



LOUISIANA
POWER & LIGHT

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August 8, 1983

W3P83-2269
3-A1.01.04
3-A20.12

Director of Nuclear Reactor Regulation
Attention: Mr. G. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Waterford 3 SES
Docket No. 50-382
Fire Water System Connection
(Tertiary Backup)
to Lubrication and Cooling
Water for Circulating Water Pumps

Reference: LP&L Letter W3P83-0660, dated March 3, 1983

Dear Mr. Knighton:

The above referenced letter provided the NRC with information regarding the subject connection. In the letter the point was made that the volume/pressure available at the largest demand interface point and the total available fire protection supply is more than adequate while considering usage of 125 gpm for the Circulating Water System.

Furthermore, it should be understood that the 3 inch connection is a tertiary backup means of supply to the Circulating Water System, which is normally closed and is actuated only in the unlikely event that it is required. Should this connection be utilized, the water flow will actuate the jockey pump and the main fire protection system pumps, as required. Again, one must remember that the normal water supply for water to the Circulating Water System is from the Clearwell Water System. The clearwell receives water from the primary water treatment system as well as an alternate source, the Parish water main.

On May 6, 1983, by way of a telephone conversation, Mr. D. Kubeckie of the NRC made a request to LP&L representative, Mr. W. Lobo for the following:

- A) Hydraulic calculations to indicate that the 3" line will not adversely effect the fire protection water supply system.
- B) Status of alarms and signals in the Control Room when the jockey pump is activated and the operator actions to distinguish these signals and alarms from other control functions.

Mr. G. Knighton
U. S. Nuclear Regulatory Commission
W3P83-2269
Page 2.

Please note that a copy of the hydraulic calculations requested has been attached for review. As mentioned above, equipment located at the intake and discharge structures requires a total flow of approximately 125 gpm. The circulating water pumps require approximately 80 gpm for motor cooling and pump seals. The screen wash pumps require approximately 11 gpm for bearing cooling and the circulating water air evacuation pumps require approximately 30 gpm for sealing water.

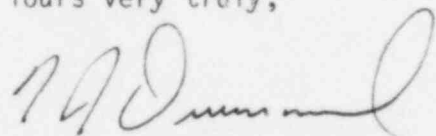
The circulating water pump bearing lubrication water pumps normally supply the required 125 gpm. Each pump is sized for 100% capacity and takes suction from the clearwell tank.

The status of alarms and signals in the Control Room was additional information requested by Mr. D. Kubeckie. A short scenario may be the best means of providing this information. Upon the loss of the subject supply pressure, resulting from loss of both CWP bearing lubrication water pumps, an air operated valve will open and permit fire protection water into the system. The Control Room annunciator E-1204, entitled "CW PUMP BRG BKUP WTR SUPPLY VA OPEN" advises the operators that the CWP bearing water is being provided from the fire protection system. The input logic for E-1204 is a valve 7FP-PM246 or valve 7FP-F245 not closed signal.

The Master Remote Control Panel (MRCP) for the Fire Protection System, in the Control Room would also alarm if the main fire protection system pumps have started and are running.

It is our hope that this information will satisfy the needs of the NRC staff concerning this subject and we await the approval for installation of the subject 3" line.

Yours very truly,



F. J. Drummond

FJD/EJS/jal

Attachments

cc: W. M. Stevenson, E. Blake, J. Wilson, D. Kubeckie, L. Constable

EBASCO SERVICES INCORPORATED

BY D. SEMEN DATE 3-30-83SHEET 1 OF 19CHKD. BY M. BYRON DATE 4/14/83OFS NO. 2796 545 DEPT. NO. 590CLIENT LOUISIANA POWER & LIGHT COMPANYPROJECT WATERFORD SES UNIT NO. 3SUBJECT F.P. WATER SUPPLY TO CWP FOR BEARING LUBRICATIONCALCULATION NO. FP-1 NUMBER OF SHEETS 19PROBLEM STATEMENT

TO DETERMINE THE ADEQUACY OF AVAILABLE PRESSURE AT THE INTERFACE POINT FOR THE LARGEST FLOW RATE DEMAND SPRINKLER SYSTEM IN RAB, PROTECTING SAFETY RELATED AREA & EQUIPMENT, WITH THE ASSUMPTION OF AN ADDITIONAL *125 GPM. DIVERTED FOR BEARING LUBRICATION OF THE CIRCULATING WATER PUMPS. (NODE 38-SEE SK-1 SH. 19 OF 19).

* ACTUAL FLOW IS 121 GPM PER TABLE 3.3-1 SH. 1 OF 2 IN FSAR, BUT 125 GPM IS USED IN THIS CALCULATION.

REV. NO.	SH. NO.	O SEMEN	3-30-83	M. BYRON	4/14/83	J C Z r q O	L. COOK	4/19/83	
		NAME	DATE	NAME	DATE			NAME	DATE
CALCULATION BY				CHECKED BY			REVIEWED OR APPROVED BY		
PRELIMINARY ☐		FINAL ☒		SUPERSEDES CALC. NO. _____					

EBASCO SERVICES INCORPORATED

BY D. SEHEN^{QS} DATE 3-30-83 SHEET 2 OF 19
 CHKD. BY P. BYRON^{MB} DATE 4/14/83 OFS NO. 2796.545 DEPT. NO. 590
 CLIENT LOUISIANA POWER & LIGHT COMPANY
 PROJECT WATERFORD SES UNIT NO. 3
 SUBJECT F.P. WATER SUPPLY TO CWP FOR BEARING LUBRICATION

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8. F.P. PIPING FLOW DIAGRAM - SK-1	19

