

Hydraulic Calculation Report – Irrigation System

1. Introduction

This report presents the hydraulic calculations for the proposed irrigation system comprising 33 manually-operated zones supplied by a submersible pump installed in a pond. The system uses Galvanized Iron (GI) pipes with Hazen-Williams C-value of 120, and sprinklers specified as Model HT-05P. The objective of this report is to explain the calculation methodology in simple terms so that reviewer understands how the results were derived.

2. Design Basis

- Total Zones: 33 (manual operation, one zone at a time)
- Sprinkler Type: HT-05P full-circle, half-circle, and quarter-circle
- Throw Radius: 10.8 m (full size) and 3.0 m (small throw)
- Flow per Sprinkler: 14.76 LPM at 3.0 bar
- Pipe Material: GI (Hazen-Williams C = 120)
- Burial Depth: 300 mm (≤ 50 mm dia), 600 mm (> 50 mm dia)
- Pump: Lubi LHS-40 submersible pump, duty 22.5 L/s @ 68 m head (30 HP)
- Operation: Manual gate valve per zone, Y-strainer, and air release valve at high points

3. Sprinkler K-Factor

The K-factor is a constant that relates the flow rate through a sprinkler to the pressure at its inlet. It is derived using the formula:

$$K = Q / \sqrt{P}$$

Where:

K = discharge coefficient (LPM / $\sqrt{\text{bar}}$)

Q = flow rate (LPM)

P = operating pressure (bar)

For the given sprinkler:

$$Q = 14.76 \text{ LPM}$$

$$P = 3.0 \text{ bar}$$

$$K = 14.76 / \sqrt{3.0} = 8.52 \text{ LPM} / \sqrt{\text{bar}}$$

This K-factor is used in hydraulic calculations to determine the required pressure at various points in the system to achieve the design flow.

4. Selection of Zones for Detailed Analysis

Although the irrigation system has 33 zones, detailed hydraulic calculations were carried out for two critical zones:

- Zone 31 – Longest pipe run from pump to remote sprinkler
- Zone 32 – Highest ground elevation relative to pump location

These zones are considered critical because:

- The longest run typically experiences the highest friction losses.
- The highest elevation requires additional pressure to overcome elevation head.

If these zones meet the pressure requirement at the remote sprinkler (3.0 bar), all other zones will also comply.

Why only two zones were fully calculated.

To prove the entire network, we analyzed the two “worst case” zones:

- **Zone 31 (longest hydraulic path)** → governs friction losses.
- **Zone 32 (highest elevation)** → governs static head.

If both satisfy the 3.0 bar requirement at the remote sprinkler, all shorter/lower zones will be compliant with greater margin.

5. Calculation Methodology

The hydraulic analysis was performed using the HASS software. The process followed these steps:

1. Determine total flow for each zone: (Number of sprinklers × Flow per sprinkler).
2. Assign pipe diameters and lengths as per layout drawing.
3. Input elevation levels from topographic survey.
4. Apply Hazen–Williams equation to calculate friction loss in each pipe segment:

$$H = \frac{10.583 * L * Q^{1.85}}{C^{1.85} * d^{4.87}} \quad (\text{for metric units})$$

where:

H = head loss (m)

L = pipe length (m)

Q = flow rate (L/s)

C = Hazen–Williams coefficient (120 for GI)

d = internal pipe diameter (m)

5. Add elevation head difference between pump and remote sprinkler.
6. Add pressure requirement at remote sprinkler (3.0 bar = 30 m).
7. Sum these values to determine required pump head for the critical zone.
8. Compare with pump curve to confirm adequacy.

6. Results

- Zone 31 (Longest Path): Calculated pressure at remote sprinkler = 3.05 bar (meets requirement).
- Zone 32 (Highest Elevation): Calculated pressure at remote sprinkler = 3.02 bar (meets requirement).
- In both cases, the pump duty point of 22.5 L/s @ 68 m head provides sufficient margin.

Results (worst cases).

- **Zone 31 (longest run):** remote sprinklers operate at ≈ 3.0 – 3.1 bar with total zone demand ≈ 206 – 221 LPM along the tested path; network nodes show adequate pressure progression.
- **Zone 32 (highest elevation):** remote sprinklers operate at ≈ 3.0 – 3.1 bar; pipe 57 velocity peaks at ≈ 2.68 m/s (within acceptable limits for GI).
- **Pump adequacy:** At the modeled duty (≈ 593 LPM for a single active zone), the pump provides ~ 6.8 bar net with required ~ 5.8 – 5.9 bar at discharge; source suction remains ≥ 0.10 bar. This yields positive margin between available and required pressure at the pump and, consequently, at the remote heads.

7. Conclusion

The hydraulic calculations confirm that the proposed pump and piping arrangement can deliver the required 3.0 bar pressure at the remote sprinkler for all zones. By analyzing the longest path and highest elevation zones, we ensured that the system meets performance criteria without having to calculate all 33 zones individually.

The HASS verification of **Zone 31** (longest friction path) and **Zone 32** (highest elevation) demonstrates ≥ 3.0 bar at the most remote sprinklers with the specified LHS-40 pump. Because every other zone is hydraulically “easier” (shorter and/or lower), the system as designed is compliant without needing to re-compute all 33 zones.

