,360.00	0	7,502.52	61.7
LOT-7	7,357.00	1	7,502.34	62.9
LOT-2	7,356.00	1	7,502.34	63.3
(2-7)	7,355.00	0	7,502.34	63.7
LOT-3	7,350.00	1	7,502.21	65.9
LOT-8	7,350.00	1	7,502.21	65.9
(FH-3-8)	7,347.00	0	7,502.22	67.2
LOT-4	7,345.00	1	7,502.03	67.9
LOT-9	7,342.00	1	7,502.03	69.2
LOT-5	7,338.00	1	7,502.03	71.0
(4-5-9)	7,336.00	0	7,502.03	71.8
J-2	7,290.00	1,350	7,501.50	91.5

1. Sprinkler flow was evaluated for the highest lot (i.e. Lot 1) to evaluate residual pressure at the house.
2. Sprinkler flows are short duration flows that occur at the beginning of a fire flow evenet. For that reason, they have been modeled at the top elevation of fire flow storage.

FlexTable: Pipe Table

Active Scenario: Peak Day + Sprinkler Flow @ Lot 1

Current Time: 0.000 hours

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-28	64	14.7	HDPE	110.0	1,357	2.57	0.003	0.18
P-30	55	14.7	HDPE	110.0	1,355	2.57	0.002	0.13
P-43	26	12.4	Ductile Iron	110.0	1,459	3.88	0.024	0.62
P-44	714	14.7	HDPE	110.0	1,459	2.77	0.003	1.86
P-49	80	14.7	HDPE	110.0	1,353	2.56	0.002	0.18
P-50	236	14.7	HDPE	110.0	1,350	2.56	0.002	0.53
P-52	32	2.0	Copper	110.0	1	0.10	0.000	0.00
P-54	35	2.0	Copper	110.0	1	0.10	0.000	0.00
P-55	49	2.0	Copper	110.0	1	0.10	0.000	0.00
P-56	26	2.0	Copper	110.0	1	0.10	0.000	0.00
P-58	27	2.0	Copper	110.0	1	0.10	0.000	0.00
P-59	31	2.0	Copper	110.0	-1	0.10	0.000	0.00
P-60	71	2.0	Copper	110.0	101	10.31	0.305	21.74
P-62	44	2.0	Copper	110.0	1	0.10	0.000	0.00
P-63	26	2.0	Copper	110.0	1	0.10	0.000	0.00

1. A maximum sprinkler flow of 100 gpm was used for this scenario. This is considered to be conservative based on actual minimums for residential sprinkler flow.

FlexTable: Tank Table
Active Scenario: Peak Day + Sprinkler Flow @ Lot 1

Current Time: 0.000 hours

ID	Label	Elevation (Maximum) (ft)	Elevation (Initial) (ft)	Hydraulic Grade (ft)	Elevation (Minimum) (ft)	Flow (Out net) (gpm)
29	Woodside Tank	7,512.17	7,505.00	7,505.00	7,488.00	1,459

Alice Claim Lateral Analysis
Summary

	Location	HGL @ Tank (ft)	HGL @ Main (ft)	HGL @ US Side of Meter (ft)	HGL @ DS Side of Meter (ft)	HGL @ Structure (ft)	Main Floor Elevation (ft)	Pressure at Main Floor (psi)
Dedicated Fire Lateral	Lot - 1	7505	7502.52	7499.66	7485.88	7485.88	7368	51.1
1 Meter	Lot - 1	7505	7502.32	7498.97	7475.38	7462.42	7368	40.9

Notes:
1. HGL at main based on WaterCAD Results (see Appendix B.6 &B.7)
2. HGL at upstream side of meter based on head loss, see attached.
3. HGL at downstream side of meter based on cut sheet, see attached.
4. HGL at structure based on head loss, see attached.
5. Main Floor Elevation based on current design.

Alice Claim Development
Lateral and Fire Sprinkler Evaluation - Lot 1 (Dedicated Fire)

Section #1 Main to Double Check

Start: Main
Stop: Double Check Inlet
Length: 49
ELEV: 7368 (MAIN ELEVATION)
HGL: 7502.5 DYNAMIC

	#	K
Entrance	1	0.8

Section #1 Main to Double Check

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
49	16	3.00	110	0.05	0.7	0.1	0.8	0.9	7501.7	57.9
49	30	3.00	110	0.05	1.4	0.2	0.8	1.0	7501.5	57.8
49	50	3.00	110	0.05	2.3	0.6	0.8	1.4	7501.1	57.7
49	60	3.00	110	0.05	2.7	0.8	0.8	1.6	7500.9	57.6
49	80	3.00	110	0.05	3.6	1.4	0.8	2.2	7500.4	57.3
49	90	3.00	110	0.05	4.1	1.7	0.8	2.5	7500.0	57.2
49	100	3.00	110	0.05	4.5	2.1	0.8	2.9	7499.7	57.0

Section #2 - Double Check

Start: Double Check Inlet
Stop: Double check Outlet
Length: 5
ELEV: 7368
HGL: VARIES, SEE SEC. #1

	#	K
90-deg bend	2	0.63
Double Check (Chart Take Off)	0	0

Section #2 - Double Check

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
5	16	3.00	110	0.05	0.7	0.0	9.7	9.7	7491.9	53.7
5	30	3.00	110	0.05	1.4	0.0	11.1	11.1	7490.4	53.0
5	50	3.00	110	0.05	2.3	0.1	12.1	12.2	7489.0	52.4
5	60	3.00	110	0.05	2.7	0.1	12.4	12.5	7488.4	52.2
5	80	3.00	110	0.05	3.6	0.1	12.7	12.9	7487.5	51.8
5	90	3.00	110	0.05	4.1	0.2	13.3	13.4	7486.6	51.4
5	100	3.00	110	0.05	4.5	0.2	13.6	13.8	7485.9	51.1

Section #3 Interior Fire Loop.

Start: Double check Outlet
Stop: HOUSE
Length: 130
ELEV: 7403
HGL: VARIES, SEE SEC. #2

	#	K
90-deg bend	3	0.63

Section #3 Interior Fire Loop.

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
162	16	2.00	110	0.0	1.6	1.6	0.1	1.7	7490.2	37.8
162	15	2.00	110	0.0	1.5	1.5	0.1	1.5	7488.8	37.2
162	25	2.00	110	0.0	2.6	3.7	0.2	3.9	7485.0	35.5
162	30	2.00	110	0.0	3.1	5.2	0.3	5.5	7482.9	34.6
162	40	2.00	110	0.0	4.1	8.9	0.5	9.4	7478.1	32.5
162	45	2.00	110	0.0	4.6	11.1	0.6	11.7	7474.9	31.1
162	50	2.00	110	0.0	5.1	13.5	0.8	14.3	7471.6	29.7

NOTES:
1. Section 1 assumes single pipe.
2. Section 2 assumes single pipe.
3. Section 3 splits to interior Fire Sprnkler Loop

Alice Claim Development
Lateral and Fire Sprinkler Evaluation - Lot 1 (1 Meter)

Section #1 Main to Meter

Start	Main		#	K
Stop	Tee in Meter box	TEE BRANCH	1	1.14
Length	5			
ELEV	7368 (MAIN ELEVATION)			
HGL	7502 DYNAMIC			