EBASCO SERVICES INCORPORATED

BY D SEMEN ^{OS} DATE 3-30-83 SHEET 3 OF 19
CHKD. BY M. BYRON ^{NB} DATE 4/14/83 OFS NO. 2796.545 DEPT. NO. 590
CLIENT LOUISIANA POWER & LIGHT COMPANY
PROJECT WATERFORD SES UNIT NO. 3
SUBJECT FP WATER SUPPLY TO CWP FOR BEARING LUBRICATION

REFERENCE DOCUMENTS

1. NAVCO PIPING DATALOG
2. PIPE ECONOMY CLOW CORPORATION 1975
3. FSAR SECTION V-5 AMENDMENT 30
4. FLOW DIAGRAM LOU 1564 G-161 SH 1 OF 2
5. FIRE PROTECTION PIPING LAYOUT DWGS: LOU 1564
G-205 SH 1 OF 9
G-205 SH 2 OF 9
G-205 SH 3 OF 9
G-205 SH 4 OF 9
G-201 SH 1 OF 2
G-201 SH 2 OF 2
6. COMPUTER PROGRAM FOR "THE ANALYSIS OF PRESSURE AND FLOW IN PIPE DISTRIBUTION SYSTEMS" BY DON J. WOOD UNIVERSITY OF KENTUCKY (REVISED JUNE 1977)

EBASCO SERVICES INCORPORATED

BY D. SEMEN ^{OS} DATE 3-30-83 SHEET 4 OF 19
 CHKD. BY M. BYRON ^{MD} DATE 4/14/83 OFS NO. 2796 545 DEPT. NO. 590
 CLIENT LOUISIANA POWER & LIGHT COMPANY
 PROJECT WATERFORD SES UNIT NO. 3
 SUBJECT F.P. WATER SUPPLY TO CWP FOR BEARING LUBRICATION

METHOD OF OBTAINING RESULTS

PRESSURE DROP CALCULATIONS WERE BASED ON THE FOLLOWING COMPUTER PROGRAM AND EQUATIONS:

1. COMPUTER PROGRAM FOR "THE ANALYSIS OF PRESSURE AND FLOW IN PIPE DISTRIBUTION SYSTEMS"

A. LINE LOSS

$$h_{LP} = \frac{4.73 Q^{1.852}}{C^{1.852} D^{4.87}} \quad (\text{HAZEN WILLIAMS EQ})$$

h_{LP} = LINE LOSS

D = LINE DIAMETER

C = HAZEN WILLIAMS ROUGHNESS COEFFICIENT

Q = DISCHARGE RATE

B. COMPONENT OF FITTING LOSS

$$h_{LM} = \frac{MV^2}{2g}$$

h_{LM} = COMPONENT OF FITTING LOSS

* M = MINOR LOSS COEFFICIENT (EL, ELL, T, VALVES ETC.)

V = LINE VELOCITY

g = GRAVITATIONAL CONSTANT

* MINOR LOSS COEFFICIENTS FOR VARIOUS FITTINGS & VALVES ARE LISTED IN TABLE-1 SH 9 OF 19.

EBASCO SERVICES INCORPORATED

BY D. SEMEN DATE 3-30-83

SHEET 5 OF 19

CHKD. BY M. BYRON DATE 4/14/83

OFS NO. 2796545 DEPT. NO. 590

CLIENT LOUISIANA POWER & LIGHT COMPANY

PROJECT WATERFORD SES UNIT NO. 3

SUBJECT F.P. WATER SUPPLY TO CWP FOR BEARING LUBRICATION

C. PUMP HEAD

$E_p = A + BQ + CQ^2$ WHERE A, B, C ARE COEFFICIENTS OF A PARABOLIC CHARACTERISTIC CURVE WHICH DESCRIBES THE NORMAL OPERATING REGION OF THE PUMP.

THIS PROGRAM USES NON-LINEAR EQUATIONS TO SOLVE PRESSURE LOSSES IN PIPES AND FITTINGS BY FLOW SPLITTING. (FOR ADDITIONAL INFORMATION SEE THE USER'S MANUAL WHICH IS AVAILABLE UPON REQUEST.).

2. CALCULATIONS WERE BASED ON TWO FIRE PUMPS OPERATING SIMULTANEOUSLY. FIRE PUMPS ARE RATED AT 100 PSI AT 2000 GPM.

3. FOLLOWING PIPE SIZES WERE USED
CARBON STEEL PIPE - SCH 40

<u>NOM. (IN)</u>	<u>O.D. (IN)</u>	<u>WALL TH. (IN)</u>	<u>I.D. (IN)</u>
4	4.500	.237 x 2	4.026
6	6.625	.280 x 2	6.065
8	8.625	.322 x 2	7.981
10	10.750	.365 x 2	10.02
12	12.750	.406 x 2	11.938
14	14.000	.438 x 2	13.124

<u>CAST IRON CEMENT LINE PIPE (AWWAC-106) (200psi)</u>				
<u>NOM (IN)</u>	<u>O.D (IN)</u>	<u>WALL TH. (IN)</u>	<u>LINING TH. (IN)</u>	<u>I.D (IN)</u>
12	13.2	.48	.0625	12.12

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BY D. SEMEN DATE 3-30-83 SHEET 6 OF 19
 CHKD. BY M. BYRON ^{NB} DATE 4/14/83 OFS NO. 2796 545 DEPT. NO. 590
 CLIENT LOUISIANA POWER & LIGHT COMPANY
 PROJECT WATERFORD SES UNIT NO. 3
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4. PIPE LENGTHS INDICATED ON COMPUTER PRINTOUTS ARE THE ACTUAL LENGTHS OF THE PIPES. CORRESPONDING EQUIVALENT LENGTHS FOR FITTINGS AND VALVES ETC. ARE LISTED UNDER COLUMN "MINOR LOSS K" AND THESE VALUES ARE OBTAINED FROM TABLE -1 SH 9 OF 19 WHICH IS PART OF THE USER'S MANUAL. DIAMETER (IN) OF PIPES ARE ROUNDED OFF TO NEAREST TENTH.