Zone-wise Sprinkler Demand Summary

Zone	Sprinklers	Demand (LPM)	Pressure (Bar)	Area (m ²)
1	11	162.36	5.479	3000
2	11	162.36	5.447	4000
3	8	162.36	5.467	2000
4	9	132.84	5.359	1550
5	9	132.84	5.433	2400
6	15	221.4	5.455	4000
7	13	191.88	5.508	4485
8	8	118.08	4.876	2500
9	10	147.6	4.874	3100
10	10	147.6	4.921	2650
11	10	147.6	4.902	3000
12	9	132.84	4.699	3000
13	14	206.64	5.045	3800
14	11	162.36	5.127	3100
15	13	191.88	5.149	4100
16	13	191.88	5.242	4100
17	13	191.88	5.344	4100
18	13	191.88	5.364	4100
19	15	162.36	5.209	3000
20	13	191.88	5.373	3450
21	17	250.92	5.335	3680
22	11	162.36	5.033	4490
23	20	295.52	4.864	5000
24	19	280.44	5.137	5530
25	9	132.84	4.959	2770
26	14	162.36	5.338	4000
27	13	191.88	5.268	4416
28	13	191.88	5.193	3100
29	11	162.36	5.074	5530
30	14	206.64	5.103	4222
31	11	162.36	4.531	3580
32	22	162.36	4.708	500
33	19	280.44	5.239	773

8. Explanation of HASS Calculation Process

The HASS (Hydraulic Analysis of Sprinkler Systems) software was used to perform detailed hydraulic calculations for the irrigation system. The software allows for accurate modeling of flows, pressures, and friction losses along the pipeline network.

Calculation Steps in HASS:

1. **Sprinkler Data Entry:** Each sprinkler's K-factor (8.52 LPM/ $\sqrt{\text{bar}}$) was entered along with the required pressure of 3.0 bar.
2. **Network Layout:** All pipe segments, diameters, and lengths were input as per the schematic drawing.
3. **Elevation Data:** Ground elevations from the survey were entered for each node to account for static head.
4. **Pipe Friction Losses:** Hazen-Williams C = 120 was used for GI pipes; HASS applied the formula across each segment.
5. **Flow Distribution:** Total flow was based on the number of sprinklers in the zone $\times$ individual sprinkler flow rate.
6. **Demand Calculation:** The software calculated total head loss = friction loss + elevation head + required outlet pressure.
7. **Pump Sizing Check:** The required head and flow were compared with the pump performance curve to confirm adequacy.

Attached Output:

Please find below the detailed HASS calculation printouts for the analyzed zones (Zone 31 – longest path, and Zone 32 – highest elevation). These outputs show node-by-node pressures, pipe flows, and total demand, verifying compliance with the 3.0 bar remote sprinkler requirement.

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

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JOB TITLE:

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (BAR)	RESID. PRESS. (BAR)	FLOW @ (LPM)	AVAIL. PRESS. (BAR)	TOTAL @ DEMAND (LPM)	REQ'D PRESS. (BAR)
POND	(N/A)	0.60	(N/A)	0.600	592.8	0.143

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	592.8 LPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 LPM
OTHER HOSE STREAM ALLOWANCES	0.0 LPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	592.8 LPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE (BAR)	DISCHARGE (L/MIN)
S1	104.84	K= 8.44	3.029	14.7
S2	105.14	K= 8.44	3.000	14.6
S3	105.14	K= 8.44	3.000	14.6
S4	104.78	K= 8.44	3.036	14.7
S5	103.87	K= 8.44	3.168	15.0
S6	104.66	K= 8.44	3.130	14.9
S7	104.34	K= 8.44	3.217	15.1
S8	103.94	K= 8.44	3.331	15.4
S9	103.80	K= 8.44	3.441	15.7
S10	103.75	K= 8.44	3.606	16.0
S11	103.76	K= 8.44	3.754	16.4
S12	103.78	K= 8.44	3.932	16.7
S13	104.13	K= 8.44	4.113	17.1
S14	104.18	K= 8.44	4.360	17.6
S15	108.11	K= 8.44	3.462	15.7
S16	108.14	K= 8.44	3.461	15.7
S17	108.11	K= 8.44	3.470	15.7
S18	108.07	K= 8.44	3.486	15.8
S19	108.09	K= 8.44	3.505	15.8
S20	108.22	K= 8.44	3.524	15.8
S21	108.22	K= 8.44	3.612	16.0
S22	108.22	K= 8.44	3.672	16.2
S23	108.17	K= 8.44	3.753	16.3
S24	107.97	K= 8.44	3.867	16.6
S25	107.97	K= 8.44	3.984	16.8
S26	107.97	K= 8.44	4.125	17.1
S27	107.92	K= 8.44	4.297	17.5
S28	108.15	K= 8.44	4.623	18.1
S29	108.21	K= 8.44	4.601	18.1
S30	108.16	K= 8.44	4.599	18.1
S31	108.14	K= 8.44	4.599	18.1

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JOB TITLE:

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE (BAR)	DISCHARGE (L/MIN)
S32	107.88	K= 8.44	4.569	18.0
S33	107.92	K= 8.44	4.567	18.0
S34	107.86	K= 8.44	4.580	18.1
S35	107.87	K= 8.44	4.611	18.1
S36	107.84	K= 8.44	4.662	18.2
15	104.52	- - - -	3.063	- - -
15A	104.86	- - - -	3.035	- - -
16	104.97	- - - -	3.018	- - -
17	103.96	- - - -	3.477	- - -
18	103.77	- - - -	3.549	- - -
19	104.19	- - - -	4.403	- - -
ZONE-31	103.58	- - - -	4.531	- - -
ZONE-30	103.99	- - - -	5.103	- - -
20	103.99	- - - -	5.103	- - -
ZONE-29	104.56	- - - -	5.074	- - -
ZONE-28	103.46	- - - -	5.193	- - -
ZONE-27	102.89	- - - -	5.268	- - -
ZONE-26	102.44	- - - -	5.338	- - -
21	101.98	- - - -	5.392	- - -
22	102.44	- - - -	5.357	- - -
ZONE-21	102.84	- - - -	5.335	- - -
ZONE-20	102.50	- - - -	5.373	- - -
ZONE-18	102.61	- - - -	5.364	- - -
ZONE-17	102.83	- - - -	5.344	- - -
ZONE-16	103.90	- - - -	5.242	- - -
ZONE-19	104.40	- - - -	5.195	- - -
ZONE-15	104.88	- - - -	5.149	- - -
23	105.88	- - - -	5.052	- - -
24	105.38	- - - -	5.103	- - -
ZONE-13	105.98	- - - -	5.045	- - -
ZONE-14	105.14	- - - -	5.127	- - -
25	107.89	- - - -	4.861	- - -
ZONE-8	107.75	- - - -	4.876	- - -
ZONE-9	107.73	- - - -	4.874	- - -
ZONE-10	107.13	- - - -	4.921	- - -
ZONE-11	107.26	- - - -	4.902	- - -
ZONE-12	109.39	- - - -	4.685	- - -
ZONE-22	105.73	- - - -	5.033	- - -
ZONE-23	107.25	- - - -	4.864	- - -
ZONE-24	104.60	- - - -	5.137	- - -
ZONE-25	105.79	- - - -	4.959	- - -
26	107.79	- - - -	4.873	- - -
27	110.44	- - - -	4.659	- - -
28	110.22	- - - -	4.684	- - -
29	108.99	- - - -	4.811	- - -
30	104.97	- - - -	5.230	- - -
31	104.28	- - - -	5.324	- - -
ZONE-1	102.93	- - - -	5.479	- - -
ZONE-2	103.25	- - - -	5.447	- - -

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JOB TITLE:

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE (BAR)	DISCHARGE (L/MIN)
ZONE-3	103.06	- - - -	5.467	- - -
ZONE-4	104.02	- - - -	5.359	- - -
ZONE-5	103.40	- - - -	5.433	- - -
ZONE-6	103.18	- - - -	5.455	- - -
ZONE-7	102.63	- - - -	5.508	- - -
32	104.39	- - - -	5.330	- - -
33	108.09	- - - -	4.676	- - -
ZONE-32	108.01	- - - -	4.708	- - -
ZONE-33	105.38	- - - -	5.239	- - -
34	107.33	- - - -	4.808	- - -
35	106.73	- - - -	4.928	- - -
36	104.45	- - - -	5.156	- - -
37	107.71	- - - -	4.844	- - -
38	103.78	- - - -	5.395	- - -
39	105.94	- - - -	5.184	- - -
40	105.70	- - - -	5.208	- - -
41	104.94	- - - -	5.282	- - -
42	101.93	- - - -	5.577	- - -
50	103.78	- - - -	5.395	- - -
51	103.84	- - - -	5.399	- - -
PUMP-OUT	98.44	- - - -	5.932	- - -
PUMP-IN	98.44	- - - -	0.100	- - -
52	98.00	- - - -	0.143	- - -
POND	98.00	SOURCE	0.143	592.8

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

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JOB TITLE:

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (LPM)	DIA (MM)	LENGTH	PRESS.
	NODES	(M)	(K)	(BAR)	(LPM)	VEL (MPS)	HW (C)	(M)	SUM.
						FL/M			(BAR)
Pipe: 1									
S1		104.84	8.4	3.029	14.7	-14.7 0.19	40.89 150	PL FTG	PF 0.001 T PE 0.032
15		104.52	0.0	3.063	0.0		0.0001	TL	PV
Pipe: 2									
S2		105.14	8.4	3.000	14.6	-14.6 0.19	40.89 150	PL FTG	PF 0.001 T PE 0.062
15		104.52	0.0	3.063	0.0		0.0001	TL	PV
Pipe: 3									
15		104.52	0.0	3.063	0.0	-3.3 0.04	40.89 150	PL FTG	PF 0.000 T PE-0.044
16		104.97	0.0	3.018	0.0		0.0000	TL	PV
Pipe: 4									
S3		105.14	8.4	3.000	14.6	-14.6 0.19	40.89 150	PL FTG	PF 0.001 T PE 0.017
16		104.97	0.0	3.018	0.0		0.0001	TL	PV
Pipe: 5									
16		104.97	0.0	3.018	0.0	14.7 0.19	40.89 150	PL FTG	PF 0.001 T PE 0.019
S4		104.78	8.4	3.036	14.7		0.0001	TL	PV
Pipe: 5A									
15		104.52	0.0	3.063	0.0	-26.0 0.33	40.89 120	PL FTG	PF 0.006 T PE-0.034
15A		104.86	0.0	3.035	0.0		0.0005	TL	PV
Pipe: 5B									
16		104.97	0.0	3.018	0.0	-32.6 0.41	40.89 120	PL FTG	PF 0.006 T PE 0.010
15A		104.86	0.0	3.035	0.0		0.0008	TL	PV
Pipe: 6									
15A		104.86	0.0	3.035	0.0	-58.6 0.74	40.89 150	PL FTG	PF 0.036 T PE 0.098
S5		103.87	8.4	3.168	15.0		0.0015	TL	PV
Pipe: 7									
S5		103.87	8.4	3.168	15.0	-73.7 0.93	40.89 150	PL FTG	PF 0.040 T PE-0.078
S6		104.66	8.4	3.130	14.9		0.0023	TL	PV
Pipe: 8									
S6		104.66	8.4	3.130	14.9	-88.6 1.12	40.89 150	PL FTG	PF 0.056 T PE 0.032
S7		104.34	8.4	3.217	15.1		0.0032	TL	PV
Pipe: 9									
S7		104.34	8.4	3.217	15.1	-103.7 1.32	40.89 150	PL FTG	PF 0.074 T PE 0.039
S8		103.94	8.4	3.331	15.4		0.0043	TL	PV
Pipe: 10									
S8		103.94	8.4	3.331	15.4	-119.1 1.51	40.89 150	PL FTG	PF 0.096 T PE 0.014
S9		103.80	8.4	3.441	15.7		0.0056	TL	PV

