REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS (DPU)
DIRECTORATE GENERAL OF HOUSING, BUILDING,
PLANNING AND URBAN DEVELOPMENT (CIPTA KARYA)

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

VOLUME V

APPENDICES

FOR VOLUME III
FEASIBILITY STUDY REPORT

MARCH 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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FEASIBILITY STUDY

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FEASIBILITY STUDY FOR
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

F1. APPENDIX FIV-1

DESIGN CRITERIA FOR PRELIMINARY DESIGN

Design Criteria for Preliminary Design

1. General Criteria

The design criteria for the preliminary design for the facilities are presented below. Consideration is given to the criteria on the basis of the present status of Jakarta water supply system.

1) Fluctuation in Water Demand

There are fluctuations in water demand seasonally and hourly.

Among these variations, the followings are used for the preliminary design considering past records of consumption pattern and scale of water supply system.

- Day Maximum Water Demand : 115% of day average water demand
- Hourly Maximum Water Demand : 130% of day maximum water demand

2) Intake and Treatment Plant Capacity

Capacity of the intake and treatment plant is determined as 107% of production capacity considering water losses during treatment process. Water loss during raw water transmission is not considered.

3) Intake and Treatment Plant Facilities

Design criteria for major facilities of intake and treatment plant are presented in 2. Criteria for Intake and Treatment Plant, of this paper.

4) Distribution Facilities

a. Water Distribution

Water pressure at supply source is variable according to the consumption level and generally water pressure in service area raises in the night time when supply pressure at supply source is stable. The higher water pressure beyond required water pressure in service area causes higher leakage from the system.

As for the distribution of water, there are two methods, namely gravity supply and pumping supply methods. In case of Jakarta water supply system, the gravity supply method will not be practicable due to the flat geographical condition in service area and sizes of water supply quantity and service area from the economical point of view in spite of rather simple and easy operation and maintenance of the system. To distribute water by gravity, service area is necessary to be divided into many in numbers with many elevated reservoirs and long treated water transmission pipelines.

Therefore water distribution to service area is planned by pump. The followings are generally applied among others:

1) Valve control methods,
2) Unit control methods,
3) Conbination of above two methods, and
4) Variable speed control method

As shown in the Table 1.1, Case 3 "Conbination of valve control and unit control method" and case 4 "variable speed control method" are practicable for Jakarta water supply system. The former method has advantage in smaller initial cost than the latter case, but operation cost of the former is higher than the latter due to the higher power cost derived from energy loss in operation. When variation of water consumption is large, the latter method will have advantage in general.

Considering the relatively small variation of daily water consumption due to large amount of leakage of the system and high ratio of non-domestic consumption of a total, the present study applies the former control method giving advantage of smaller initial cost. However detailed study, during the detailed design stage, is recommendable to study the advantage and disadvantage of the above methods considering rather high portion of power cost of a total operation cost.

b. Operational Storage

- Effective Capacity : 3 hours' storage of Maximum Day Demand

- Number of Basin : More than 2 units

Operational storage is to reserve water which can be drawn upon during those hours of the day when distribution system demand is high and then replenished during the night when the system demand is low.

For determining the effective capacity, typical curves representing hourly consumption patterns is prepared and is shown in Fig. 1.

c. Water Pressure of Distribution Pipelines

Distribution pipelines will be classified into three categories by pipe sizes and purposes, namely, trunk main, secondary main and tertiary pipe.

The trunk main forms distribution network to distribute water to the whole supply area, and the sizes of trunk mains are ø 300 mm in diameter and larger. The secondary mains, ø 250 mm and ø 200 mm in diameter, distribute water within a grid formed by the trunk mains. The tertiary pipes, ø 150 mm in diameter and smaller, are for supplying water to consumers directly.

The minimum water pressure required at the end of the trunk mains is 1.7 kg/cm2. The secondary mains are designed with maximum head loss of 3.5 m on pipeline length of 2 km. Head loss of the tertiary pipes is 6 m with pipeline length of 750 m. The minimum water pressure at service connection is 0.75 kg/cm2 so as to supply water up to the second floor directly with flow rate of 0.15 l/sec.

The maximum water pressure proposed for the project is 7.5 kg/cm2 considering extent of service area and strength of pipe materials.

d. Hydraulic Calculation

Hydraulic calculation of pipelines is made using Hazen-Williams formula for distribution pipelines and Weston formula for small size of service connections.

2. Criteria for Intake and Treatment Plant

It is needed to determine numbers, capacities and dimensions of the proposed facilities for computing the construction costs. Thus, this design criteria are prepared for the preliminary design on the facilities for the feasibility study and subject to change considering the results of further raw water quality analysis in the detailed design stage.

1) The inflow rate at intake : approximately 0.5 m/sec

2) Grit Chamber

a. Retention Time : 10 minutes

b. Number of Basin : 2 units (Divided by Partition Wall)

c. Desludging Method : Travelling submersible pump

Grit chambers are provided to remove grit and sand flowing in with surface water which is taken by means of intake gate, intake tower and intake pumping system. The grit chamber will be provided for the water supply system of the Cisadane river source.

3) Receiving Well

a. Retention Time : 1.5 minutes

Receiving well is provided to stabilize the water level of raw water inflow. Flow measurement equipment will be furnished in the well or after the well.

4) Mixing Well

a. Retention Time : 1 minute

b. Mixing Method : Mixing by waterfall

Function of the mixing well is to flash-mix chemicals with water. According to practice and experience, one minute retention time is considered to be appropriate for flash-mixing. Mixing method by waterfall is employed considering simplicity and effectiveness without any mechanical equipment. This method is employed in the existing Pulogadung plant with satisfactory results. The height of water fall is desired to be more than one meter.

5) Flocculation basin

a.	Retention Time	:	20 minutes
b.	Flocculation Method	:	Paddle type flocculation
c.	G.T. Value	:	23,000 - 210,000

Retention time is determined on the basis of present coagulating condition in the Pulogadung Treatment Plant. The paddle type flocculator is employed as it will be variable for the conditions of alterating treatment flow rate and fluctuating turbidity of raw water.

6) Sedimentation basin

a.	Overflow Rate	:	1.2 m3/m2/hour
b.	Retention Time	:	3 hours
c.	Type	:	Rectangular horizontal flow type
d.	Mean velocity	:	40 cm/min
e.	Desludge method	:	Sludge scrapper
f.	Effluent	:	Effluent launder at basin end

Horizontal flow type is employed to both WTC and Cisadane Systems. This type basin is easier in operation and more staple in function than the upflow type basin.

Three hours retention time is applied considering present treatment condition in the Pulogadung plant as well as comparatively heavy suspended solids of the raw water of the Cisadane system and settling velocity of the floc will be accelerated by applying polymer for the WTC system.

7) Rapid sand filter

a.	Filtration Rate	:	6.25 m3/m2/hour (150 m/day)
b.	Type	:	Conventional type with single media
c.	Surface Wash	:	Flow rate 0.20 m3/m2/min Pressure at nozzle 20 m

d. Backwash : Flow rate 0.7 m3/m2/min
Pressure at underdrain 2.5 m

150 m/day of filtration rate is employed by single media type because effective coagulation will be carried out at both systems, though its 120 m/day has been employed at the existing plants. Judging from the present raw water quality and optimum chemical applications to be employed to both systems, it can be expected that turbidity of the settled water is kept low comparing with those of the existing plants. Dual media type with high rate filtration is not recommended at this stage, since; 1) substantial difficulties with filter cleaning is anticipated due to deeper penetration of floc in the bed, and 2) highly educated or trained operator's attendance is necessary as a matter of course. Up to now single media system has been employed for the Jakarta water treatment system. Surface wash by jet water is employed considering its effective washing and easy control of its equipment.