EBASCO SERVICES INCORPORATED

BY O SEMEN DATE 3-30-83

CHKD. BY N. BYRON DATE 4/14/83

SHEET 7 OF 19

OFS NO. 2796545 DEPT. NO. 590

CLIENT LOUISIANA POWER & LIGHT COMPANY

PROJECT WATERFORD SES UNIT NO. 3

SUBJECT F.P. WATER SUPPLY TO CWP FOR BEARING LUBRICATION

SUMMARY CALCULATION RESULTS

THE SYSTEM FP-M28 (SEE SK-1 SH 19 OF 19) WET PIPE SPRINKLER SYSTEM PROTECTING DIESEL OIL PIPING IN THE PIPING PENETRATION AREA HAS THE LARGEST EXPECTED FLOW RATE DEMAND IN RAB (≈ 1223 GPM @ 77.98 PSI). SEE TABLE 2 SH 10 OF 19.

THE CURVE 'A' (SEE FIG. 1 SH 8 OF 19) ESTABLISHES THE WATERFLOW AVAILABLE AT THE INTERFACE POINT OF FP-M28 FOR ANY GIVEN FLOWRATE. PT. A REPRESENTS THE AVAILABLE PRESSURE OF 95.00 PSI FOR FLOW OF ≈ 1223.00 GPM (LARGEST DEMAND IN RAB) AT THE INTERFACE PT. POINT B REPRESENTS THE REQUIRED PRESSURE OF 77.98 PSI FOR THE SAME FLOW RATE OF ≈ 1223.00 GPM @ THE INTERFACE PT.

FROM THE PRECEEDING RESULTS, ONE COULD CLEARLY CONCLUDE THAT THE PRESSURE AVAILABLE AT THE INTERFACE PT. IS MORE THAN ADEQUATE WITH THE ADDITIONAL REMOVAL OF 125 GPM FOR THE CWP BEARING LUBRICATION.

THE TOTAL WATER DEMAND FOR THE WORST CASE FIRE FOR A DURATION OF 120 MINUTES IS 221,760 GAL WHICH INCLUDES ≈ 1223 GPM FOR SPK. SYSTEM FP-M28, 500 GPM FOR HYDRANT DEMAND AND 125 GPM FOR CWP BEARING LUBRICATION DEMAND.

WATER AVAILABLE AT EACH FIRE PROTECTION WATER STORAGE TANK IS 243,462 GAL.

THEREFORE, FIRE PROTECTION WATER SUPPLY IS MORE THAN SUFFICIENT TO MEET NOTED DEMAND.