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (LPM)	DIA (MM)	LENGTH	PRESS.
	NODES	(M)	(K)	(BAR)	(LPM)	VEL (MPS)	HW (C)	(M)	SUM.
							FL/M		(BAR)
S9	Pipe: 11					-134.8	40.89	PL	PF 0.051
	103.80	8.4	3.441	15.7	1.71	150	FTG	E	PE-0.016
	17	103.96	0.0	3.477	0.0		0.0070	TL	PV
17	Pipe: 12					-134.8	40.89	PL	PF 0.054
	103.96	0.0	3.477	0.0	1.71	150	FTG	E	PE 0.018
	18	103.77	0.0	3.549	0.0		0.0070	TL	PV
18	Pipe: 13					-134.8	40.89	PL	PF 0.055
	103.77	0.0	3.549	0.0	1.71	150	FTG	T	PE 0.002
	S10	103.75	8.4	3.606	16.0		0.0070	TL	PV
S10	Pipe: 14					-150.8	40.89	PL	PF 0.149
	103.75	8.4	3.606	16.0	1.91	150	FTG	T	PE-0.001
	S11	103.76	8.4	3.754	16.4		0.0087	TL	PV
S11	Pipe: 15					-167.2	40.89	PL	PF 0.180
	103.76	8.4	3.754	16.4	2.12	150	FTG	T	PE-0.002
	S12	103.78	8.4	3.932	16.7		0.0105	TL	PV
S12	Pipe: 16					-183.9	40.89	PL	PF 0.215
	103.78	8.4	3.932	16.7	2.33	150	FTG	T	PE-0.034
	S13	104.13	8.4	4.113	17.1		0.0125	TL	PV
S13	Pipe: 17					-201.0	40.89	PL	PF 0.253
	104.13	8.4	4.113	17.1	2.55	150	FTG	T	PE-0.005
	S14	104.18	8.4	4.360	17.6		0.0147	TL	PV
S14	Pipe: 18					-218.6	52.50	PL	PF 0.043
	104.18	8.4	4.360	17.6	1.68	150	FTG	E	PE-0.001
	19	104.19	0.0	4.403	0.0		0.0051	TL	PV
19	Pipe: 19					-218.6	52.50	PL	PF 0.069
	104.19	0.0	4.403	0.0	1.68	150	FTG	EG	PE 0.060
	ZONE-31	103.58	0.0	4.531	0.0		0.0051	TL	PV
ZONE-31	Pipe: 20					-218.6	52.50	PL	PF 0.612
	103.58	0.0	4.531	0.0	1.68	150	FTG	E2G	PE-0.040
	20	103.99	0.0	5.103	0.0		0.0051	TL	PV
ZONE-30	Pipe: 20A					0.0	80.00	PL	PF 0.000
	103.99	0.0	5.103	0.0	0.00	120	FTG	TG	PE-0.000
	20	103.99	0.0	5.103	0.0		0.0000	TL	PV
ZONE-29	Pipe: 21					-218.6	80.00	PL	PF 0.027
	103.99	0.0	5.103	0.0	0.72	120	FTG	T	PE-0.056
	104.56	0.0	5.074	0.0			0.0010	TL	PV

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PIPE TAG					Q (LPM)	DIA (MM)	LENGTH	PRESS.	
END	ELEV.	NOZ.	PT	DISC.	VEL (MPS)	HW (C)	(M)	SUM.	
NODES	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)	
Pipe: 21A					-218.6	102.26	PL	30.10	PF 0.011
ZONE-29	104.56	0.0	5.074	0.0	0.44	120	FTG	T	PE 0.108
ZONE-28	103.46	0.0	5.193	0.0		0.0003	TL	36.20	PV
Pipe: 22					-218.6	102.26	PL	59.70	PF 0.020
ZONE-28	103.46	0.0	5.193	0.0	0.44	120	FTG	T	PE 0.055
ZONE-27	102.89	0.0	5.268	0.0		0.0003	TL	65.80	PV
Pipe: 23					-218.6	102.26	PL	80.50	PF 0.026
ZONE-27	102.89	0.0	5.268	0.0	0.44	120	FTG	T	PE 0.044
ZONE-26	102.44	0.0	5.338	0.0		0.0003	TL	86.60	PV
Pipe: 24					-218.6	102.26	PL	26.40	PF 0.009
ZONE-26	102.44	0.0	5.338	0.0	0.44	120	FTG	EG	PE 0.045
21	101.98	0.0	5.392	0.0		0.0003	TL	30.06	PV
Pipe: 25					-218.6	102.26	PL	32.40	PF 0.011
21	101.98	0.0	5.392	0.0	0.44	120	FTG	E	PE-0.045
22	102.44	0.0	5.357	0.0		0.0003	TL	35.45	PV
Pipe: 26					-218.6	102.26	PL	47.20	PF 0.016
22	102.44	0.0	5.357	0.0	0.44	120	FTG	TG	PE-0.039
ZONE-21	102.84	0.0	5.335	0.0		0.0003	TL	53.91	PV
Pipe: 27					-218.6	154.05	PL	121.70	PF 0.005
ZONE-21	102.84	0.0	5.335	0.0	0.20	120	FTG	T	PE 0.033
ZONE-20	102.50	0.0	5.373	0.0		0.0000	TL	130.84	PV
Pipe: 28					-218.6	154.05	PL	9.10	PF 0.001
ZONE-20	102.50	0.0	5.373	0.0	0.20	120	FTG	T	PE-0.010
ZONE-18	102.61	0.0	5.364	0.0		0.0000	TL	18.24	PV
Pipe: 29					-218.6	154.05	PL	52.50	PF 0.003
ZONE-18	102.61	0.0	5.364	0.0	0.20	120	FTG	T	PE-0.022
ZONE-17	102.83	0.0	5.344	0.0		0.0000	TL	61.64	PV
Pipe: 30					-218.6	154.05	PL	52.50	PF 0.003
ZONE-17	102.83	0.0	5.344	0.0	0.20	120	FTG	T	PE-0.105
ZONE-16	103.90	0.0	5.242	0.0		0.0000	TL	61.64	PV
Pipe: 31					-218.6	154.05	PL	26.60	PF 0.001
ZONE-16	103.90	0.0	5.242	0.0	0.20	120	FTG	T	PE-0.049
ZONE-19	104.40	0.0	5.195	0.0		0.0000	TL	35.74	PV
Pipe: 32					-218.6	154.05	PL	25.80	PF 0.001
ZONE-19	104.40	0.0	5.195	0.0	0.20	120	FTG	T	PE-0.047
ZONE-15	104.88	0.0	5.149	0.0		0.0000	TL	34.94	PV