Section #1 Main to Meter

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
5	16	2.00	110	0.02	1.6	0.1	0.05	0.1	7502.2	58.2
5	30	2.00	110	0.02	3.1	0.2	0.17	0.3	7502.0	58.1
5	50	2.00	110	0.02	5.1	0.4	0.46	0.9	7501.4	57.8
5	60	2.00	110	0.02	6.1	0.6	0.66	1.2	7501.1	57.7
5	80	2.00	110	0.02	8.2	1.0	1.18	2.2	7500.1	57.3
5	90	2.00	110	0.02	9.2	1.2	1.50	2.7	7499.6	57.0
5	100	2.00	110	0.02	10.2	1.5	1.85	3.3	7499.0	56.7

Section #2 - Meter

Start	US METER		#	K
Stop	DS METER	90-deg bend	5	0.63
Length	7	Meter chart takeoff	0	0
ELEV	7368			
HGL	VARIES, SEE SEC. #1			

Section #2 - Meter

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
7	16	1.50	110	0.01	2.9	0.3	0.15	0.9	7501.3	57.8
7	30	1.50	110	0.01	5.4	0.9	0.53	2.3	7499.7	57.1
7	50	1.50	110	0.01	9.1	2.4	1.46	5.9	7495.5	55.3
7	60	1.50	110	0.01	10.9	3.3	2.10	8.2	7492.9	54.1
7	80	1.50	110	0.01	14.5	5.6	3.73	14.0	7486.2	51.2
7	90	1.50	110	0.01	16.3	7.0	4.73	18.7	7480.9	48.9
7	100	1.50	110	0.01	18.2	8.5	5.84	23.6	7475.4	46.5

Section #3 Meter to House

Start	DS METER		#	K
Stop	HOUSE	Tee Branch	1	1.14
Length	23			
ELEV	7368			
HGL	VARIES, SEE SEC. #2			

Section #3 Meter to House

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
37	16	2.00	110	0.02	1.6	0.4	0.05	0.4	7500.9	57.6
37	30	2.00	110	0.02	3.1	1.2	0.17	1.4	7498.4	56.5
37	50	2.00	110	0.02	5.1	3.1	0.46	3.5	7492.0	53.7
37	60	2.00	110	0.02	6.1	4.3	0.66	5.0	7487.9	52.0
37	80	2.00	110	0.02	8.2	7.4	1.18	8.5	7477.6	47.5
37	90	2.00	110	0.02	9.2	9.1	1.50	10.6	7470.3	44.3
37	100	2.00	110	0.02	10.2	11.1	1.85	13.0	7462.4	40.9

Section #4 House to Most Remote Sprinkler

Start	HOUSE		#	K
Stop	FIRE SPRINKLER	90-deg bend	3	0.57
Length	130			
ELEV	7403			
HGL	VARIES, SEE SEC. #3			

Section #4 House to Most Remote Sprinkler

Length	Q	Dia	C_{H-W}	Area	V	$h_{L\ pipe}$	$h_{L\ fit}$	$h_{L\ Total}$	HGL	P_{DS}
(ft)	(gpm)	(in)		(ft^2)	ft/s	(ft)	(ft)	(ft)	(ft)	(psi)
162	8	2.00	110	0.02	0.8	0.5	0.02	0.5	7500.4	42.2
162	15	2.00	110	0.02	1.5	1.5	0.06	1.5	7496.9	40.7
162	25	2.00	110	0.02	2.6	3.7	0.17	3.9	7488.1	36.9
162	30	2.00	110	0.02	3.1	5.2	0.25	5.5	7482.4	34.4
162	40	2.00	110	0.02	4.1	8.9	0.44	9.4	7468.2	28.3
162	45	2.00	110	0.02	4.6	11.1	0.56	11.7	7458.6	24.1
162	50	2.00	110	0.02	5.1	13.5	0.69	14.2	7448.2	19.6

NOTES:
1. Section 1 assumes single pipe.
2. Section 2 assumes single pipe.
3. Section 3 assumes single pipe.
4. Section 4 assumes looped fire sprinkler system.

DS-W-OMR-00-00-0611-03-A

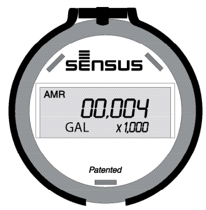
OMNI™ R²

1-1/2" and 2" OMNI R² Meter

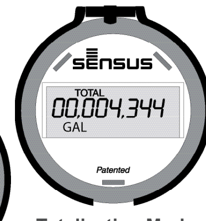
Description

1-1/2" and 2" Sizes

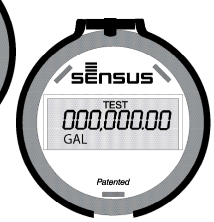
The OMNI R² meter operation is based on advanced Floating Ball Technology (FBT).



AMR/AMI Mode



Totalization Mode



Resettable Test Mode

Features

CONFORMANCE TO STANDARDS

The OMNI R² meter meets and far exceeds the most recent revision of ANSI/AWWA Standard C701 class II standards and exceeds ANSI/AWWA C700 Residential Standard using Sensus Turbo technology. Each meter is performance tested to ensure compliance. All OMNI meters are NSF/ANSI Standard 61, Annex F and G approved.

PERFORMANCE

The patented measurement principles of the OMNI R² meter assure enhanced accuracy ranges, an overall greater accuracy, and a longer service life than any other comparable class meter produced. The OMNI R² meter has no restrictions as to sustained flow rates within its continuous operating range. The floating ball measurement technology allows for flows up to its rated maximum capacity without affecting undue wear or accuracy degradation when installed in any orientation.

CONSTRUCTION

The OMNI R² meter consists of two basic assemblies; the maincase and the measuring chamber. The measuring chamber assembly includes the "floating ball" impeller with a coated titanium shaft, hybrid axial bearings, integral flow straightener and an all electronic programmable register with protective bonnet. The maincase is made from industry proven Ductile Iron with an approved NSF epoxy coating. Maincase features are; easily removable measuring chamber, unique chamber seal to the maincase using a high pressure o-ring, testing port and a convenient integral strainer.

OMNI ELECTRONIC REGISTER

The OMNI R² electronic register consist of a hermetically sealed register with an electronic pickup containing no mechanical gearing. The large character LCD displays AMR, Totalization and a Resettable Test Totalizer. OMNI register features; AMR resolution units that are fully programmable, Large, easy-to-read LCD also displays both forward and reverse flow directions and all with a 10-year battery life guarantee.

MAGNETIC DRIVE

Meter registration is achieved by utilizing a fully magnetic pickup system. This is accomplished by the magnetic actions of the embedded rotor magnets and the ultra sensitive register pickup probe. The only moving component in water is the "floating ball" impeller.

MEASURING ELEMENT

The revolutionary thermoplastic, hydro dynamically balanced impeller floats between the bearings. The Floating Ball Technology (FBT) allows the measuring element to operate virtually without friction or wear, thus creating the extended upper and lower flow ranges capable on only the OMNI R² meter.

STRAINER

The OMNI R² with the "V" shaped integral strainer using a stainless steel screen along with Floating Ball Technology (FBT) create a design that gives far improved accuracy even in those once thought questionable settings. A removable strainer cover permits easy access to the screen for routine maintenance.