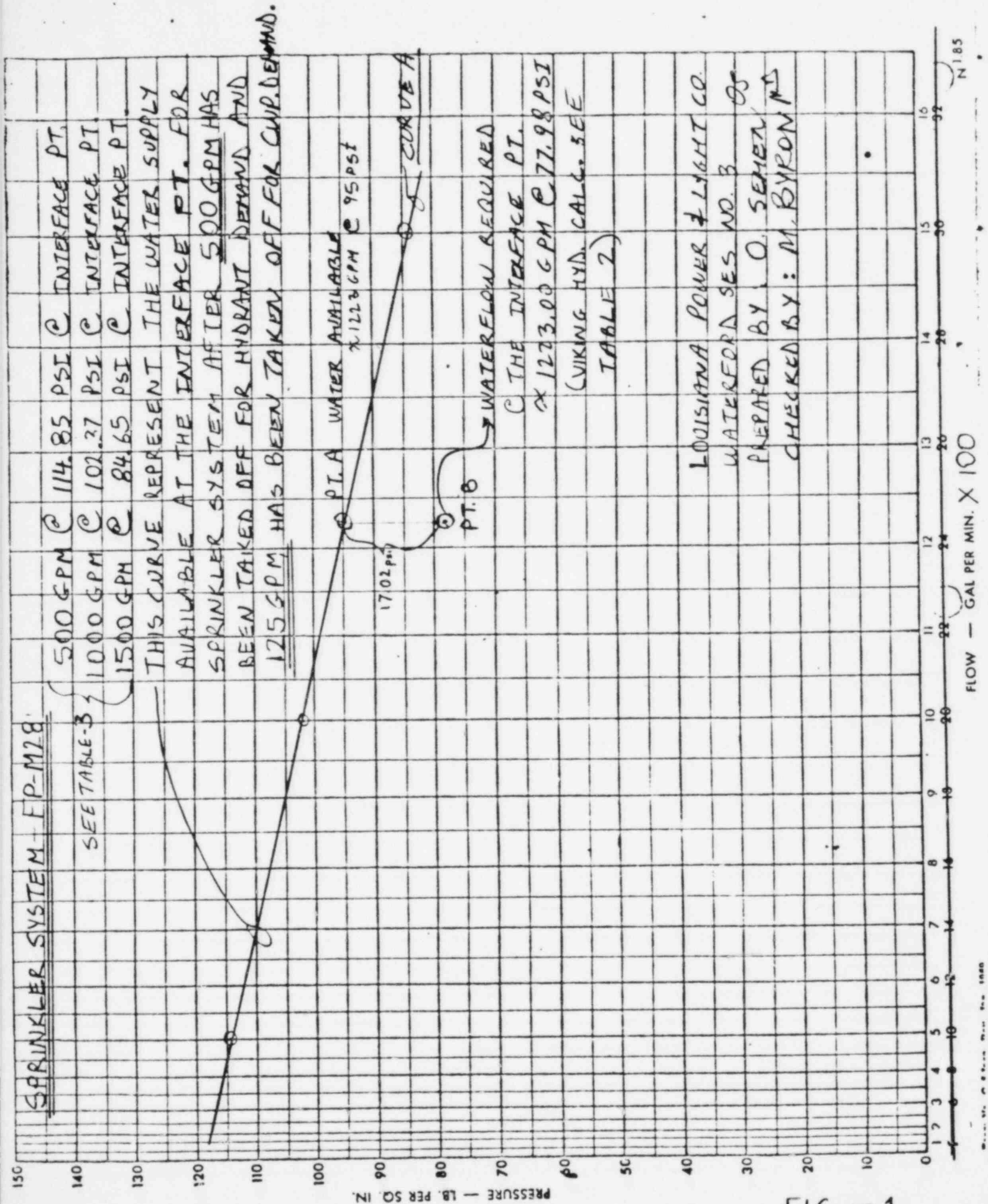


FIG. - 1

Loss Coefficients for Common Fittings	
fitting	M
Globe valve, fully open	10.0
Angle valve, fully open	5.0
Swing check valve, fully open	2.5
Gate valve, fully open	0.2
Gate valve, 3/4 open	1.0
Gate valve, 1/2 open	5.6
Gate valve, 1/4 open	24.0
Short-radius elbow	0.9
Medium-radius elbow	0.8
Long-radius elbow	0.6
45 Elbow	0.4
Closed return bend	2.2
Tee, through side outlet	1.8
Tee, straight run	0.3
Coupling	0.3
45 Wye, through side outlet	0.8
45 Wye, straight run	0.3
Entrance	
square	.5
bell mouth	.1
re-entrant	.9
Exit	1.0

$$h_{LM} = M \frac{v^2}{2g}$$

MINOR LOSS COEFFICIENTS

TABLE - 1

HYDRAULIC CALCULATIONS

FOR

LOUISIANA POWER & LIGHT COMPANY

WATERFORD S.E.S.

ST. CHARLES PARISH, LA.

CONTRACT NO. 04-81367

DATE 4/1/82

DESIGN DATA— FOR SYSTEM FP-M28

DENSITY .3 GPM/SQ. FT.

AREA OF APPLICATION 3110.44 SQ. FT.

COVERAGE PER SPRINKLER VARIES SQ. FT.

NO. OF SPRINKLERS CALCULATED 52

CALCULATIONS BY: S. SANDOCK

CHECKED BY:

WATERFLOW REQUIRED IN INTERFACE

1222.59 GPM @
77.98 PSI

TABLE - 2

PIPE NUMBER NODE NUMBER LENGTH (FEET) DIAMETER (INCHES) ROUGHNESS COEFFICIENTS- A MINOR LOSS K FIXED GRADE
 THERE IS A PUMP IN LINE 1 WITH CHARACTERISTIC COEFFICIENTS- A = 272.6 B = -.3465E-02, C = -.1732E-05
 16.00

PIPE NUMBER	NODE NUMBER	LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	COEFFICIENTS- A	MINOR LOSS K	FIXED GRADE
1	0	70.0	10.0	120.0	2.90	272.6	16.00
2	1	21.0	10.0	75.0	2.70		
3	2	5.0	10.0	75.0	0.30		
4	1	25.0	10.0	75.0	1.90		
5	1	412.1	12.1	140.0	8.20		
6	2	364.0	10.0	75.0	3.80		
7	3	404.5	10.0	75.0	1.20		
8	3	92.0	10.0	75.0	0.20		
9	4	46.0	8.0	75.0	6.00		
10	5	74.5	8.0	120.0	3.20		
11	6	172.0	8.0	120.0	2.60		
12	7	123.0	8.0	120.0	6.60		
13	6	405.0	8.0	120.0	8.10		
14	9	140.0	8.0	120.0	6.20		
15	9	34.0	8.0	120.0	2.70		
16	8	15.0	8.0	120.0	1.10		
17	11	152.0	8.0	75.0	4.20		
18	14	187.0	10.0	75.0	2.40		
19	13	186.0	10.0	75.0	2.60		
20	12	11.0	10.0	75.0	6.50		
21	15	4.0	10.0	75.0	0.50		
22	16	295.0	10.0	75.0	1.60		
23	17	33.0	10.0	75.0	0.30		
24	31	757.0	10.0	75.0	6.80		
25	4	113.0	10.0	75.0	0.70		
26	19	100.0	8.0	75.0	2.60		
27	20	93.0	8.0	75.0	1.30		
28	21	18.0	8.0	120.0	0.30		
29	22	40.8	8.0	120.0	1.30		
30	23	33.8	8.0	120.0	1.60		
31	24	73.0	4.0	120.0	7.20		
32	36	55.0	4.0	120.0	4.10		
33	24	123.0	6.0	120.0	6.00		
34	26	95.0	4.0	120.0	9.40		
35	27	84.8	8.0	120.0	1.90		
36	28	26.0	6.0	120.0	2.80		
37	29	322.8	8.0	75.0	8.00		
38	31	105.0	10.0	75.0	1.80		
39	32	51.0	8.0	120.0	6.60		
40	32	15.0	8.0	120.0	6.60		
41	36	3.0	6.1	120.0	1.80		
42	33	17.0	6.1	120.0	1.10		
43	36	55.0	4.0	120.0	4.10		
44	37	50.0	4.0	120.0	4.90		
45	18	195.0	10.0	75.0	1.80		

THE FLOW IN LINE NUMBER 37 IS RESTRICTED

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES
1	0.0	16.00	1 2 4
2	0.0	0.0	2 3 6
3	0.0	0.0	7 8
4	0.0	0.0	8 9 25
5	0.0	0.0	4 10
6	0.0	0.0	10 11 13
7	0.0	0.0	11 12
8	0.0	0.0	12 14 16
9	0.0	0.0	12 14 15