8) Clear water reservoir

a. Effective Capacity : 1 hour's storage of plant production capacity

b. Number of Basin : More than 2 units

Function of clear water reservoir is to regulate the fluctuations occurring between the quantity of filtrate and that of delivery as well as at the time of power suspension or sudden change in supply.

9) Standby ratio of equipment

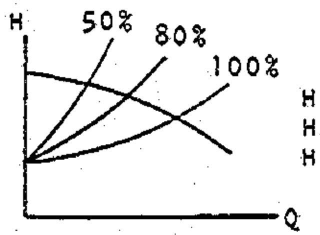
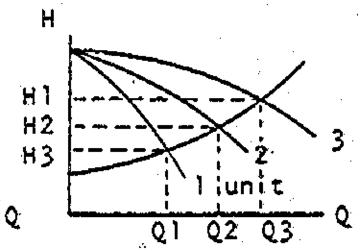
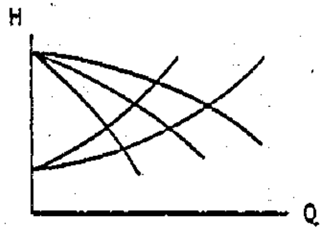
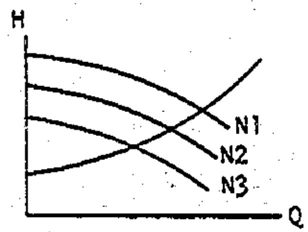
a. Raw water, transmission and distribution pumps : 50% for pumps in operation

b. Surface wash and backwash pump : 100% for pumps in operation

c. Chemical pumps, chlorinator and other equipment : 100% for equipment in operation

Considering time needed for overhaul, repair, and replacement of the pumping unit and equipment, and availability of materials, parts, and equipment which is required to be imported, the said ratio is applied.

Table 1.1 Distribution Method (Pump Supply)

METHOD	1) VALVE CONTROL	2) UNIT CONTROL	3) COMBINATION OF 1) and 2)	4) VARIABLE SPEED CONTROL
CONTROL METHOD	control flow rate by valve opening ratio	control flow rate by number of pumps in operation	control flow rate by both unit of pumps and valve control	control flow rate by changing rotation speed of pump impeler
				
ADVANTAGE	a. simple method b. low initial cost c. continuou flow and pressure control is possible	a. simple method b. low initial cost	a. simple metod b. low initial cost c. continuous flow and pressure control is possible	a. continuous flow and pressure control is possible b. high efficiency of pump operation
DISADVANTAGE	a. Low efficiency of operation (energy is lost by valve control)	a. big variation of supply pressure b. continuous flow and pressure control is not possible	a. Lower efficiency of pump operation	a. high initial cost

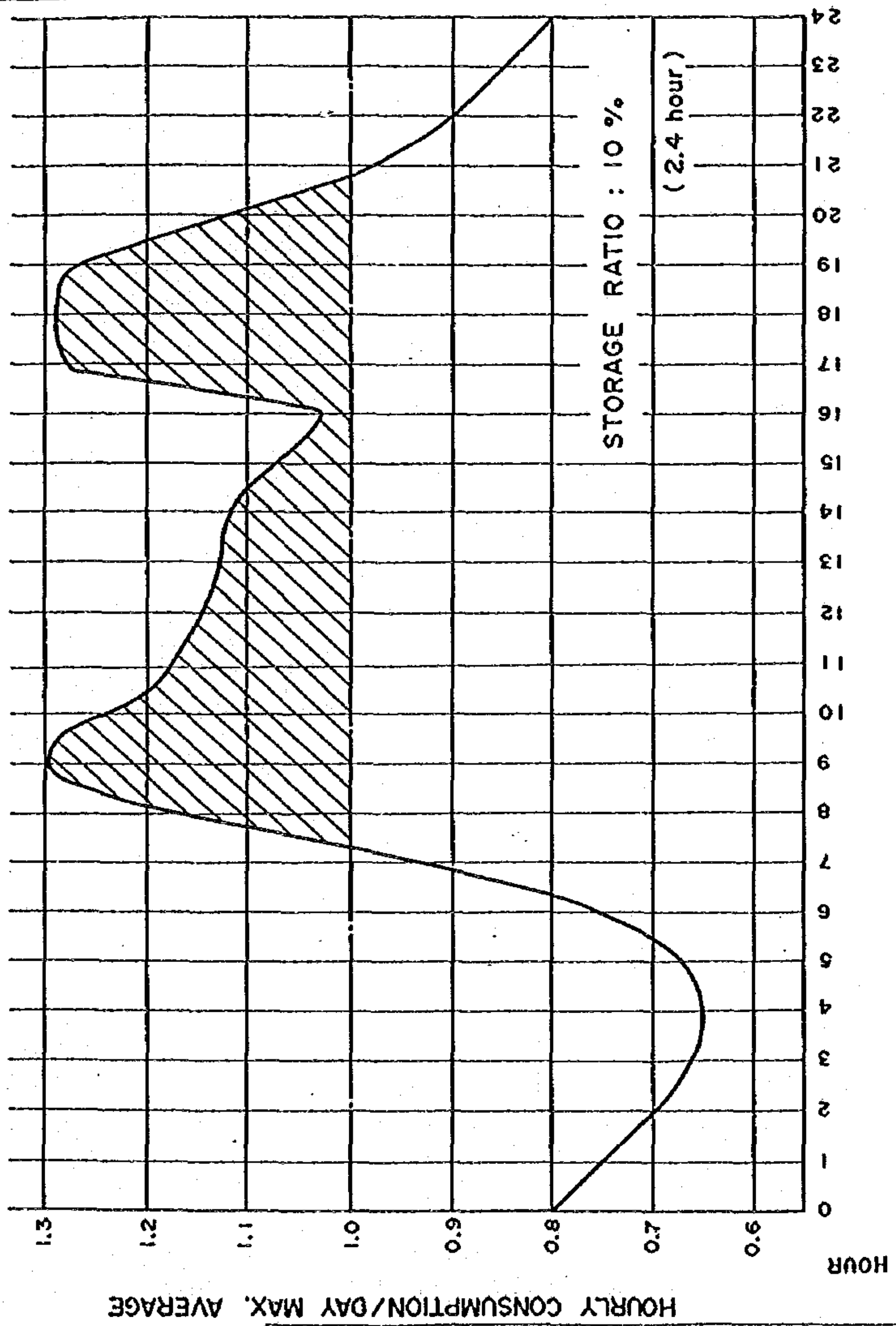
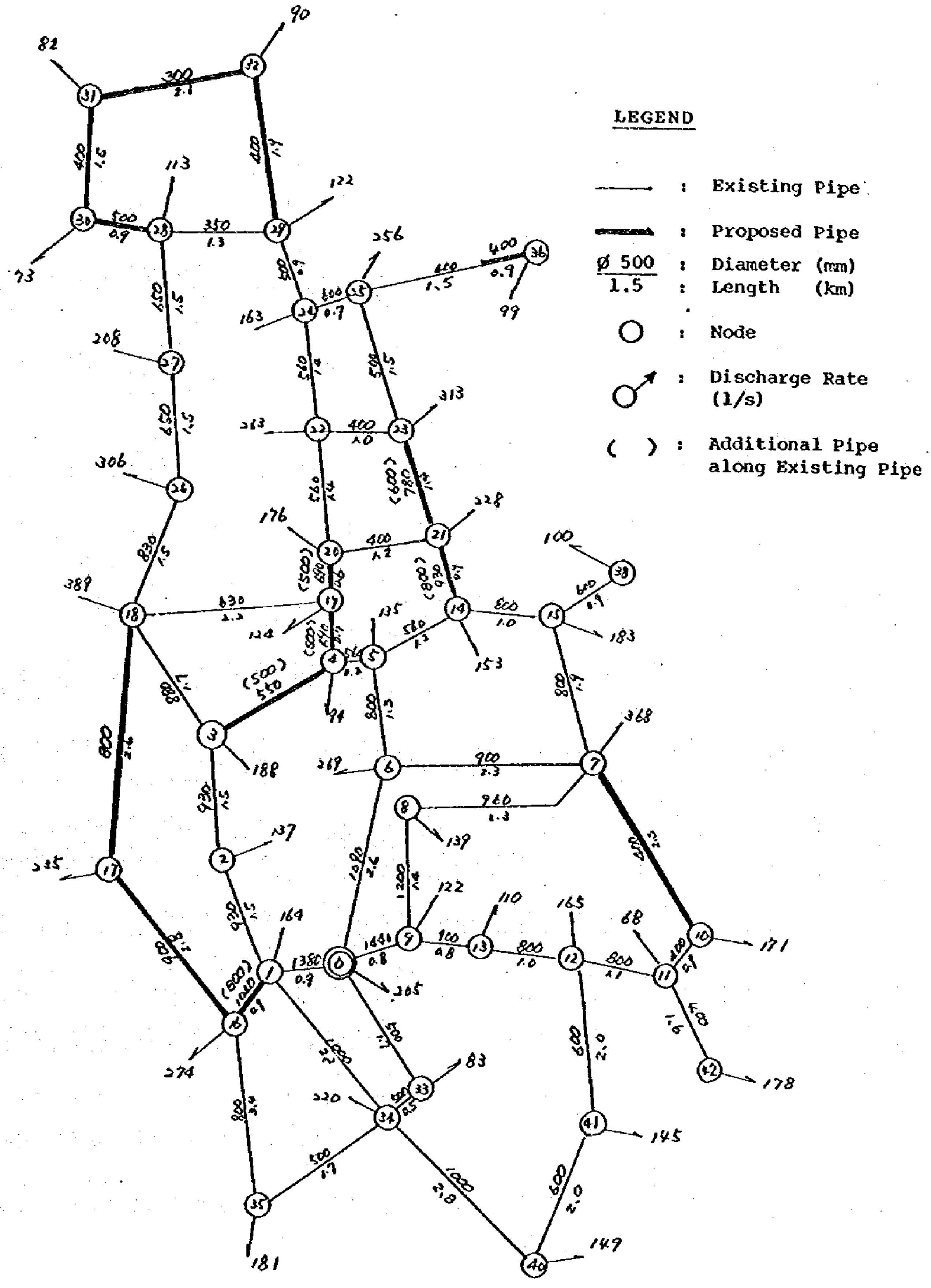