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

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JOB TITLE:

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (LPM)	DIA (MM)	LENGTH	PRESS.
	NODES	(M)	(K)	(BAR)	(LPM)	VEL (MPS)	HW (C)	(M)	SUM.
						FL/M			(BAR)
Pipe: 33						-218.6	154.05	PL	PF 0.001
ZONE-15	104.88	0.0	5.149	0.0	0.20	120	FTG	EG	PE-0.098
23	105.88	0.0	5.052	0.0		0.0000	TL	24.18	PV
Pipe: 34						-218.6	154.05	PL	PF 0.003
23	105.88	0.0	5.052	0.0	0.20	120	FTG	T	PE 0.049
24	105.38	0.0	5.103	0.0		0.0000	TL	62.54	PV
Pipe: 35						-218.6	154.05	PL	PF 0.003
24	105.38	0.0	5.103	0.0	0.20	120	FTG	E	PE-0.245
25	107.89	0.0	4.861	0.0		0.0000	TL	84.07	PV
Pipe: 36						-218.6	154.05	PL	PF 0.001
25	107.89	0.0	4.861	0.0	0.20	120	FTG	TG	PE 0.013
ZONE-8	107.75	0.0	4.876	0.0		0.0000	TL	33.55	PV
Pipe: 37						-218.6	154.05	PL	PF 0.001
ZONE-8	107.75	0.0	4.876	0.0	0.20	120	FTG	E	PE-0.004
26	107.79	0.0	4.873	0.0		0.0000	TL	32.47	PV
Pipe: 38						-592.8	154.05	PL	PF 0.045
26	107.79	0.0	4.873	0.0	0.53	120	FTG	E	PE-0.259
27	110.44	0.0	4.659	0.0		0.0003	TL	174.97	PV
Pipe: 39						-592.8	154.05	PL	PF 0.004
27	110.44	0.0	4.659	0.0	0.53	120	FTG	T	PE 0.021
28	110.22	0.0	4.684	0.0		0.0003	TL	15.14	PV
Pipe: 40						-592.8	154.05	PL	PF 0.006
28	110.22	0.0	4.684	0.0	0.53	120	FTG	----	PE 0.121
29	108.99	0.0	4.811	0.0		0.0003	TL	22.80	PV
Pipe: 41						-592.8	154.05	PL	PF 0.025
29	108.99	0.0	4.811	0.0	0.53	120	FTG	E	PE 0.394
30	104.97	0.0	5.230	0.0		0.0003	TL	97.87	PV
Pipe: 42						-592.8	154.05	PL	PF 0.027
30	104.97	0.0	5.230	0.0	0.53	120	FTG	----	PE 0.067
31	104.28	0.0	5.324	0.0		0.0003	TL	104.30	PV
Pipe: 43						-592.8	154.05	PL	PF 0.010
31	104.28	0.0	5.324	0.0	0.53	120	FTG	TG	PE 0.026
ZONE-4	104.02	0.0	5.359	0.0		0.0003	TL	37.25	PV
Pipe: 44						-592.8	154.05	PL	PF 0.007
ZONE-4	104.02	0.0	5.359	0.0	0.53	120	FTG	EG	PE-0.036
32	104.39	0.0	5.330	0.0		0.0003	TL	25.28	PV

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JOB TITLE:

PIPE	TAG				Q (LPM)	DIA (MM)	LENGTH	PRESS.	
END	ELEV.	NOZ.	PT	DISC.	VEL (MPS)	HW (C)	(M)	SUM.	
NODES	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)	
	Pipe: 45				-15.7	40.89	PL	5.60	PF 0.002
S15	108.11	8.4	3.462	15.7	0.20	120	FTG	T	PE-0.002
S16	108.14	8.4	3.461	15.7		0.0002	TL	8.04	PV
	Pipe: 46				-31.4	40.89	PL	5.60	PF 0.006
S16	108.14	8.4	3.461	15.7	0.40	120	FTG	T	PE 0.003
S17	108.11	8.4	3.470	15.7		0.0007	TL	8.04	PV
	Pipe: 47				-47.1	40.89	PL	5.60	PF 0.012
S17	108.11	8.4	3.470	15.7	0.60	120	FTG	T	PE 0.003
S18	108.07	8.4	3.486	15.8		0.0015	TL	8.04	PV
	Pipe: 48				-62.9	40.89	PL	5.60	PF 0.021
S18	108.07	8.4	3.486	15.8	0.80	120	FTG	T	PE-0.001
S19	108.09	8.4	3.505	15.8		0.0026	TL	8.04	PV
	Pipe: 49				-78.7	40.89	PL	5.60	PF 0.032
S19	108.09	8.4	3.505	15.8	1.00	120	FTG	T	PE-0.013
S20	108.22	8.4	3.524	15.8		0.0039	TL	8.04	PV
	Pipe: 50				-94.5	40.89	PL	13.60	PF 0.088
S20	108.22	8.4	3.524	15.8	1.20	120	FTG	T	PE 0.000
S21	108.22	8.4	3.612	16.0		0.0055	TL	16.04	PV
	Pipe: 51				-110.6	40.89	PL	5.60	PF 0.059
S21	108.22	8.4	3.612	16.0	1.40	120	FTG	T	PE 0.000
S22	108.22	8.4	3.672	16.2		0.0074	TL	8.04	PV
	Pipe: 52				-126.7	40.89	PL	5.60	PF 0.076
S22	108.22	8.4	3.672	16.2	1.61	120	FTG	T	PE 0.005
S23	108.17	8.4	3.753	16.3		0.0095	TL	8.04	PV
	Pipe: 53				-143.1	40.89	PL	5.60	PF 0.095
S23	108.17	8.4	3.753	16.3	1.82	120	FTG	T	PE 0.019
S24	107.97	8.4	3.867	16.6		0.0119	TL	8.04	PV
	Pipe: 54				-159.7	40.89	PL	5.60	PF 0.117
S24	107.97	8.4	3.867	16.6	2.03	120	FTG	T	PE 0.000
S25	107.97	8.4	3.984	16.8		0.0145	TL	8.04	PV
	Pipe: 55				-176.5	40.89	PL	5.60	PF 0.141
S25	107.97	8.4	3.984	16.8	2.24	120	FTG	T	PE 0.000
S26	107.97	8.4	4.125	17.1		0.0175	TL	8.04	PV
	Pipe: 56				-193.7	40.89	PL	5.60	PF 0.167
S26	107.97	8.4	4.125	17.1	2.46	120	FTG	T	PE 0.005
S27	107.92	8.4	4.297	17.5		0.0208	TL	8.04	PV

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (LPM)	DIA (MM)	LENGTH	PRESS.
	NODES	(M)	(K)	(BAR)	(LPM)	VEL (MPS)	HW (C)	(M)	SUM.
							FL/M		(BAR)
	Pipe: 57					-211.2	40.89	PL	PF 0.396
S27	107.92	8.4	4.297	17.5	2.68	120	FTG	T	PE-0.017
33	108.09	0.0	4.676	0.0		0.0244	TL	16.24	PV
	Pipe: 58					-18.1	40.89	PL	PF 0.002
S31	108.14	8.4	4.599	18.1	0.23	120	FTG	T	PE-0.002
S30	108.16	8.4	4.599	18.1		0.0003	TL	8.04	PV
	Pipe: 59					-36.2	40.89	PL	PF 0.008
S30	108.16	8.4	4.599	18.1	0.46	120	FTG	T	PE-0.005
S29	108.21	8.4	4.601	18.1		0.0009	TL	8.04	PV
	Pipe: 60					-54.3	40.89	PL	PF 0.016
S29	108.21	8.4	4.601	18.1	0.69	120	FTG	T	PE 0.006
S28	108.15	8.4	4.623	18.1		0.0020	TL	8.04	PV
	Pipe: 61					-72.5	40.89	PL	PF 0.047
S28	108.15	8.4	4.623	18.1	0.92	120	FTG	T	PE 0.006
33	108.09	0.0	4.676	0.0		0.0034	TL	14.04	PV
	Pipe: 62					-18.0	40.89	PL	PF 0.002
S32	107.88	8.4	4.569	18.0	0.23	120	FTG	T	PE-0.005
S33	107.92	8.4	4.567	18.0		0.0003	TL	8.04	PV
	Pipe: 63					-36.1	40.89	PL	PF 0.007
S33	107.92	8.4	4.567	18.0	0.46	120	FTG	T	PE 0.006
S34	107.86	8.4	4.580	18.1		0.0009	TL	8.04	PV
	Pipe: 64					-54.1	40.89	PL	PF 0.032
S34	107.86	8.4	4.580	18.1	0.69	120	FTG	T	PE-0.001
S35	107.87	8.4	4.611	18.1		0.0020	TL	16.24	PV
	Pipe: 65					-72.3	40.89	PL	PF 0.047
S35	107.87	8.4	4.611	18.1	0.92	120	FTG	T	PE 0.003
S36	107.84	8.4	4.662	18.2		0.0034	TL	14.14	PV
	Pipe: 66					-90.5	40.89	PL	PF 0.063
S36	107.84	8.4	4.662	18.2	1.15	120	FTG	TG	PE-0.017
ZONE-32	108.01	0.0	4.708	0.0		0.0051	TL	12.44	PV
	Pipe: 67					-283.6	80.00	PL	PF 0.024
33	108.09	0.0	4.676	0.0	0.94	120	FTG	TG	PE 0.008
ZONE-32	108.01	0.0	4.708	0.0		0.0016	TL	15.13	PV
	Pipe: 68					-374.1	102.26	PL	PF 0.034
ZONE-32	108.01	0.0	4.708	0.0	0.76	120	FTG	T	PE 0.067
34	107.33	0.0	4.808	0.0		0.0008	TL	41.70	PV

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

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JOB TITLE:

PIPE TAG					Q (LPM)	DIA (MM)	LENGTH	PRESS.
END	ELEV.	NOZ.	PT	DISC.	VEL (MPS)	HW (C)	(M)	SUM.
NODES	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Pipe: 69					0.0	52.50	PL	PF 0.000
34	107.33	0.0	4.808	0.0	0.00	120	FTG	PE 0.151
ZONE-25	105.79	0.0	4.959	0.0		0.0000	TL	PV
Pipe: 70					-374.1	102.26	PL	PF 0.048
34	107.33	0.0	4.808	0.0	0.76	120	FTG	PE 0.008
ZONE-23	107.25	0.0	4.864	0.0		0.0008	TL	PV
Pipe: 71					-374.1	102.26	PL	PF 0.013
ZONE-23	107.25	0.0	4.864	0.0	0.76	120	FTG	PE 0.051
35	106.73	0.0	4.928	0.0		0.0008	TL	PV
Pipe: 72					0.0	62.71	PL	PF 0.000
35	106.73	0.0	4.928	0.0	0.00	120	FTG	PE 0.209
ZONE-24	104.60	0.0	5.137	0.0		0.0000	TL	PV
Pipe: 73					-374.1	154.05	PL	PF 0.005
35	106.73	0.0	4.928	0.0	0.33	120	FTG	PE 0.223
36	104.45	0.0	5.156	0.0		0.0001	TL	PV
Pipe: 74					-374.1	154.05	PL	PF 0.002
36	104.45	0.0	5.156	0.0	0.33	120	FTG	PE-0.125
ZONE-22	105.73	0.0	5.033	0.0		0.0001	TL	PV
Pipe: 75					-374.1	154.05	PL	PF 0.006
ZONE-22	105.73	0.0	5.033	0.0	0.33	120	FTG	PE-0.194
37	107.71	0.0	4.844	0.0		0.0001	TL	PV
Pipe: 76					-374.1	154.05	PL	PF 0.005
37	107.71	0.0	4.844	0.0	0.33	120	FTG	PE-0.165
ZONE-12	109.39	0.0	4.685	0.0		0.0001	TL	PV
Pipe: 77					-374.1	154.05	PL	PF 0.008
ZONE-12	109.39	0.0	4.685	0.0	0.33	120	FTG	PE 0.209
ZONE-11	107.26	0.0	4.902	0.0		0.0001	TL	PV
Pipe: 78					-374.1	154.05	PL	PF 0.008
ZONE-11	107.26	0.0	4.902	0.0	0.33	120	FTG	PE 0.012
ZONE-10	107.13	0.0	4.921	0.0		0.0001	TL	PV
Pipe: 79					-374.1	154.05	PL	PF 0.011
ZONE-10	107.13	0.0	4.921	0.0	0.33	120	FTG	PE-0.058
ZONE-9	107.73	0.0	4.874	0.0		0.0001	TL	PV
Pipe: 80					-374.1	154.05	PL	PF 0.005
ZONE-9	107.73	0.0	4.874	0.0	0.33	120	FTG	PE-0.006
26	107.79	0.0	4.873	0.0		0.0001	TL	PV

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JOB TITLE:

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

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JOB TITLE:

PIPE TAG					Q (LPM)	DIA (MM)	LENGTH	PRESS.
END	ELEV.	NOZ.	PT	DISC.	VEL (MPS)	HW (C)	(M)	SUM.
NODES	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Pipe: 93					0.0	80.00	PL	4.70
ZONE-2	103.25	0.0	5.447	0.0	0.00	120	FTG	T
ZONE-3	103.06	0.0	5.467	0.0		0.0000	TL	9.89
								PV
Pipe: 95					-592.8	154.05	PL	16.30
32	104.39	0.0	5.330	0.0	0.53	120	FTG	T
50	103.78	0.0	5.395	0.0		0.0003	TL	25.44
								PV
Pipe: 96					592.8	154.05	PL	13.00
51	103.84	0.0	5.399	0.0	0.53	120	FTG	2C3G
50	103.78	0.0	5.395	0.0		0.0003	TL	35.23
								PV
Pipe: 96A					0.0	154.05	PL	14.20
50	103.78	0.0	5.395	0.0	0.00	120	FTG	T
38	103.78	0.0	5.395	0.0		0.0000	TL	23.34
								PV
Pipe: 97					-592.8	154.05	PL	10.00
51	103.84	0.0	5.399	0.0	0.53	120	FTG	E
PUMP-OUT	98.44	0.0	5.932	0.0		0.0003	TL	14.27
								PV
Pipe: 98				FIRE PUMP	Rating:	1350.0	lpm @	6.8 bar
PUMP-IN	98.4	0.0	0.1	0.0	Avail.:	592.5	lpm @	6.8 bar
PUMP-OUT	98.4	0.0	5.9	0.0	Req'd.:	592.5	lpm @	5.8 bar
Pipe: 99					-592.8	154.05	PL	1.00
PUMP-IN	98.44	0.0	0.100	0.0	0.53	120	FTG	----
52	98.00	0.0	0.143	0.0		0.0003	TL	1.00
								PV
Pipe: 100					-592.8	154.05	PL	1.00
52	98.00	0.0	0.143	0.0	0.53	120	FTG	G
POND	98.00	SRCE	0.143	(N/A)		0.0003	TL	1.91
								PV

NOTES (HASS):

(1) Calculations were performed by the HASS computer program

under license no. 66309840 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average imbalance at each node of 0.0048 lpm and a maximum imbalance at any node of 0.2468 lpm.

(3) Total pressure at each node is used in balancing the system. Maximum water velocity is 2.68 m/sec at pipe 57.

(4) The Minimum pump suction pressure under maximum calculated demand is

(5) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(6) Available pressure at source node POND under full flow conditions is 0.60 bar with a flow of 673.43 lpm.