12	0.0	17	13	20
13	0.0	18	19	
14	0.0	3	4	18
15	0.0	20	21	37
16	0.0	21	22	
17	0.0	22	23	
18	0.0	23	24	
19	0.0	24	25	26
20	500.00	26	27	
21	0.0	27	28	
22	0.0	28	29	
23	0.0	29	30	
24	0.0	30	31	33
25	0.0	31	32	39
26	0.0	32	33	
27	0.0	33	34	
28	0.0	34	35	35
29	0.0	35	36	44
30	0.0	36	37	
31	0.0	6	7	
32	0.0	24	28	
33	500.00	39	40	
34	0.0	40	42	
35	0.0	41		
36	0.0	42	41	43
37	0.0	32	44	
38	125.00	38	45	

THIS SYSTEM HAS 45 PIPES WITH 38 JUNCTIONS • 7 LOOPS AND 1 FIXED GRADE NODES

JUNCTION NUMBER DEMAND
37 0.0
27 500.00

LUASCO SERVICES INC. LOUISIANA POWER & LIGHT CO. WATERFORD SFS 3
SYSTEM FP-M28 WING AREA EL.1.00 VALVE 7FF-V146 0 SEMEN MAR 25 P3
RUN:1 - HYD AT NODE:20 CNP DEMAND=1256PM AT NODE 38 FLOW=500GPM

THE FOLLOWING RESULTS ARE OBTAINED AFTER 2 TRIALS

PIPE NO.	NODE NUMBERS	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0 1	1125.00	0.62	266.49	0.94	4.58	8.80
2	1 2	351.76	0.05	0.0	0.09	1.43	2.44
3	2 14	-43.85	-0.60	0.0	-0.00	-0.18	-0.05
4	1 14	374.09	0.07	0.0	0.07	1.52	2.74
5	1 10	359.13	0.16	0.0	0.16	1.11	0.38
6	2 30	395.63	1.10	0.0	0.15	1.61	3.03
7	30 3	395.63	1.23	0.0	0.05	1.61	3.03
8	3 4	395.63	0.28	0.0	0.01	1.61	3.03
9	4 5	-344.92	-0.68	0.0	-0.46	-2.21	-7.13
10	5 6	-344.92	-0.22	0.0	-0.24	-2.21	-2.99
11	6 7	-147.92	-0.11	0.0	-0.04	-0.95	-0.62
12	7 8	-147.92	-0.08	0.0	-0.09	-0.95	-0.62
13	6 9	-197.00	-0.43	0.0	-0.20	-1.26	-1.06
14	9 8	202.13	0.16	0.0	0.16	1.30	1.11
15	9 10	-399.13	-0.13	0.0	-0.27	-2.56	-3.91
16	8 11	54.21	0.00	0.0	0.00	0.35	0.10
17	11 12	54.21	0.04	0.0	0.01	0.35	0.23
18	14 13	330.24	0.41	0.0	0.07	1.34	2.17
19	13 12	330.24	0.40	0.0	0.07	1.34	2.17
20	12 15	384.45	0.03	0.0	0.02	1.56	2.88
21	15 16	384.45	0.01	0.0	0.02	1.56	2.88
22	16 17	384.45	0.85	0.0	0.06	1.56	2.88
23	17 18	384.45	0.09	0.0	0.01	1.56	2.88
24	31 19	259.45	1.05	0.0	0.12	1.39	1.39
25	4 19	740.55	1.10	0.0	0.10	3.51	9.69
26	19 20	1000.00	5.12	0.0	1.66	6.41	51.18
27	20 21	500.00	1.32	0.0	0.21	3.21	14.18
28	21 22	500.00	0.11	0.0	0.05	3.21	5.94
29	22 23	500.00	0.24	0.0	0.21	3.21	5.94
30	23 24	500.00	0.20	0.0	0.26	3.21	5.94
31	24 25	52.08	0.18	0.0	0.19	1.31	2.52
32	25 26	52.08	0.14	0.0	0.11	1.31	2.52
33	26 27	447.92	0.60	0.0	0.77	2.87	4.84
34	27 28	52.08	0.24	0.0	0.25	1.31	2.52
35	28 29	0.0	0.0	0.0	0.0	0.0	0.0
36	29 30	0.0	0.0	0.0	0.0	0.0	0.0
37	30 31	-259.45	-0.15	0.0	-0.03	-1.06	-1.39
38	31 32	0.0	0.0	0.0	0.0	0.0	0.0
39	32 33	0.0	0.0	0.0	0.0	0.0	0.0
40	33 34	0.0	0.0	0.0	0.0	0.0	0.0
41	34 35	0.0	0.0	0.0	0.0	0.0	0.0
42	35 36	0.0	0.0	0.0	0.0	0.0	0.0
43	36 37	-52.08	-0.14	0.0	-0.11	-1.31	-2.52
44	37 38	0.0	0.0	0.0	0.0	0.0	0.0
45	38 39	384.45	0.56	0.0	0.07	1.56	2.88