FIG 1	ESTIMATED HOURLY FLUCTUATION OF WATER CONSUMPTION
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT	JICA

FEASIBILITY STUDY FOR
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

F2. APPENDIX FIV-2

ANALYSIS OF DISTRIBUTION NETWORK



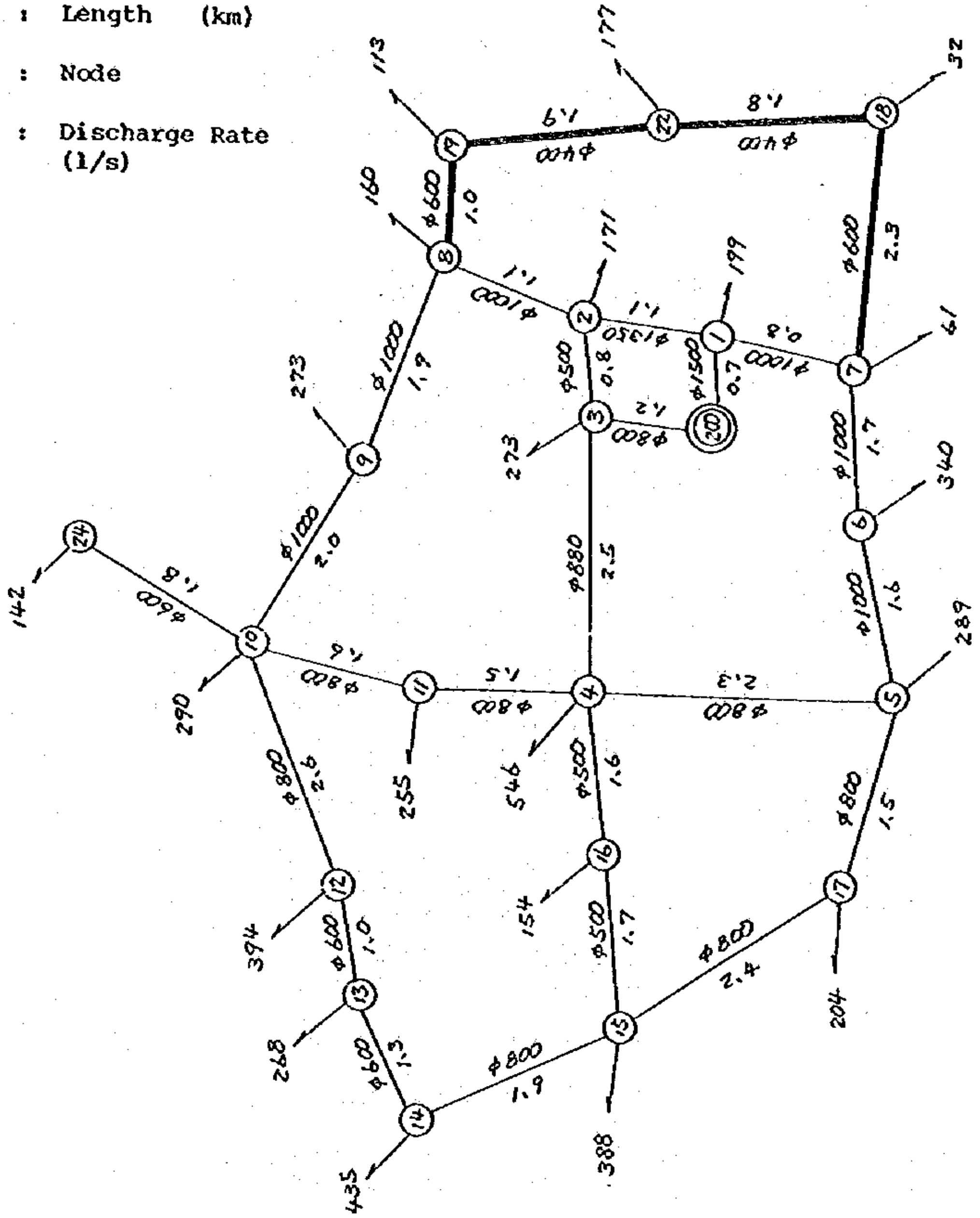
NETWORK DIAGRAM OF SUPPLY ZONE 1 (1990)