MAINTENANCE

The OMNI R² meter is designed for easy maintenance. Should any maintenance be required, the measuring chamber and/or strainer cover can be removed independently. Parts and or a replacement measuring chamber may be utilized in the event repairs are needed. Replacement Measuring Chambers are available for the OMNI R² meters and may be utilized for retrofitting to competitive meters to achieve increased accuracy and extended service life.

AMR / AMI SYSTEMS

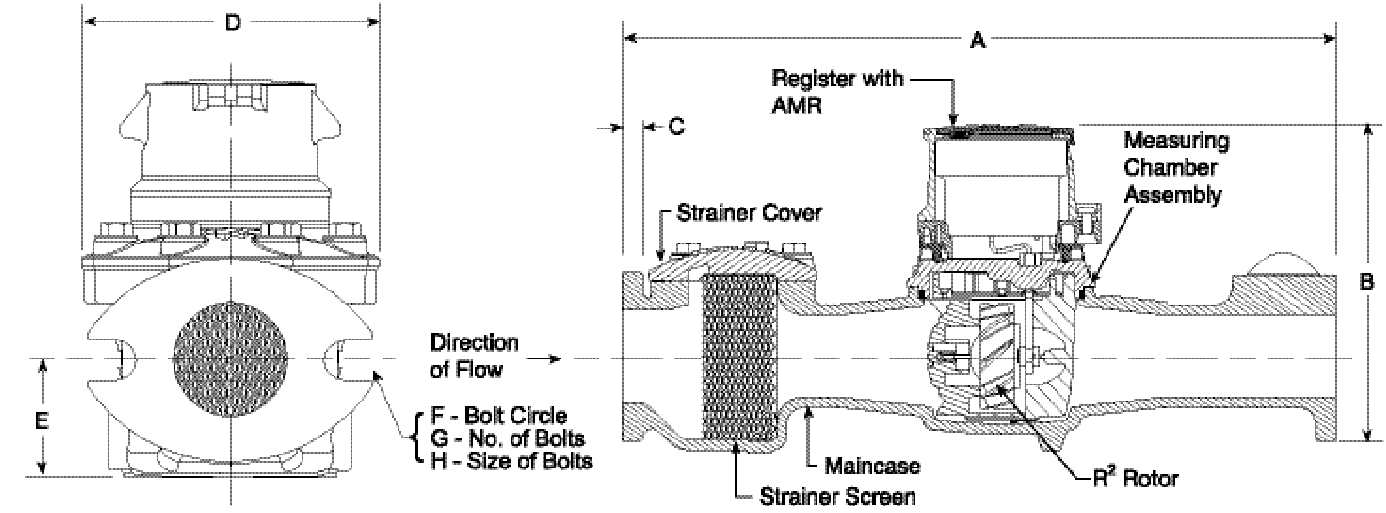
Meters and encoders are compatible with current Sensus AMR/AMI systems.

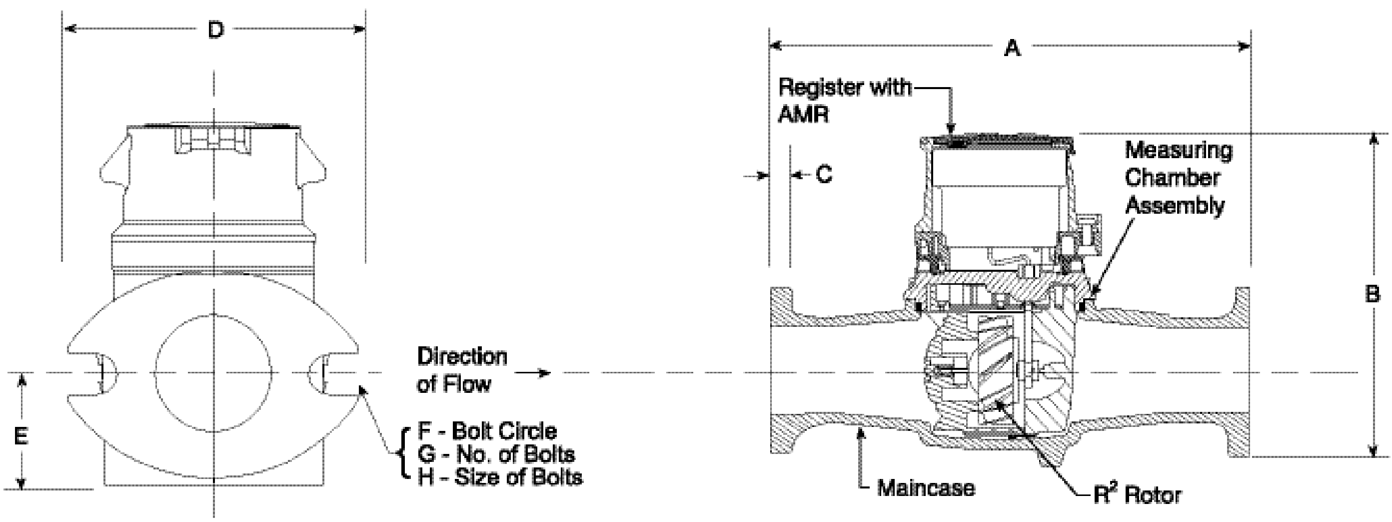
GUARANTEE

Sensus OMNI R² Meters are backed by "The Sensus Guarantee." Ask your Sensus representative for details or see Bulletin G-500.

sensus

OMNI R^2: 1-1/2" and 2"Sizes





DIMENSIONS AND NET WEIGHTS

Meter and Pipe Size	Normal Operating Range		Connec-tions	A	B	C	D	E	F	G	H	J	Net Weight	Shipping Weight
1-1/2" DN 40mm	2 gpm .45 m³/hr	150 gpm 34 m³/hr	Flanged	13" 330mm	7-7/8" 200mm	15/16" 24mm	5-1/8" 130mm	2-5/16" 59mm	4" 102mm	2	5/8" 16mm	1" 25mm	18.8 lbs. 8.53 kg..	22.5 lbs. 10.20 kg.
2" DN 50mm	2.5 gpm .56 m³/hr	200 gpm 45 m³/hr	Flanged	17" 432mm	7-7/8" 200mm	1" 25mm	5-3/4" 146mm	2-5/16" 59mm	4-1/2" 114mm	2	3/4" 19mm	1" 25mm	27.4 lbs. 12.42 kg.	34.5 lbs. 15.65 kg.
2" without Strainer DN 80mm	2.5 gpm .56 m³/hr	250 gpm 57 m³/hr	Flanged	10" 254mm	7-7/8" 200mm	1" 25mm	5-3/4" 146mm	2-5/16" 59mm	4-1/2" 114mm	2	3/4" 19mm	1" 25mm	17 lbs. 7.9 kg.	24.5 lbs. 11.11 kg.