THE FLOW IN LINE NUMBER 37 IS RESTRICTED

1	0.0	269.93	16.00	114.80
2	0.0	280.79		
3	0.0	278.26		
4	0.0	277.97		
5	0.0	279.11		
6	0.0	279.58		
7	0.0	279.72		
8	0.0	274.69		
9	0.0	280.21		
10	0.0	280.61		
11	0.0	279.89		
12	0.0	279.84		
13	0.0	280.32		
14	0.0	280.79		
15	0.0	279.79		
16	0.0	279.76		
17	0.0	278.85		
18	0.0	278.75		
19	0.0	276.78		
20	500.00	270.00		
21	0.0	268.47		
22	0.0	268.32		
23	0.0	267.87		
24	0.0	267.41	-2.00	116.75
25	0.0	267.04	3.25	114.31
26	0.0	266.54	7.00	112.47
27	500.00	266.05	1.00	114.85
28	0.0	266.05	4.25	111.28
29	0.0	266.05		
30	0.0	279.53		
31	0.0	277.95		
32	0.0	267.41	10.00	111.55
33	0.0	267.41	23.00	105.91
34	0.0	266.79	3.80	113.96
35	0.0	267.41	48.00	95.08
36	0.0	266.79		
37	0.0	266.05	-1.50	115.94
38	125.00	278.12	12.00	115.32

THE NET SYSTEM DEMAND = 1125.00
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE
1 1125.00

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1125.00
THE NET FLOW OUT OF THE SYSTEM FROM FIXED GRADE NODES = 0.0

THE RELATIVE CHANGE IN FLOWRATE FROM THE PREVIOUS TRIAL = 0.00024

JUNCTION NUMBER DEMAND
27 0.0
27 1000.00

FEASCO SERVICES INC. LOUISIANA POWER & LIGHT CO. WATERFORD SES 3
SYSTEM FP-M26 WING AREA EL.1.00 VALVE 7-P V146 0 SEMFN MAR 25 83
RUN:2 - HYD AT NODE 20 CWP DEMAND=1250GPM AT NODE 38 FLOW:1000GPM

THE FOLLOWING RESULTS ARE OBTAINED AFTER 2 TRIALS

PIPE NO.	NODE NUMBERS	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0 1	1625.00	1.22	262.37	1.97	6.61	17.39
2	1 2	509.81	0.10	0.0	0.18	2.07	4.85
3	2 14	-72.53	-0.00	0.0	-0.00	-0.30	-0.13
4	1 14	543.86	0.14	0.0	0.14	2.21	5.47
5	1 10	571.33	0.31	0.0	0.32	1.59	0.75
6	2 30	582.34	2.26	0.0	0.33	2.37	6.21
7	3 3	582.34	2.51	0.0	0.10	2.37	6.21
8	3 4	582.34	0.57	0.0	0.02	2.37	6.21
9	4 5	-506.00	-1.39	0.0	-0.58	-3.24	-14.49
10	5 6	-506.00	-3.45	0.0	-0.52	-3.24	-6.07
11	6 7	-219.67	-0.22	0.0	-0.08	-1.41	-1.29
12	7 8	-219.67	-0.16	0.0	-0.20	-1.41	-1.29
13	6 9	-286.33	-0.86	0.0	-0.84	-1.84	-2.11
14	9 8	285.00	0.29	0.0	0.32	1.83	2.10
15	10 9	-571.33	-0.26	0.0	-0.56	-3.66	-7.60
16	8 11	65.33	0.00	0.0	0.00	0.42	0.14
17	11 12	65.33	0.05	0.0	0.01	0.42	0.33
18	14 13	471.33	0.78	0.0	0.14	1.92	4.20
19	13 12	471.33	0.78	0.0	0.15	1.92	4.20
20	12 15	536.66	0.06	0.0	0.04	2.18	5.34
21	15 16	536.66	0.02	0.0	0.04	2.18	5.34
22	16 17	536.66	1.57	0.0	0.12	2.18	5.34
23	17 18	536.66	0.16	0.0	0.02	2.18	5.34
24	31 19	411.66	2.47	0.0	0.30	1.67	3.27
25	4 19	1088.34	2.23	0.0	0.21	4.43	19.77
26	19 20	1500.00	10.85	0.0	3.74	9.62	108.46
27	20 21	1000.00	4.76	0.0	0.83	6.41	51.18
28	21 22	1000.00	0.59	0.0	0.19	6.41	21.43
29	22 23	1000.00	0.87	0.0	0.83	6.41	21.43
30	23 24	1000.00	0.72	0.0	0.83	6.41	21.43
31	24 25	104.55	0.67	0.0	1.02	2.63	9.17
32	36 26	104.55	0.50	0.0	0.78	2.63	9.17
33	24 27	895.45	2.15	0.0	0.44	5.74	17.47
34	26 27	104.55	0.87	0.0	3.07	2.63	9.17
35	27 28	0.0	0.0	0.0	1.01	0.0	0.0
36	28 29	0.0	0.0	0.0	0.0	0.0	0.0
37	31 38	-411.66	-0.34	0.0	-0.08	-1.67	-3.27
38	38 32	0.0	0.0	0.0	0.0	0.0	0.0
39	32 33	0.0	0.0	0.0	0.0	0.0	0.0
40	33 34	0.0	0.0	0.0	0.0	0.0	0.0
41	34 35	0.0	0.0	0.0	0.0	0.0	0.0
42	35 36	-104.55	-0.50	0.0	-0.44	-2.63	-5.17
43	36 25	0.0	0.0	0.0	0.0	0.0	0.0
44	37 28	0.0	0.0	0.0	0.0	0.0	0.0
45	18 38	536.66	1.04	0.0	0.13	2.18	5.34