ZONE-1
1990

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
100	-	1	0	1380	900	120	2942.554	1.967	2.33	2.10	0.00	49.90	10.00	39.90
100	-	6	0	1090	2600	120	1626.403	1.743	2.45	6.38	0.00	45.62	6.00	39.62
100	-	9	0	1440	800	120	2202.950	1.353	1.11	0.89	0.00	51.11	8.00	43.11
100	-	33	0	500	1700	120	264.093	1.345	3.78	6.43	0.00	45.57	13.00	32.57
1	-	2	0	930	1500	120	1322.491	1.947	3.63	5.44	0.00	44.46	8.00	36.46
1	-	16	0	1040	900	120	1453.079	1.711	2.50	2.25	0.00	47.65	11.00	36.65
1	-	34	0	100	2200	120	2.983	0.380	2.40	5.27	0.00	44.63	13.00	31.63
2	-	3	0	930	1500	120	1185.491	1.745	2.96	4.44	0.00	40.02	6.00	34.02
3	-	4	0	550	1600	120	190.300	0.801	1.30	2.08	0.00	37.94	4.00	33.94
3	-	18	0	880	1700	120	807.191	1.327	1.90	3.24	0.00	36.78	4.00	32.78
5	-	4	0	560	200	120	508.652	2.065	7.32	1.46	0.00	37.94	4.00	33.94
4	-	19	0	690	700	120	604.952	1.618	3.65	2.56	0.00	35.39	3.00	32.39
6	-	5	0	800	1300	120	1032.524	2.054	4.78	6.21	0.00	39.41	4.00	35.41
5	-	14	0	560	1200	120	388.872	1.579	4.46	5.35	0.00	34.06	4.00	30.06
6	-	7	0	900	2300	120	324.879	0.511	0.32	0.73	0.00	44.89	6.00	38.89
8	-	7	0	960	2300	120	1084.692	1.499	2.15	4.95	0.00	44.89	6.00	38.89
7	-	10	0	400	2300	120	48.795	0.388	0.49	1.13	0.00	43.75	8.00	35.75
7	-	15	0	800	1900	120	992.776	1.975	4.44	8.44	0.00	36.45	4.00	32.45
9	-	8	0	1200	1400	120	1223.692	1.082	0.91	1.27	0.00	49.84	6.00	43.84
9	-	13	0	900	800	120	857.258	1.348	1.91	1.53	0.00	49.59	8.00	41.59
12	-	11	0	800	1100	120	368.205	0.733	0.71	0.78	0.00	46.18	8.00	38.18
13	-	12	0	800	1000	120	747.258	1.487	2.63	2.63	0.00	46.96	8.00	38.96
15	-	14	0	800	1000	120	709.776	1.412	2.39	2.39	0.00	34.06	4.00	30.06
14	-	21	0	930	900	120	945.648	1.392	1.95	1.76	0.00	32.30	3.00	29.30
16	-	17	0	900	2800	120	882.209	1.387	2.01	5.63	0.00	42.01	8.00	34.01
16	-	35	0	800	3400	120	296.870	0.591	0.48	1.62	0.00	46.03	15.00	31.03
17	-	18	0	800	2600	120	647.209	1.288	2.01	5.23	0.00	36.78	4.00	32.78
20	-	21	0	400	1200	120	42.928	0.342	0.39	0.47	0.00	32.30	3.00	29.30
20	-	22	0	560	1400	120	446.729	1.814	5.76	8.06	0.00	24.71	2.00	22.71
21	-	23	0	780	1400	120	760.576	1.592	3.07	4.30	0.00	28.01	2.00	26.01
23	-	22	0	400	1000	120	136.317	1.085	3.30	3.30	0.00	24.71	2.00	22.71
23	-	25	0	500	1500	120	311.259	1.585	5.13	7.69	0.00	20.32	1.00	19.32
24	-	25	0	600	700	120	43.741	0.155	0.06	0.04	0.00	20.32	1.00	19.32
24	-	29	0	500	900	120	113.305	0.577	0.79	0.71	0.00	19.64	0.40	19.24
25	-	36	0	400	2400	120	99.000	0.788	1.83	4.38	0.00	15.94	1.00	14.94
26	-	27	0	650	1500	120	574.695	1.732	4.44	6.66	0.00	25.65	1.00	24.65
27	-	28	0	650	1500	120	366.695	1.105	1.93	2.90	0.00	22.75	0.40	22.35
28	-	29	0	350	1300	120	80.582	0.838	2.39	3.11	0.00	19.64	0.40	19.24
28	-	30	0	500	900	120	173.113	0.882	1.73	1.56	0.00	21.19	0.40	20.79
29	-	32	0	400	1900	120	71.887	0.572	1.01	1.92	0.00	17.73	0.40	17.33
30	-	31	0	400	1500	120	100.113	0.797	1.86	2.80	0.00	18.40	0.40	18.00
31	-	32	0	300	2100	120	18.113	0.256	0.32	0.67	0.00	17.73	0.40	17.33
33	-	34	0	500	500	120	181.093	0.922	1.88	0.94	0.00	44.63	13.00	31.63
35	-	34	0	500	1700	120	115.870	0.590	0.82	1.40	0.00	44.63	13.00	31.63
34	-	40	0	1000	2800	120	79.946	0.102	0.01	0.04	0.00	44.59	19.00	25.59
100	-	111	0	543	1234	120	205.000	0.885	1.58	1.95	0.00	50.05	10.00	40.05
19	-	20	0	690	600	120	665.657	1.780	4.36	2.62	0.00	32.77	3.00	29.77
22	-	24	0	560	1400	120	320.046	1.299	3.11	4.35	0.00	20.36	1.00	19.36
15	-	38	0	350	900	100	100.000	1.039	4.99	4.49	0.00	31.95	3.00	28.95
11	-	10	0	400	900	120	122.205	0.972	2.70	2.43	0.00	43.75	8.00	35.75
18	-	19	0	630	2200	120	184.705	0.593	0.63	1.39	0.00	35.39	3.00	32.39
18	-	26	0	830	1500	120	880.695	1.628	2.98	4.46	0.00	32.32	2.00	30.32
11	-	42	0	400	1600	120	178.000	1.416	5.40	8.65	0.00	37.53	11.00	26.53
12	-	41	0	600	2000	120	214.054	0.757	1.06	2.11	0.00	44.85	15.00	29.85
41	-	40	0	600	2000	120	69.054	0.244	0.13	0.26	0.00	44.59	19.00	25.59