sensus

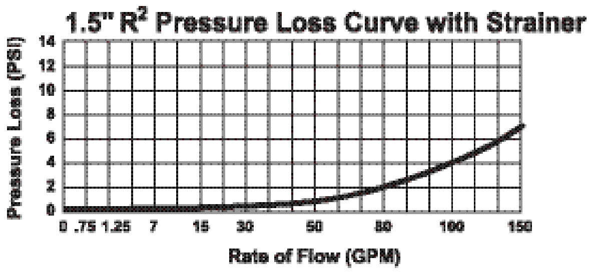
OMNI R^2: 1-1/2" and 2" Sizes

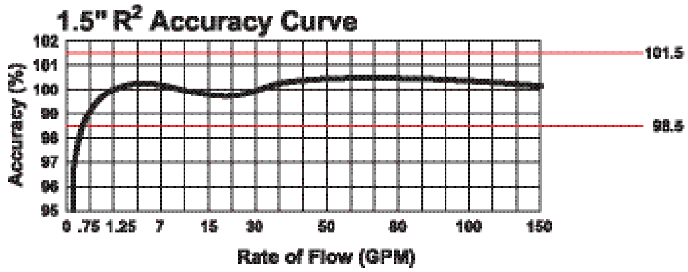
SPECIFICATIONS

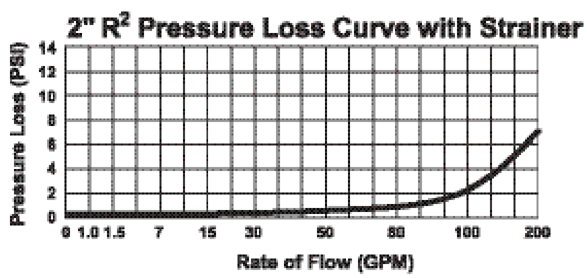
SERVICE	Measurement of potable and reclaim water. Operating temperature range of 33 ºF (.56 ºC) - 150 ºF (65.6 ºC)
OPERATING RANGE (100% ± 1.5%)	1-1/2": 2 – 150 GPM (.45 - 34 m³/hr) 2": 2.5 – 200 GPM (.56 – 45 m³/hr) 2" without Strainer: 2.5 – 200 GPM (.56 – 45 m³/hr)
LOW FLOW (95% – 101.5%)	1-1/2": .75 GPM (.17 m³/hr) 2": 1.0 GPM (.23 m³/hr) 2" without Strainer: 1.0 GPM (.23 m³/hr)
PRESSURE LOSS	1-1/2": 6.7 psi @ 150 GPM (0.46 bar @ 34 m³/hr) 2": 7.0 psi @ 200 GPM (.48 bar @ 45 m³/hr)
MAXIMUM OPERATING PRESSURE	200 PSI (13.8 bar)

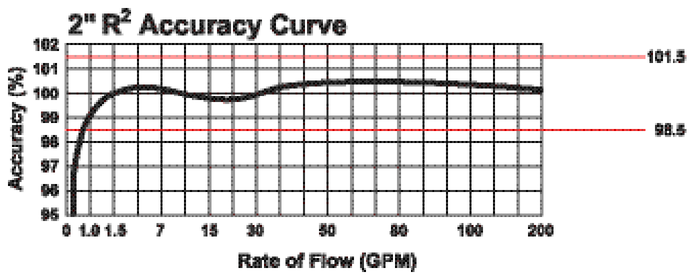
FLANGE CONNECTIONS	U.S. ANSI B16.1 / AWWA Class 125
REGISTER	Fully electronic sealed register with programmable registration (Gal. /Cu.Ft./ Cu. Mtr. / Imp.Gal / Acre Ft.) Programmable AMR/AMI reading Guaranteed 10 year battery life
NSF APPROVED MATERIALS	**Maincase:** Coated Ductile Iron **Measuring Chamber:** Thermoplastic **Rotor "Floating Ball":** Thermoplastic **Radial Bearings:** Hybrid Thermoplastic **Thrust Bearings:** Sapphire/Ceramic Jewel **Magnets:** Ceramic Magnet **Strainer Screen:** Stainless Steel **Strainer Cover:** Coated Ductile Iron **Test Plug:** Coated Ductile Iron

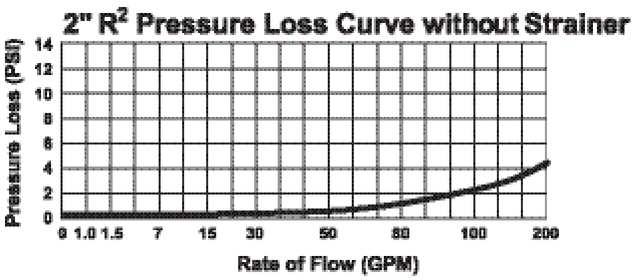
Headloss Curves











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Raleigh, NC 27615
1-800-638-3748
www.sensus.com/water

For Non-Health Hazard Applications

Job Name ______________________

Contractor ______________________

Job Location ______________________

Approval ______________________

Engineer ______________________

Contractor's P.O. No. ______________________

Approval ______________________

Representative ______________________

LEAD FREE*

Series LF007

Double Check Valve Assemblies

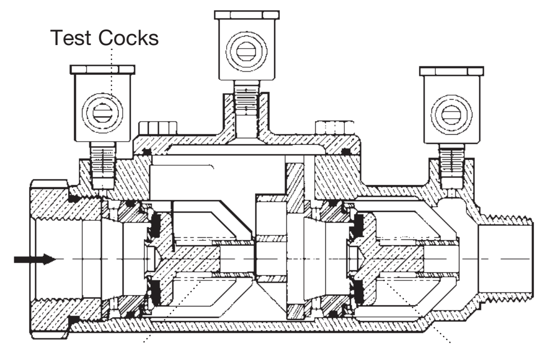
Sizes: ½" – 3" (15 – 80mm)

Series LF007 Double Check Valve Assemblies shall be installed at referenced cross-connections to prevent the backflow of polluted water into the potable water supply. Only those cross-connections identified by local inspection authorities as non-health hazard shall be allowed the use of an approved double check valve assembly. The LF007 features Lead Free* construction to comply with Lead Free* installation requirements.

Check with local authority having jurisdiction regarding vertical orientation, frequency of testing or other installation requirements.

The valve shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510. Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

¾" (20mm) LF007M3QT



The LF007 Series features a modular design concept which facilitates complete maintenance and assembly by retaining the spring load.

Features

- Ease of maintenance — only one cover
- Top entry
- Replaceable seats and seat discs
- Modular construction
- Compact design
- Lead Free* cast copper silicon alloy body construction — ½" – 2" (15 – 50mm)
- Fused epoxy coated cast iron body — 2½" – 3" (65 – 80mm)
- Top mounted Lead Free* ball valve test cocks
- Low pressure drop
- No special tools required for servicing
- ½" – 1" (15 – 25mm) have tee handles

Specifications

A Double Check Valve Assembly shall be installed at each noted location. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The Double Check Valve Assemblies shall be constructed using Lead Free* cast copper silicon alloy. Lead Free* Double Check Valve Assemblies shall comply with state codes and standards, where applicable, requiring reduced lead content. The assembly shall also include two resilient seated isolation valves; four top mounted, resilient seated test cocks. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510. Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California. Assembly shall be a Watts Series LF007.

NOTICE

Inquire with governing authorities for local installation requirements

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

Pressure — Temperature

½" – 2" (15 – 50mm)

Temperature Range: 33°F – 180°F (0.5°C – 82°C).

Maximum Working Pressure: 175psi (12.1 bar).