(7) PIPE FITTINGS TABLE

User Pipe Table Name: BS EN 12845

PAGE: A	MATERIAL: S40		HWC: 120						
Diameter	Equivalent Fitting Lengths in Meters								
(mm)	E	T	L	C	B	G	A	D	N
	Ell	Tee	LngEll	ChkVlv	BfyVlv	GatVlv	AlmChk	DPVlv	NTee

	F								
	F45Ell								
40.89	1.22	2.44	0.61	2.74	1.83	0.30	3.05	3.05	2.44
	0.61								
52.50	1.52	3.05	0.91	3.35	1.83	0.30	3.05	3.05	3.05
	0.76								
62.71	1.83	3.66	1.22	4.27	2.13	0.30	3.05	3.05	3.66
	0.91								
102.26	3.05	6.10	1.83	6.71	3.66	0.61	6.10	6.10	6.10
	1.52								
154.05	4.27	9.14	2.74	9.75	3.05	0.91	8.53	8.53	9.14
	2.13								

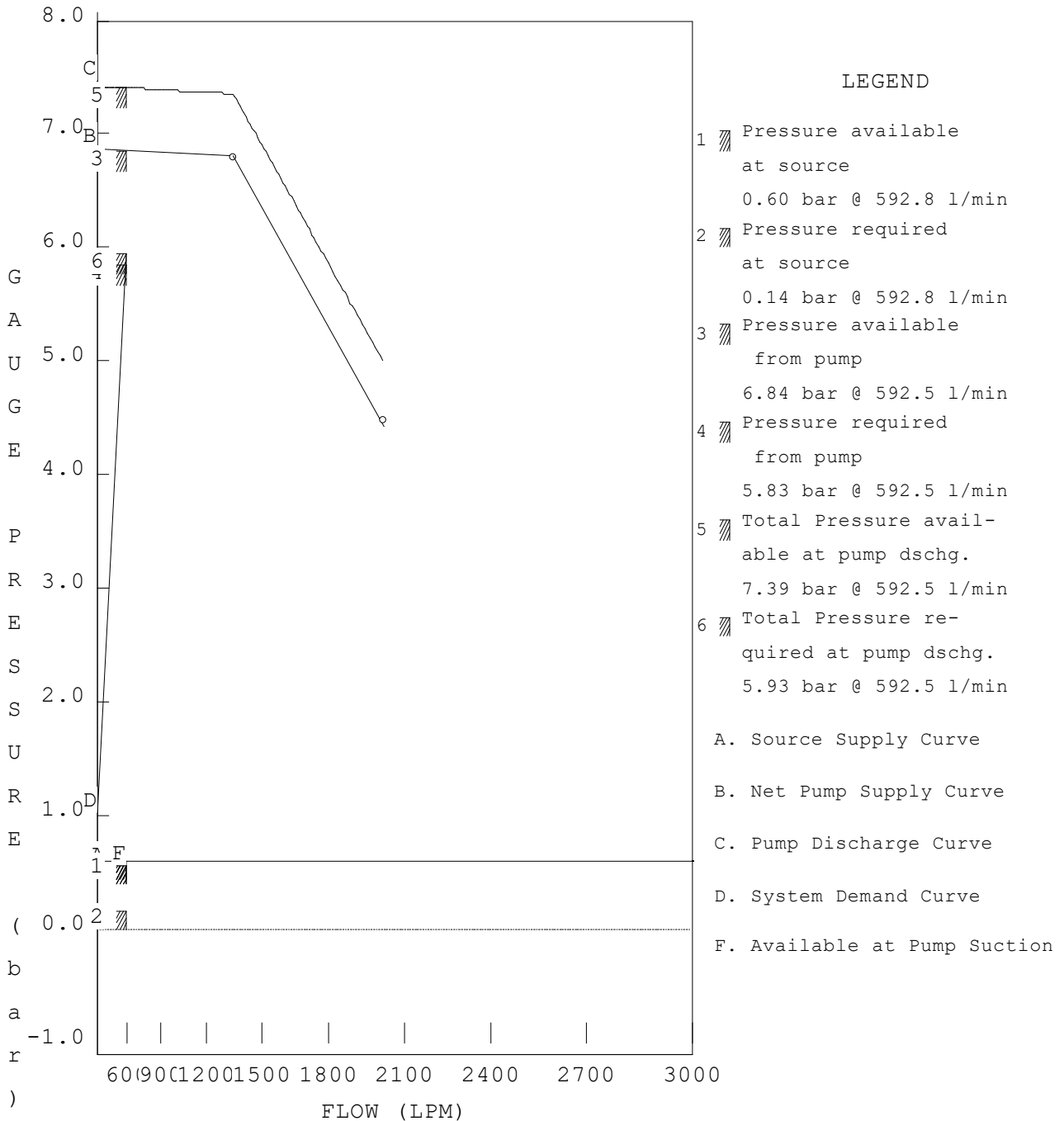
PAGE: *	MATERIAL: Custom								
Diameter	Equivalent Fitting Lengths in Meters								
(mm)	E	T	L	C	B	G	A	D	N
	Ell	Tee	LngEll	ChkVlv	BfyVlv	GatVlv	AlmChk	DPVlv	NPTee

	F								
	F45Ell								
77.93	2.13	4.57	1.52	4.88	3.05	0.30	3.96	3.96	4.57
	1.07								

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JOB TITLE:

WATER SUPPLY ANALYSIS

Fixed Source Pressure: 0.60 bar



.) Dashed Lines indicate extrapolated values from Test Results

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

DATE: 8/9/2025S\KIRAN K\WORKING\IRRIGATION SYSTEM COFFE FACTORY CALC

JOB TITLE:

WATER SUPPLY CURVE