LEGEND

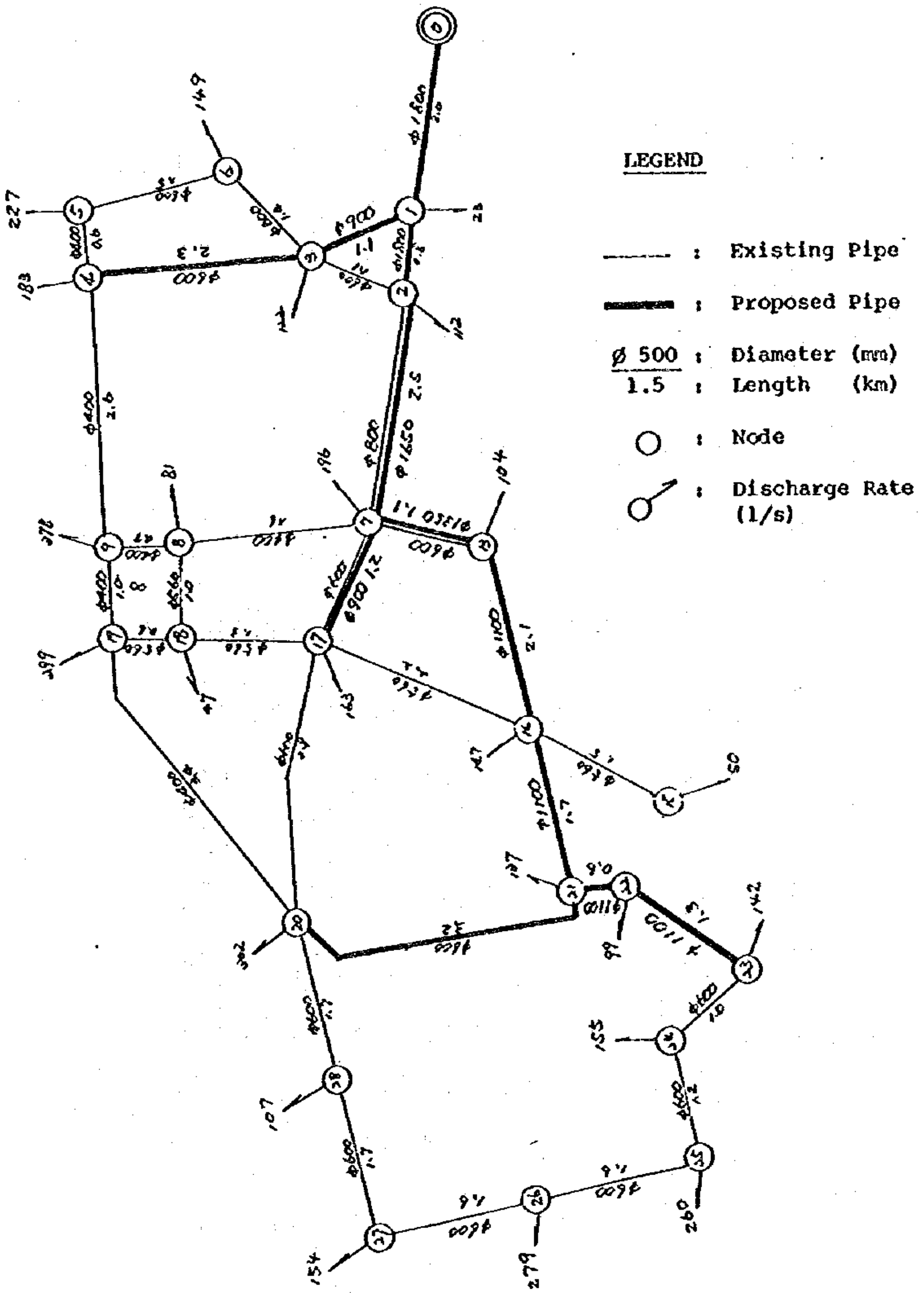
———	:	Existing Pipe
▬▬▬	:	Proposed Pipe
ø 500	:	Diameter (mm)
1.5	:	Length (km)
○	:	Node
○⁄	:	Discharge Rate (l/s)



NETWORK DIAGRAM OF SUPPLY ZONE 2 (1990)

ZONE-2
1990

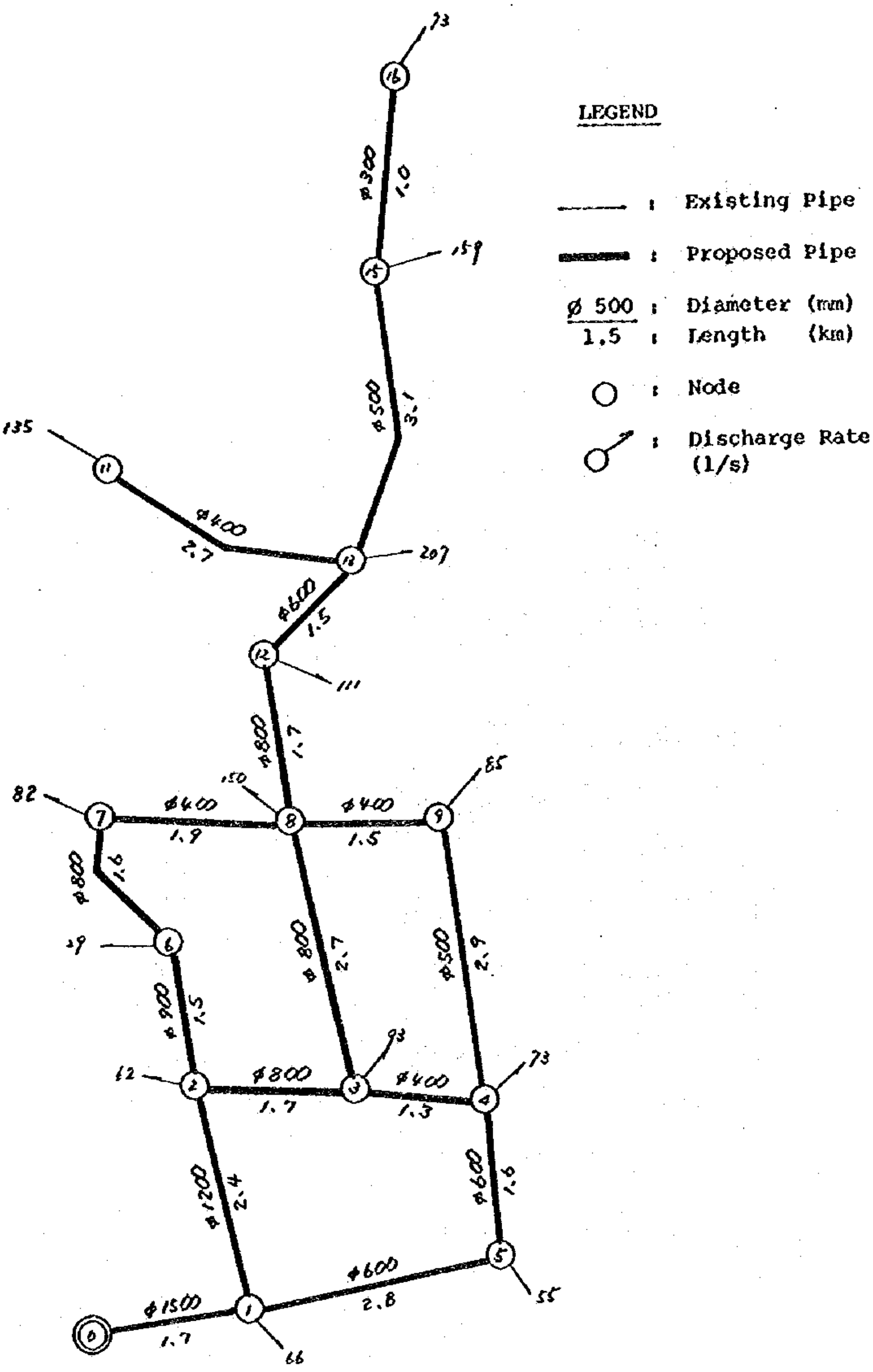
Node	- Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
200 -	1	0	1500	700	120	4058.293	2.297	2.81	1.97	0.00	50.03	7.00	43.03
200 -	3	0	800	1200	120	1105.707	2.200	5.42	6.51	0.00	45.49	4.00	41.49
1 -	2	0	1350	1100	120	2103.742	1.470	1.39	1.53	0.00	48.50	4.00	44.50
1 -	7	0	1000	800	120	1755.551	2.235	4.30	3.44	0.00	46.59	9.00	37.59
2 -	3	0	500	800	120	263.020	1.340	3.75	3.00	0.00	45.49	4.00	41.49
2 -	8	0	1000	1100	120	1669.722	2.126	3.92	4.31	0.00	44.18	3.00	41.18
3 -	4	0	880	2500	120	1095.727	1.802	3.35	8.38	0.00	37.11	4.00	33.11
5 -	4	0	800	2300	120	102.697	0.204	0.07	0.15	0.00	37.11	4.00	33.11
4 -	11	0	800	1500	120	363.501	0.723	0.69	1.04	0.00	36.07	3.00	33.07
4 -	16	0	500	1600	120	288.922	1.471	4.47	7.15	0.00	29.97	4.00	25.97
6 -	5	0	1000	1600	120	1214.559	1.546	2.18	3.48	0.00	37.27	13.00	24.27
5 -	17	0	800	1500	120	822.862	1.637	3.14	4.71	0.00	32.56	14.00	18.56
7 -	6	0	1000	1700	120	1554.559	1.979	3.44	5.84	0.00	40.75	15.00	25.75
7 -	18	0	600	2300	120	139.993	0.495	0.48	1.11	0.00	45.48	11.00	34.48
8 -	9	0	1000	1900	120	1327.715	1.691	2.57	4.88	0.00	39.31	2.00	37.31
8 -	19	0	600	1000	120	182.007	0.644	0.78	0.78	0.00	43.40	3.00	40.40
9 -	10	0	1000	2000	120	1054.715	1.343	1.68	3.35	0.00	35.96	1.50	34.46
11 -	10	0	800	1600	120	108.501	0.216	0.07	0.12	0.00	35.96	1.50	34.46
10 -	12	0	800	2600	120	731.216	1.455	2.52	6.56	0.00	29.39	2.00	27.39
12 -	13	0	600	1000	120	337.216	1.193	2.45	2.45	0.00	26.95	2.00	24.95
13 -	14	0	600	1300	120	69.216	0.245	0.13	0.17	0.00	26.78	2.00	24.78
15 -	14	0	800	1900	120	365.784	0.728	0.70	1.33	0.00	26.78	2.00	24.78
16 -	15	0	500	1700	120	134.922	0.687	1.09	1.86	0.00	28.11	4.00	24.11
17 -	15	0	800	2400	120	618.862	1.231	1.85	4.45	0.00	28.11	4.00	24.11
18 -	22	0	400	1800	120	107.993	0.859	2.14	3.86	0.00	41.62	10.00	31.62
19 -	22	0	400	1900	120	69.007	0.549	0.94	1.78	0.00	41.62	10.00	31.62
10 -	24	0	600	1800	120	142.000	0.502	0.49	0.89	0.00	35.07	1.00	34.07