2½" – 3" (65 – 80mm)

Temperature Range: 33̊F – 110°F (0.5̊C – 43°C) continuous, 140°F (60°C) intermittent.

Maximum Working Pressure: 175psi (12.1 bar).

Standards

ASSE Std. 1015, AWWA Std. C510

IAPMO PS31, CSA B64.5

Approvals

† ASSE, AWWA, IAPMO, CSA, UPC

▲ Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

• Models with suffix LF and S are not listed.

◆ UL Classified (without shutoff valves only) ¾" – 2" (20 – 50mm) (except 007M3LF)

◆ UL Classified with OSY gate valves (2½" and 3" horizontal only.)

▼ ½" - 2" models Lead Free* with strainer

Horizontal and vertical "flow up" approval on all sizes

Models

Sizes:

½" – 2" (15 – 50mm)

Suffix:

S - copper silicon alloy strainer

LF - without shutoff valves

Prefix:

U - Union connections

2½" – 3" (65 – 80mm)

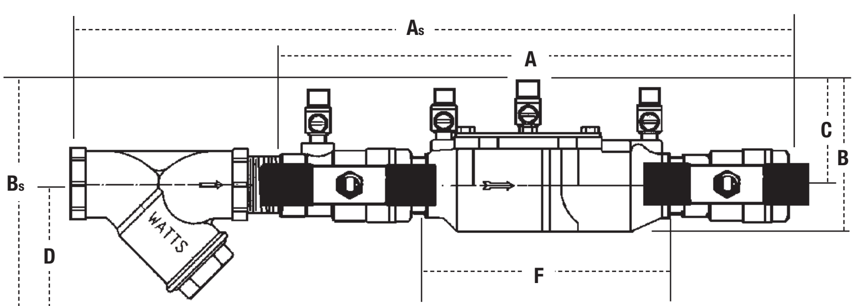
Suffix:

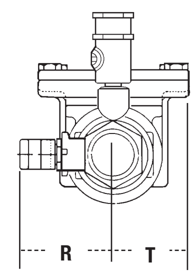
NRS - non-rising stem resilient seated gate valves

OSY - UL/FM outside stem and yoke resilient seated gate valves

LF - without shutoff valves

QT-FDA - FDA epoxy coated quarter-turn ball valves





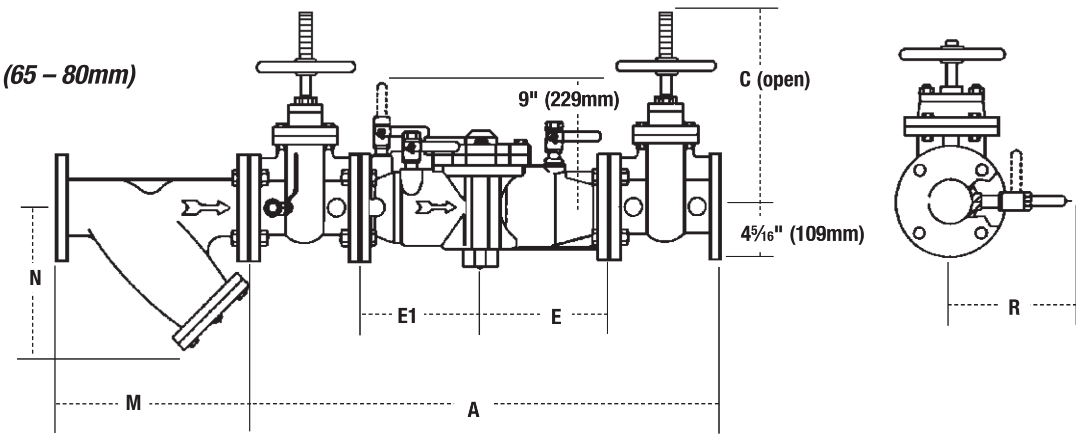
Subscript 'S' = strainer model

Dimensions – Weights

MODEL	SIZE (DN)		DIMENSIONS																WEIGHT	
			A		B		C		D		F		G		R		T			
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
†▲▼ LF007QT	½	15	10	254	4⅝	117	2 7/16	62	—	—	5	127	3⅜	85	2 5/16	59	2 1/16	52	4.5	2
†▲▼ LF007M3QT	¾	20	11⅛	282	4	102	3⅛	79	—	—	6 3/16	157	3 7/16	87	2⅛	54	15/16	33	5	2.3
†▲▼ LF007M1QT	1	25	13¼	337	5⅛	130	4	102	—	—	7½	191	3⅜	85	1 11/16	43	1 11/16	43	12	5.4
†▲▼ LF007M2QT	1¼	32	16⅜	416	5	127	3 5/16	84	—	—	9½	241	5	127	3	76	2	50	15	6.8
†▲▼ LF007M2QT	1½	40	16¾	425	4⅞	124	3½	89	—	—	9¾	248	5 13/16	148	3⅛	79	2 11/16	68	15.9	7.2
†▲▼ LF007M1QT	2	50	19½	495	6¼	159	4	102	—	—	13⅜	340	6⅛	156	3 7/16	87	2 11/16	68	25.7	11.7
•▼ LF007QT-S	½	15	13	330	6	152	2 7/16	62	3	76	5	127	3⅜	85	2 5/16	59	2 1/16	52	5.5	2.5
•▼ LF007M3QT-S	¾	20	14½	368	6⅛	156	3⅛	79	3	76	6 3/16	157	3 7/16	87	2⅛	54	15/16	33	6.7	3.1
•▼ LF007M1QT-S	1	25	17 15/16	157	7¾	197	4	102	3¼	83	7½	191	3⅜	85	1 11/16	43	1 11/16	43	14	6.4
•▼ LF007M2QT-S	1¼	32	21½	546	7 1/16	179	3 5/16	84	3½	83	9½	241	5	127	3	76	2	50	19	8.6
•▼ LF007M2QT-S	1½	40	25 1/16	637	7 1/16	179	3½	89	3¾	95	9¾	248	5 13/16	148	3⅛	79	2 11/16	68	19.6	8.9
•▼ LF007M1QT-S	2	50	27¼	692	8¾	222	4	102	4	102	13⅜	340	6⅛	156	3 7/16	87	2 11/16	68	33.5	15.2

Dimensions – Weights

Sizes: 2½" – 3" (65 – 80mm)