THE FLOW IN LINE NUMBER 37 IS RESTRICTED

1	0.0	275.19	16.00	112.31
2	0.0	274.91		
3	0.0	269.70		
4	0.0	269.11		
5	0.0	271.48		
6	0.0	272.46		
7	0.0	272.76		
8	0.0	273.12		
9	0.0	273.74		
10	0.0	274.56		
11	0.0	273.12		
12	0.0	273.06		
13	0.0	273.59		
14	0.0	274.91		
15	0.0	272.96		
16	0.0	272.90		
17	0.0	271.21		
18	0.0	271.03		
19	0.0	266.66		
20	500.00	252.08		
21	0.0	246.49		
22	0.0	245.91		
23	0.0	244.21		
24	0.0	242.47	-2.00	105.94
25	0.0	241.02	3.25	103.03
26	0.0	239.13	7.00	100.59
27	1000.00	227.25	1.00	102.37
28	0.0	237.25	9.25	98.80
29	0.0	237.25		
30	0.0	272.31		
31	0.0	269.43		
32	0.0	242.47	10.00	100.74
33	0.0	242.47	23.00	95.10
34	0.0	240.07	3.60	102.39
35	0.0	242.47	48.00	84.27
36	0.0	240.07		
37	0.0	237.25	-1.50	103.46
38	125.00	269.05	12.00	111.74

THE NET SYSTEM DEMAND = 1625.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE
1 1625.00

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1625.00

THE NET FLOW OUT OF THE SYSTEM FROM FIXED GRADE NODES = 0.0

THE RELATIVE CHANGE IN FLOWRATE FROM THE PREVIOUS TRIAL = 0.00060

JUNCTION NUMBER DEMAND
27 1500.00
27

LIASCO SERVICES INC. LOUISIANA POWER & LIGHT CO. WATERFORD SES 3
SYSTEM FP-M26 WING AREA EL.1.00 VALVE 70P-VI46 0 SFMEN MAR 25 83
RUN:3 - HYD AT NODE 20 CWP DEMAND=1250PP AT NODE 38 FLOW:1500GPM

THE FOLLOWING RESULTS ARE OBTAINED AFTER 2 TRIALS

PIPE NO.	NODE NUMBERS	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0 1	2125.00	2.00	257.39	3.37	8.65	28.59
2	1 2	668.18	0.17	0.0	0.31	2.72	8.01
3	2 14	-101.67	-0.00	0.0	-0.00	-0.41	-0.25
4	1 14	714.49	0.23	0.0	0.25	2.91	9.07
5	1 10	742.32	0.50	0.0	0.54	2.36	1.21
6	2 30	770.06	3.79	0.0	0.58	3.13	10.42
7	30 3	770.06	4.21	0.0	0.18	3.13	10.42
8	3 4	770.06	0.96	0.0	0.03	3.13	10.42
9	4 5	-666.47	-2.32	0.0	-1.70	-4.27	-24.14
10	5 6	-666.47	-0.75	0.0	-0.91	-4.27	-10.11
11	6 7	-291.10	-0.38	0.0	-0.14	-1.87	-2.18
12	7 8	-291.10	-0.27	0.0	-0.26	-1.87	-2.18
13	6 9	-375.37	-1.41	0.0	-0.73	-2.41	-3.49
14	9 8	366.96	0.47	0.0	0.53	2.35	3.35
15	9 10	-742.32	-0.42	0.0	-0.95	-4.76	-12.34
16	8 11	75.85	0.00	0.0	0.60	0.49	0.18
17	11 12	75.85	0.07	0.0	0.02	0.49	0.43
18	14 13	612.62	1.28	0.0	0.23	2.49	6.82
19	13 12	612.62	1.27	0.0	0.25	2.49	6.82
20	12 15	688.47	0.09	0.0	0.06	2.80	8.47
21	15 16	688.47	0.03	0.0	0.06	2.80	8.47
22	16 17	688.47	2.50	0.0	0.19	2.80	8.47
23	17 18	688.47	0.25	0.0	0.34	2.60	8.47
24	31 19	563.47	4.42	0.0	0.55	2.29	5.84
25	4 19	1436.53	3.74	0.0	0.37	5.84	33.06
26	19 20	2000.00	18.46	0.0	6.64	12.63	184.77
27	20 21	1500.00	10.04	0.0	1.87	9.62	108.46
28	21 22	1500.00	0.62	0.0	0.43	9.62	45.42
29	22 23	1500.00	1.85	0.0	1.47	9.62	45.42
30	23 24	1500.00	1.53	0.0	0.30	9.62	45.42
31	24 25	157.15	1.4	0.0	1.75	3.96	19.50
32	26 26	157.15	1.07	0.0	1.00	3.96	19.50
33	24 27	1342.65	4.55	0.0	4.91	8.61	37.00
34	26 27	157.15	1.85	0.0	2.29	3.96	19.50
35	27 28	0.0	0.0	0.0	0.0	0.0	0.0
36	28 29	0.0	0.0	0.0	0.0	0.0	0.0
37 IS RESTRICTED							
38	31 38	-563.47	-0.61	0.0	-0.15	-2.29	-5.84
39	32 32	0.0	0.0	0.0	0.0	0.0	0.0
40	32 33	0.0	0.0	0.0	0.0	0.0	0.0
41	33 34	0.0	0.0	0.0	0.0	0.0	0.0
42	33 35	0.0	0.0	0.0	0.0	0.0	0.0
43	36 35	-157.15	-1.07	0.0	-1.00	-3.96	-19.50
44	37 37	0.0	0.0	0.0	0.0	0.0	0.0
45	18 38	688.47	1.65	0.0	0.22	2.49	6.82