NETWORK DIAGRAM OF SUPPLY ZONE 3 (1990)

ZONE-3
1990

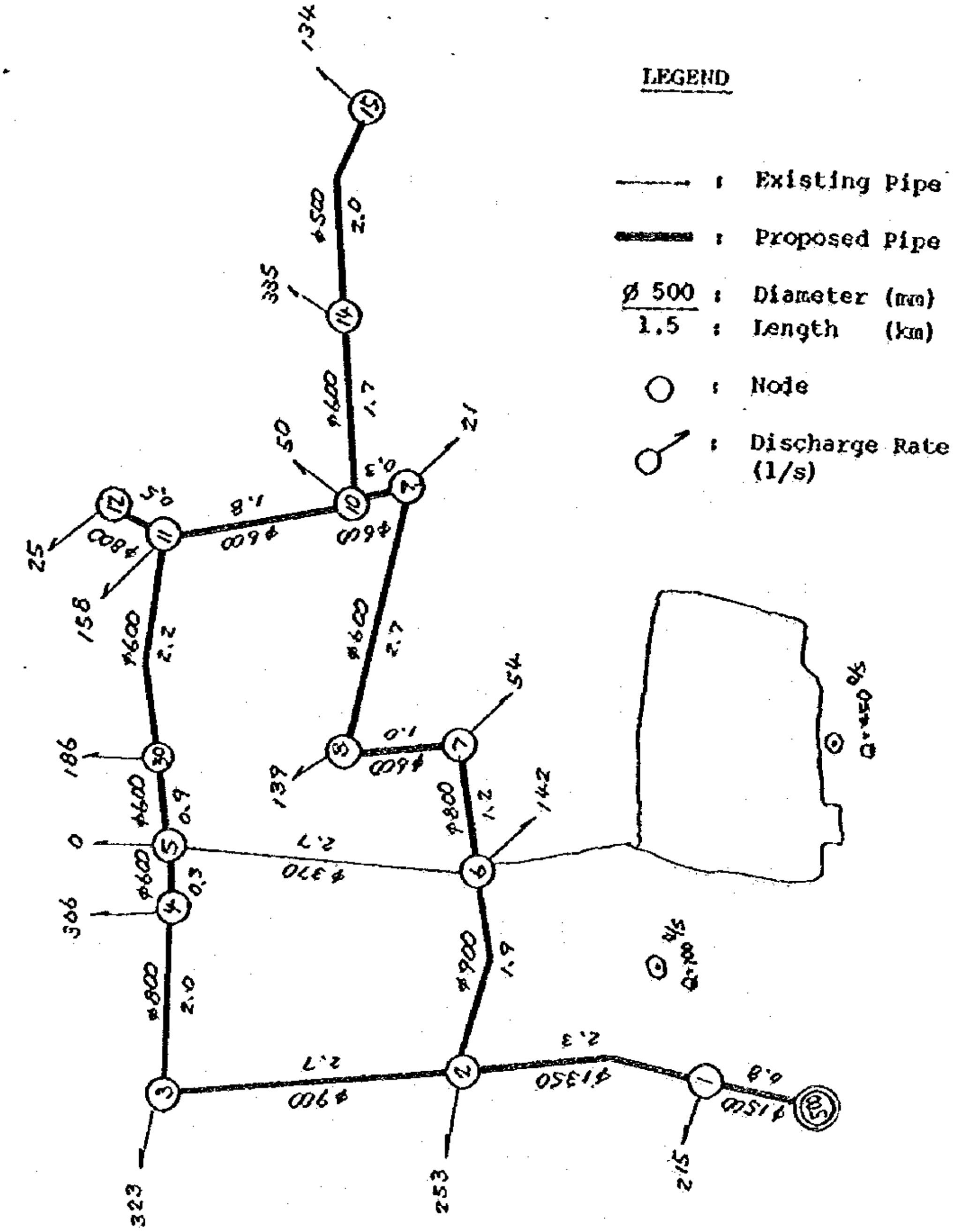
Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
300	-	1	0	1800	2000	120	3916.000	1.539	1.08	2.17	0.00	52.83	3.00	49.83
1	-	2	0	1800	800	120	3232.765	1.270	0.76	0.61	0.00	52.22	3.00	49.22
1	-	3	0	900	1100	120	660.236	1.038	1.18	1.29	0.00	51.54	2.00	49.54
2	-	7	0	800	2500	120	383.179	0.762	0.76	1.91	0.00	50.31	3.00	47.31
2	-	3	0	600	1100	120	161.132	0.570	0.62	0.69	0.00	51.54	2.00	49.54
3	-	4	0	600	2300	120	334.618	1.183	2.41	5.55	0.00	45.99	1.00	44.99
3	-	6	0	600	1400	120	364.750	1.290	2.83	3.96	0.00	47.58	1.00	46.58
4	-	5	0	400	600	120	11.250	0.090	0.03	0.02	0.00	45.97	1.00	44.97
4	-	9	0	400	2600	120	140.367	1.117	3.48	9.06	0.00	36.93	1.00	35.93
6	-	5	0	600	1500	120	215.750	0.763	1.07	1.61	0.00	45.97	1.00	44.97
7	-	8	0	400	1600	120	194.021	1.544	6.34	10.14	0.00	40.17	1.00	39.17
7	-	13	0	600	1100	120	148.965	0.527	0.54	0.59	0.00	49.72	3.00	46.72
7	-	17	0	600	1200	120	297.157	1.051	1.94	2.32	0.00	47.99	2.00	45.99
8	-	9	0	400	700	120	163.646	1.302	4.63	3.24	0.00	36.93	1.00	35.93
18	-	8	0	560	1000	120	50.625	0.206	0.10	0.10	0.00	40.17	1.00	39.17
19	-	9	0	400	1000	120	73.987	0.589	1.07	1.07	0.00	36.93	1.00	35.93
16	-	15	0	560	1500	120	50.000	0.203	0.10	0.15	0.00	46.29	3.00	43.29
17	-	16	0	560	2200	120	143.417	0.582	0.70	1.55	0.00	46.44	3.00	43.44
17	-	18	0	560	1300	120	454.032	1.843	5.94	7.72	0.00	40.28	1.00	39.28
17	-	20	0	600	2900	120	400.748	1.417	3.37	9.76	0.00	38.23	1.00	37.23
18	-	19	0	560	600	120	356.407	1.447	3.79	2.28	0.00	38.00	1.00	37.00
20	-	19	0	400	3400	120	16.580	0.132	0.07	0.23	0.00	38.00	1.00	37.00
21	-	20	0	600	3200	120	285.657	1.010	1.80	5.76	0.00	38.23	1.00	37.23
20	-	28	0	600	1700	120	367.825	1.301	2.87	4.88	0.00	33.34	1.00	32.34
21	-	22	0	1100	600	120	828.175	0.871	0.67	0.40	0.00	43.58	3.00	40.58
22	-	23	0	1100	1300	120	729.175	0.767	0.53	0.69	0.00	42.89	3.00	39.89
23	-	24	0	600	1000	120	587.175	2.077	6.83	6.83	0.00	36.07	3.00	33.07
24	-	25	0	600	1200	120	432.175	1.529	3.87	4.65	0.00	31.42	3.00	28.42
28	-	27	0	600	1700	120	260.825	0.922	1.52	2.59	0.00	30.76	1.00	29.76
25	-	26	0	600	1600	120	172.175	0.609	0.71	1.13	0.00	30.29	2.00	28.29
27	-	26	0	600	1600	120	106.825	0.378	0.29	0.47	0.00	30.29	2.00	28.29
2	-	7	0	1650	2500	120	2576.454	1.205	0.76	1.91	0.00	50.31	3.00	47.31
7	-	13	0	1350	1100	120	1259.450	0.880	0.54	0.59	0.00	49.72	3.00	46.72
7	-	17	0	900	1200	120	864.040	1.358	1.94	2.32	0.00	47.99	2.00	45.99
13	-	16	0	1100	2100	120	1304.415	1.373	1.56	3.28	0.00	46.44	3.00	43.44
16	-	21	0	1100	1700	120	1250.832	1.316	1.44	2.46	0.00	43.99	3.00	40.99