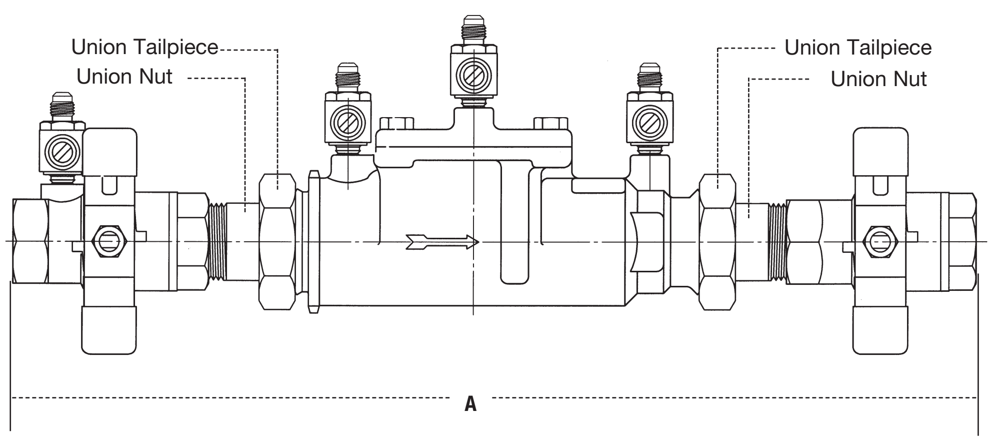


MODEL	SIZE (DN)		DIMENSIONS								WEIGHT	
			A		B		E, E1		R			
	in.	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kgs.*
LF007QT-FDA	2½	65	33⅛	841	6⅜	162	9 1/16	230	8¾	222	155	70
▲ LF007-NRS	2½	65	33⅛	841	9⅜	238	9 1/16	230	8¾	222	155	70
▲◆ LF007-OSY	2½	65	33⅛	841	16⅜	416	9 1/16	230	8¾	222	158	72
LF007-QT-FDA	3	80	33⅛	867	6⅜	162	9 1/16	230	8¾	222	155	70
▲ LF007-NRS	3	80	33⅛	867	10¼	260	9 1/16	230	8¾	222	185	84
▲◆ LF007-OSY	3	80	33⅛	867	18⅞	479	9 1/16	230	8¾	222	185	84

Strainer Dimensions

SIZE						WEIGHT	
		M		N			
in.	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kgs.*
2½	65	10	254	6½	165	28	13
3	80	10⅛	267	7	178	34	15

1" LFU007M1QT



Sizes: ½" – 2" (15 – 50mm)

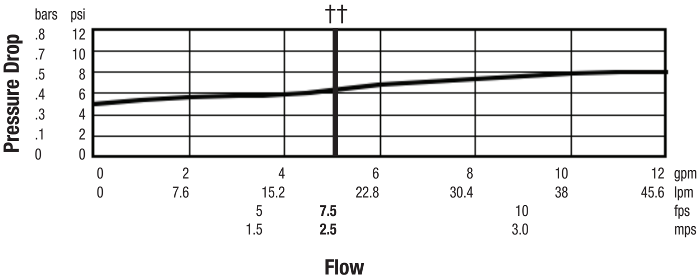
MODEL	SIZE(DN)		DIMENSIONS	
			A	
	in.	*mm*	*in.*	*mm*
LFU007QT	½	15	12 13/16	326
LFU007M2QT	¾	20	13 13/16	350
LFU007M2QT	1	25	16⅝	422
LFU007M2QT	1¼	32	20¾	527
LFU007M2QT	1½	40	21½	546
LFU007M1QT	2	50	24½	622

Capacity

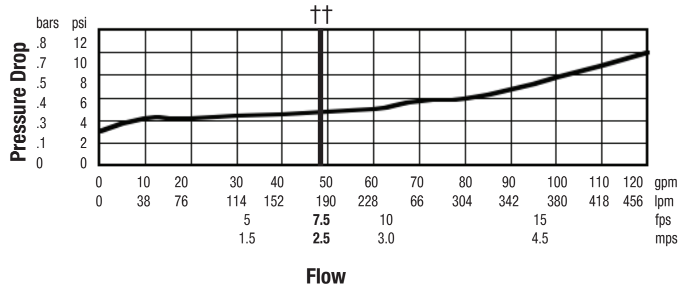
As compiled from documented Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California lab tests.

†† Typical maximum system flow rate (7.5 feet/sec., 2.3 meters/sec.)
** UL rated flow

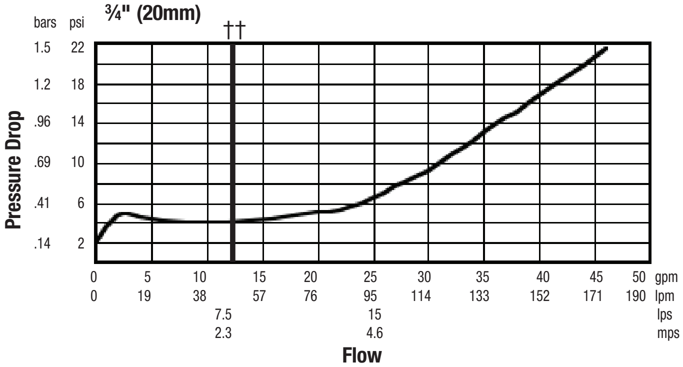
½" (15mm)



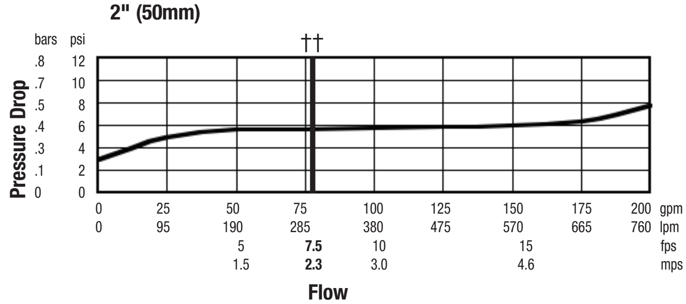
1½" (40mm)



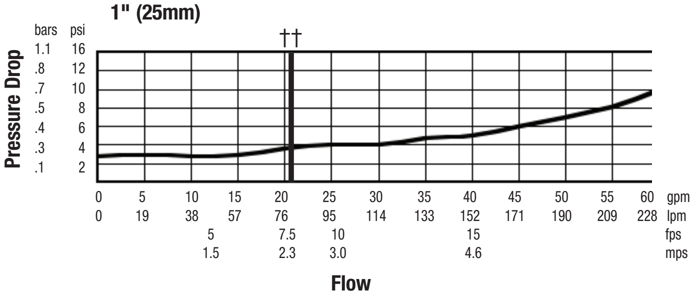
¾" (20mm)



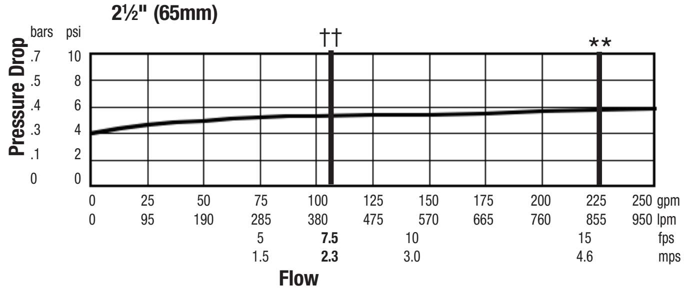
2" (50mm)



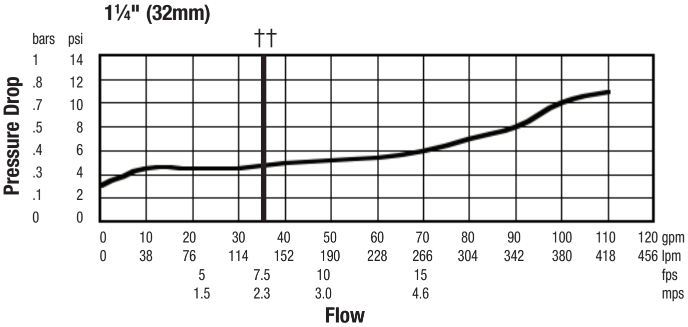
1" (25mm)