1	0.0	268.33	16.00	109.21
2	0.0	267.55		
3	0.0	258.76		
4	0.0	257.74		
5	0.0	261.81		
6	0.0	263.47		
7	0.0	263.99		
8	0.0	264.61		
9	0.0	265.61		
10	0.0	266.98		
11	0.0	269.60		
12	0.0	264.52		
13	0.0	266.04		
14	0.0	267.55		
15	0.0	264.37		
16	0.0	264.28		
17	0.0	261.58		
18	0.0	261.29		
19	0.0	253.69		
20	100.00	228.57		
21	0.0	216.61		
22	0.0	215.36		
23	0.0	211.65		
24	0.0	207.81	-2.00	96.92
25	0.0	204.64	3.25	87.27
26	0.0	200.50	7.00	83.85
27	1500.00	196.36	1.00	84.65
28	0.0	196.36	9.25	81.08
29	0.0	196.36		
30	0.0	263.18		
31	0.0	258.66		
32	0.0	207.81	10.00	85.72
33	0.0	207.81	23.00	80.09
34	0.0	202.57	3.80	86.13
35	0.0	207.81	48.00	69.25
36	0.0	202.57		
37	0.0	196.36	-1.50	85.74
38	125.00	259.42	12.00	107.22

THE NET SYSTEM DEMAND = 2125.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
1	2125.00

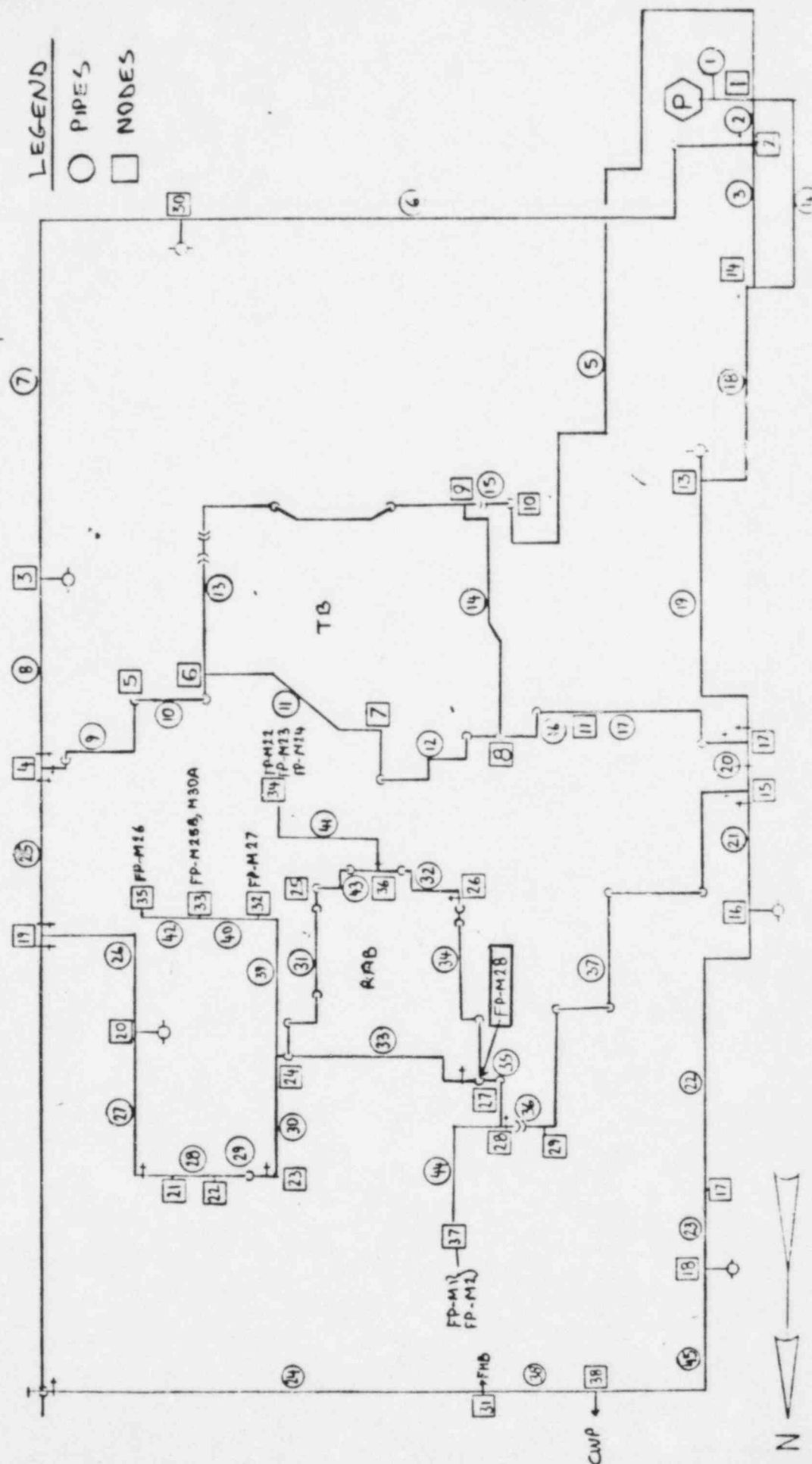
THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2125.00

THE NET FLOW OUT OF THE SYSTEM FROM FIXED GRADE NODES = 0.0

THE RELATIVE CHANGE IN FLOWRATE FROM THE PREVIOUS TRIAL = 0.00024

SUBJECT UNDERGROUND VARD LOOP (FIRE PROTECTION)

PRECIPITATION	DATE
0.0	10/1/01
0.0	10/2/01
0.0	10/3/01
0.0	10/4/01
0.0	10/5/01
0.0	10/6/01
0.0	10/7/01
0.0	10/8/01
0.0	10/9/01
0.0	10/10/01
0.0	10/11/01
0.0	10/12/01
0.0	10/13/01
0.0	10/14/01
0.0	10/15/01
0.0	10/16/01
0.0	10/17/01
0.0	10/18/01
0.0	10/19/01
0.0	10/20/01
0.0	10/21/01
0.0	10/22/01
0.0	10/23/01
0.0	10/24/01
0.0	10/25/01
0.0	10/26/01
0.0	10/27/01
0.0	10/28/01
0.0	10/29/01
0.0	10/30/01
0.0	10/31/01



SK-1