NETWORK DIAGRAM OF SUPPLY ZONE 4 (1990)

ZONE-4
1990

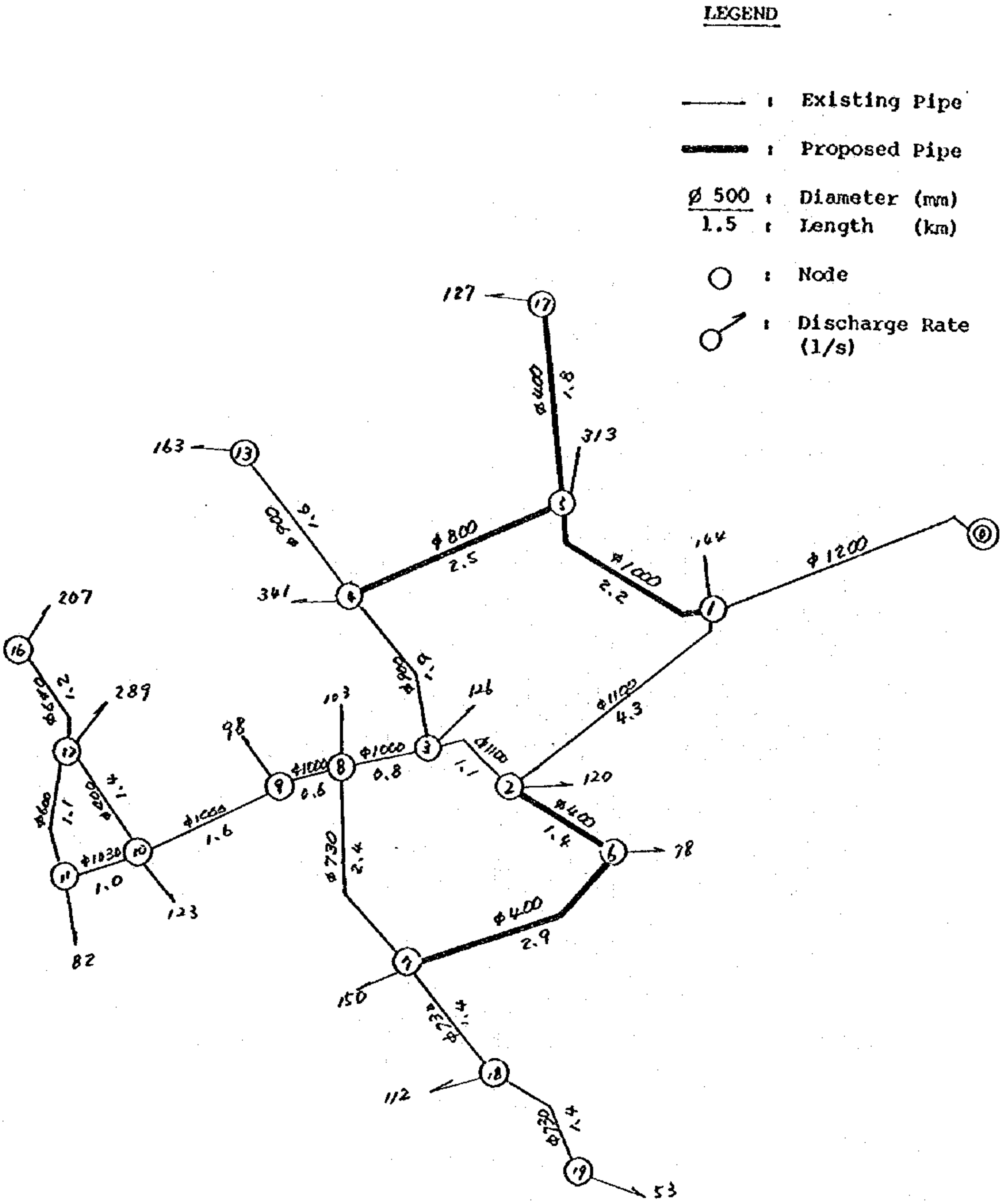
Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
400	-	1	0	1500	1700	120	1380.000	0.781	0.38	0.65	0.00	55.35	7.00	48.35
1	-	5	0	600	2800	120	261.990	0.927	1.53	4.29	0.00	51.06	7.00	44.06
1	-	2	0	1200	2400	120	1052.010	0.930	0.69	1.65	0.00	53.70	6.00	47.70
2	-	3	0	800	1700	120	720.730	1.434	2.46	4.18	0.00	49.53	6.00	43.53
2	-	6	0	900	1500	120	269.280	0.423	0.22	0.34	0.00	53.37	5.00	48.37
3	-	4	0	400	1300	120	13.234	0.105	0.04	0.06	0.00	49.47	6.00	43.47
3	-	8	0	800	2700	120	614.496	1.223	1.83	4.94	0.00	44.59	5.00	39.59
4	-	9	0	500	2900	120	147.224	0.750	1.28	3.72	0.00	45.75	5.00	40.75
5	-	4	0	600	1600	120	206.990	0.732	0.99	1.59	0.00	49.47	6.00	43.47
6	-	7	0	800	1600	120	240.280	0.478	0.32	0.52	0.00	52.85	5.00	47.85
7	-	8	0	400	1900	120	158.280	1.260	4.35	8.26	0.00	44.59	5.00	39.59
9	-	8	0	400	1500	120	62.224	0.495	0.77	1.16	0.00	44.59	5.00	39.59
8	-	12	0	800	1700	120	685.000	1.363	2.24	3.80	0.00	40.79	4.00	36.79
13	-	11	0	400	2700	120	135.000	1.074	3.24	8.75	0.00	22.22	1.00	21.22
12	-	13	0	600	1500	120	574.000	2.030	6.54	9.82	0.00	30.97	4.00	26.97
13	-	15	0	500	3100	120	232.000	1.182	2.98	9.23	0.00	21.74	1.00	20.74
15	-	16	0	300	1000	120	73.000	1.033	4.22	4.22	0.00	17.52	0.50	17.02