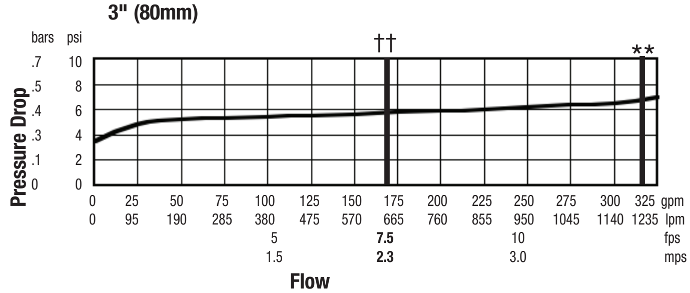
2½" (65mm)



1¼" (32mm)



3" (80mm)



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Appendix C CHECKLIST FOR HYDRAULIC MODEL DESIGN ELEMENTS REPORT

CHECKLIST FOR HYDRAULIC MODEL DESIGN ELEMENTS REPORT

This hydraulic model checklist identifies the components included in the Hydraulic Model Design Elements Report for

Alice Lode Development
(Project Name)

22011
(Water System Number)

Park City
(Water System Name)

9/29/14
(Date)

The checkmarks or P.E. initials after each item indicate the conditions supporting P.E. Certification of this Report.

1. At least 80 percent of the total pipe lengths in the distribution system affected by the proposed project are included in the model. *[R309-511-5(1)]* ☒ JMP

2. 100 percent of the flow in the distribution system affected by the proposed project is included in the model. If customer usage in the system is metered, water demand allocations in the model account for at least 80 percent of the flow delivered by the distribution system affected by the proposed project. *[R309-511-5(2)]* ☒ JMP

3. All 8-inch diameter and larger pipes are included in the model. Pipes smaller than 8-inch diameter are also included if they connect pressure zones, storage facilities, major demand areas, pumps, and control valves, or if they are known or expected to be significant conveyers of water such as fire suppression demand. *[R309-511-5(3)]* ☒ JMP

4. All pipes serving areas at higher elevations, dead ends, remote areas of a distribution system, and areas with known under-sized pipelines are included in the model. *[R309-511-5(4)]* ☒ JMP

5. All storage facilities and accompanying controls or settings applied to govern the open/closed status of the facility for standard operations are included in the model. *[R309-511-5(5)]* ☑ JMP

6. Any applicable pump stations, drivers (constant or variable speed), and accompanying controls and settings applied to govern their on/off/speed status for various operating conditions and drivers are included in the model. *[R309-511-5(6)]* ☒ N/A JMT

7. Any control valves or other system features that could significantly affect the flow of water through the distribution system (i.e. interconnections with other systems, pressure reducing valves between pressure zones) for various operating conditions are included in the model. *[R309-511-5(7)]* ☐ N/A JMT

8. Imposed peak day and peak instantaneous demands to the water system's facilities are included in the model. The Hydraulic Model Design Elements Report explains which of the Rule-recognized standards for peak day and peak instantaneous demands are implemented in the model (i.e., (i) peak day and peak instantaneous demand values per *R309-510, Minimum Sizing Requirements*, (ii) reduced peak day and peak instantaneous demand values approved by the Executive Secretary per *R309-510-5, Reduction of Requirements*, or (iii) peak day and peak instantaneous demand values expected by the water system in excess of the values in *R309-510, Minimum Sizing Requirements*). The Hydraulic Model Design Elements Report explains the multiple model simulations to account for the varying water demand conditions, or it clearly explains why such simulations are not included in the model. The Hydraulic Model Design Elements Report explains the extended period simulations in the model needed to evaluate changes in operating conditions over time, or it clearly explains (e.g., in the context of the water system, the extent of anticipated fire event, or the nature of the new expansion) why such simulations are not included in the model. *[R309-511-5(8) & R309-511-6(1)(b)]* ☒ BWS

9. The hydraulic model incorporates the appropriate demand requirements as specified in *R309-510, Minimum Sizing Requirements*, and *R309-511, Hydraulic Modeling Rule*, in the evaluation of various operating conditions of the public drinking water system. The Report includes:
   - the methodology used for calculating demand and allocating it to the model;
   - a summary of pipe length by diameter;
   - a hydraulic schematic of the distribution piping showing pressure zones, general pipe connectivity between facilities and pressure zones, storage, elevation, and sources; and
   - a list or ranges of values of friction coefficient used in the hydraulic model according to pipe material and condition in the system. In accordance with Rule stipulation, all coefficients of friction used in the hydraulic analysis are consistent with standard practices.

   [R309-511-7(4)] ☒ JMT

10. The Hydraulic Model Design Elements Report documents the calibration methodology used for the hydraulic model and quantitative summary of the

calibration results (i.e., comparison tables or graphs). The hydraulic model is sufficiently accurate to represent conditions likely to be experienced in the water delivery system. The model is calibrated to adequately represent the actual field conditions using field measurements and observations. *[R309-511-4(2)(b), R309-511-5(9), R309-511-6(1)(e) & R309-511-7(7)]* ☒ N/A BMT

11. The Hydraulic Model Design Elements Report includes a statement regarding whether fire hydrants exists within the system. Where fire hydrants are connected to the distribution system, the model incorporates required fire suppression flow standards. The statement that appears in the Report also identifies the local fire authority's name, address, and contact information, as well as the standards for fire flow and duration explicitly adopted from *R309-510-9(4), Fireflows*, or alternatively established by the local fire suppression agency, pursuant to *R309-510-9(4), Fireflows.* The Hydraulic Model Design Elements Report explains if a steady-state model was deemed sufficient for residential fire suppression demand, or acknowledges that significant fire suppression demand warrants extended model simulations and explains the run time used in the simulations for the period of the anticipated fire event. *[R309-511-5(10) & R309-511-7(5)]* ☑ BMT

12. If the public drinking water system provides water for outdoor use, the Report describes the criteria used to estimate this demand. If the irrigation demand map in *R309-510-7(3), Estimated Outdoor Use,* is not used, the report provides justification for the alternative demands used in the model. If the irrigation demands are based on the map in *R309-510-7(3), Estimated Outdoor Use,* the Report identifies the irrigation zone number, a statement and/or map of how the irrigated acreage is spatially distributed, and the total estimated irrigated acreage. The indicated irrigation demands are used in the model simulations in accordance with Rule stipulation. The model accounts for outdoor water use, such as irrigation, if the drinking water system supplies water for outdoor use. *[R309-511-5(11) & R309-511-7(1)]* ☒ N/A BMT

13. The Report states the total number of connections served by the water system including existing connections and anticipated new connections served by the water system after completion of the construction of the project. *[R309-511-7(2)]* ☑ BMT
NEW ONLY

14. The Report states the total number of equivalent residential connections (ERC) including both existing connections as well as anticipated new connections associated with the project. In accordance with Rule stipulation, the number of ERC's includes high as well as low volume water users. In accordance with Rule stipulation, the determination of the equivalent residential connections is based on flow requirements using the anticipated demand as outlined in *R309-510, Minimum Sizing Requirements*, or is based on alternative sources of information that are deemed acceptable by the Executive Secretary. *[R309-511-7(3)]* ☑ BMT

15. The Report identifies the locations of the lowest pressures within the distribution system, and areas identified by the hydraulic model as not meeting each scenario of the minimum pressure requirements in *R309-105-9, Minimum Pressure Requirements*. *[R309-511-7(6)]* ☒ PMT

16. The Hydraulic Model Design Elements Report identifies the hydraulic modeling method, and if computer software was used, the Report identifies the software name and version used. *[R309-511-6(1)(f)]* ☒ PMT

17. For community water system models, the community water system management has been provided with a copy of input and output data for the hydraulic model with the simulation that shows the worst case results in terms of water system pressure and flow. *[R309-511-6(2)(c)]* ☒ N/A PMT

18. The hydraulic model predicts that new construction will not result in any service connection within the new expansion area not meeting the minimum distribution system pressures as specified in *R309-105-9, Minimum Pressure Requirements*. *[R309-511-6(1)(c)]* ☒ PMT

19. The hydraulic model predicts that new construction will not decrease the pressures within the existing water system to such that the minimum pressures as specified in *R309-105-9, Minimum Pressure Requirements* are not met. *[R309-511-6(1)(d)]* ☒ PMT

Appendix D INTERNATIONAL RESIDENTIAL CODE FIRE SPRINKLER COALITION

INTERNATIONAL RESIDENTIAL CODE FIRE SPRINKLER COALITION

FACT SHEET

Water Supplies for Home Fire Sprinkler Systems

This document has been developed to dispel myths by providing factual information about water supply requirements for home fire sprinkler systems.

MYTH: *Home fire sprinkler systems require expensive upgrades to a new home's water supply system.*

FACTS: Home fire sprinkler systems have become so efficient that they can often be designed to use the same or even less water than a new home's plumbing system.

- Fire sprinklers typically require only 7 pounds-per-square-inch (psi) to operate, which is less than the minimum required pressure for residential plumbing fixtures.

  Plumbing systems require:
  - 8 psi minimum pressure for any plumbing fixture.[1]
  - 20 psi minimum pressure for temperature controlled shower valves (these are mandatory in new homes).[2]
  - 40 psi minimum pressure for the main supply connection (applies to all homes with indoor plumbing, even those supplied by wells).[3]
- A single fire sprinkler can use as little as 8 gallons-per-minute (gpm). With home fire sprinkler systems typically designed to accommodate two simultaneously flowing sprinklers, 16 gpm may be all that's needed to supply fire sprinklers. This is actually less than the 18 gpm minimum that would be required by the Plumbing Code to supply plumbing fixtures in a typical entry-level home with 3 bedrooms, 2 bathrooms and 2 outdoor hose connections.[4]
- Fire sprinklers will typically require more water in larger, more expensive homes, but such homes tend to have more plumbing fixtures, which require an increased water supply for plumbing as well. One or two sprinklers must flow for a minimum of 7-10 minutes, which can be provided by a well and/or a small tank when sprinklers are not supplied by a water distribution system.

MYTH: *Home fire sprinkler systems require big, expensive water meters.*

FACTS: When a fire sprinkler system is supplied by a water distribution system, water meter size is based on the required pressure and flow, which as stated above, may actually be greater for plumbing than for fire sprinklers. Fire sprinklers won't lead to increased meter or tap fees when the sprinkler system is able to be supplied by the same size meter that serves household plumbing.

A typical 5/8-inch meter will flow up to 20 gpm, which is adequate to operate a fire sprinkler system in many homes.[5] A 3/4-inch meter, which will flow well over 30 gpm, is capable of handling just about any home fire sprinkler system. Most often, the size of underground pipe leading to a house is much more limiting than the meter itself. Upsizing the underground piping

[1] International Residential Code (IRC) Table P2903.1
[2] IRC Section P2708
[3] IRC Section P2903.3
[4] IRC Table P2903.6 [17.5 fixture units: 2 bathroom groups, 1 kitchen group, 1 laundry group and 2 hose bibs], and IRC Table P2903.6(1)
[5] IRC Table P2904.6.2(2) [This is the prescriptive allowance for any meter. When a meter of known flow characteristics flows more, the higher flow may be used.]

8207 Asmara Drive ◆ Austin, Texas 78750 ◆ (202) 470-6447 ◆ www.IRCFireSprinkler.org

between the meter and the house is an easy and inexpensive way to improve pressure and flow for all plumbing, including fire sprinklers, without a larger meter.

It's important to note some meter manufacturers' literature specify lesser flow limits, focusing on the range over which a meter will accurately measure continuous flow. With respect to supplying home fire sprinklers, meter flow limits should be evaluated based on the maximum flow rate rather than continuous flow accuracy limits. Water authorities should recognize that sprinklers will always use less water than fire hoses connected to unmetered fire hydrants that would otherwise be needed to put out a fire, so there is no legitimate value in requiring accurate measurement of sprinkler flow in the event of a fire

MYTH: Fire sprinkler systems require expensive backflow preventers.

FACTS: National plumbing codes never require backflow protection for home fire sprinkler systems fabricated with materials approved for household plumbing, such as CPVC, PEX or copper.[6] Occasionally, a local plumbing authority may nevertheless request a backflow preventer, not recognizing that fire sprinkler systems can be safety connected directly to a potable water supply.

Where backflow prevention is an issue because of a local requirement, there are several options whereby additional backflow controls for fire sprinklers can be avoided.

- Fire sprinklers can be incorporated as part of a multipurpose plumbing system that feeds both sprinklers and plumbing fixtures from a home's cold water plumbing pipes.
- Fire sprinklers can be supplied by a separate water connection, with a toilet connected to the end of sprinkler piping to ensure that the piping is occasionally purged by flushing the toilet to prevent stagnant water. This arrangement is referred to as "passive purge."
- Where a yard irrigation system is installed, backflow prevention will be required because such systems are subject to backflow of non-potable water. Fire sprinklers can share the irrigation backflow preventer; thereby, eliminating the need for an additional device.

MYTH: Rural water distribution systems and wells don't have enough water to supply home fire sprinklers.

FACTS: As indicated above, if the water distribution system or well provides enough water to supply household plumbing needs, the supply may be adequate for fire sprinklers. In some cases a larger pump or tank may be needed for sprinklers, but standard, off-the-shelf pumps and tanks suitable for plumbing systems are permitted. When such upgrades are provided, they actually benefit the owner on a daily basis beyond fire protection, because the home's plumbing system will be more robust. Additional water storage can also be invaluable for emergency use in the event of a natural disaster that interrupts utilities.

It should also be noted that, were a rural water distribution system found to be inadequate to supplying 16 gpm for fire sprinklers, it would probably fall short of the minimum code-required plumbing demand, and it would surely fall far short of the 1,000+ gpm needed from fire hydrants to support a fire department extinguishing a fire in an unsprinklered home.

About IRC Fire Sprinkler Coalition
Founded in 2007, the IRC Fire Sprinkler Coalition has grown to include more than 100 international, national and regional public safety organizations, including associations representing 45 states, all of whom support the mission of promoting residential fire sprinkler systems in new home construction. More information can be found at www.IRCFireSprinkler.org.

[6] IRC Section P2904.1