NETWORK DIAGRAM OF SUPPLY ZONE 5 (1990)

ZONE-5
1990

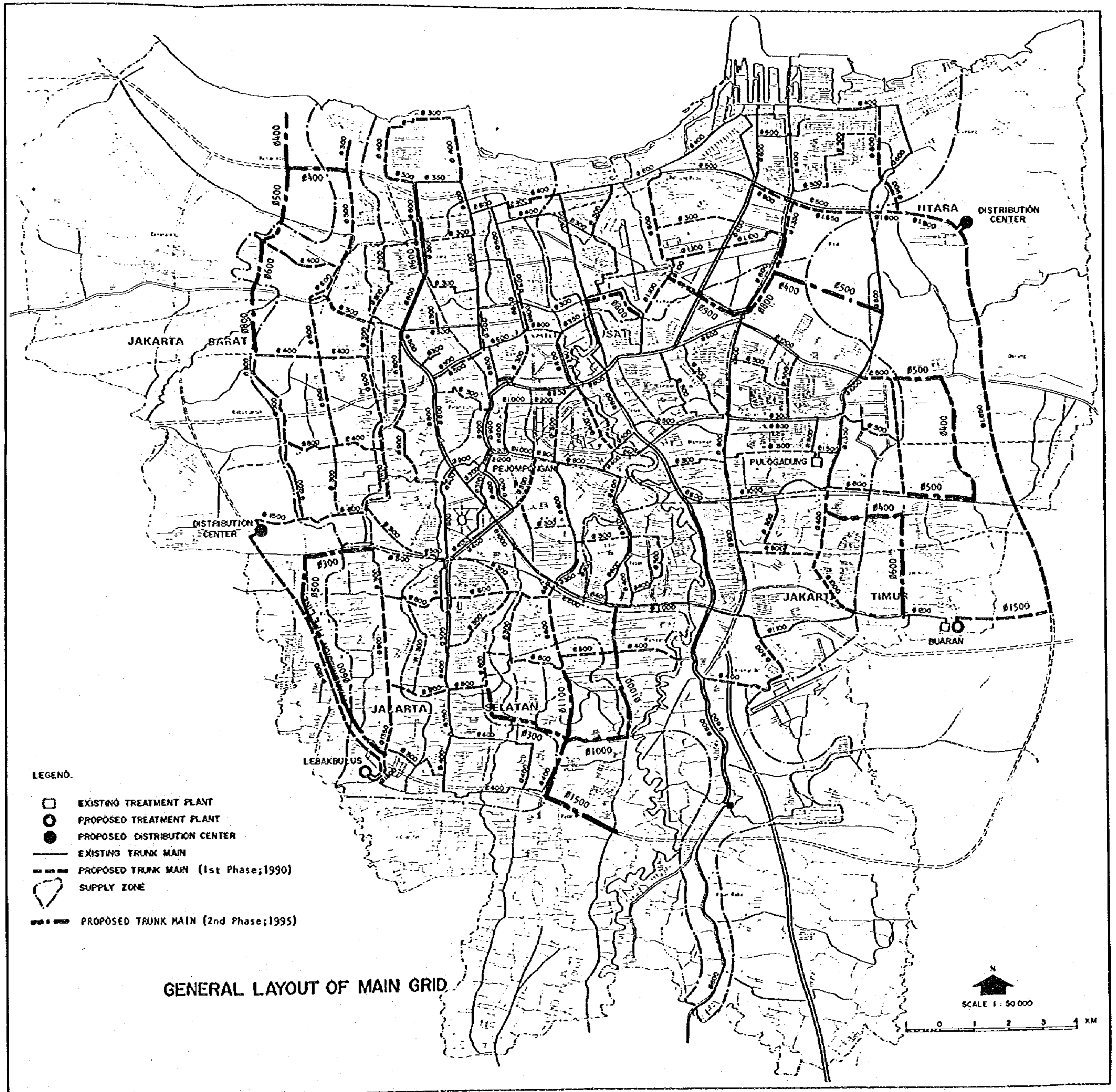
Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
500	-	1	0	1500	800	120	2341.000	1.325	1.02	0.81	0.00	74.19	32.00	42.19
1	-	2	0	1350	2300	120	2126.000	1.485	1.42	3.27	0.00	70.92	30.00	40.92
2	-	3	0	900	2700	120	1014.693	1.595	2.61	7.04	0.00	63.88	23.00	40.88
2	-	6	0	900	1900	120	858.307	1.349	1.91	3.63	0.00	67.28	32.00	35.28
3	-	4	0	800	2000	120	691.693	1.376	2.28	4.55	0.00	59.33	17.00	42.33
4	-	5	0	600	300	120	385.693	1.364	3.14	0.94	0.00	58.38	17.00	41.38
6	-	5	0	370	2700	120	110.963	1.032	3.30	8.90	0.00	58.38	17.00	41.38
5	-	30	0	600	900	120	496.656	1.757	5.01	4.51	0.00	53.88	17.00	36.88
6	-	7	0	800	1200	120	605.344	1.204	1.78	2.13	0.00	65.15	24.00	41.15
7	-	8	0	600	1000	120	551.344	1.950	6.08	6.08	0.00	59.07	20.00	39.07
8	-	9	0	600	2700	120	412.344	1.458	3.55	9.58	0.00	49.49	24.00	25.49
9	-	10	0	600	300	120	391.344	1.384	3.22	0.97	0.00	48.52	24.00	24.52
11	-	10	0	600	1800	120	127.656	0.451	0.41	0.73	0.00	48.52	24.00	24.52
10	-	14	0	600	1700	120	469.000	1.659	4.50	7.66	0.00	40.87	24.00	16.87
11	-	12	0	800	500	120	25.000	0.050	0.00	0.00	0.00	49.25	12.00	37.25
14	-	15	0	500	2000	120	134.000	0.682	1.08	2.16	0.00	38.71	24.00	14.71
30	-	11	0	600	2200	120	310.656	1.099	2.10	4.62	0.00	49.25	12.00	37.25

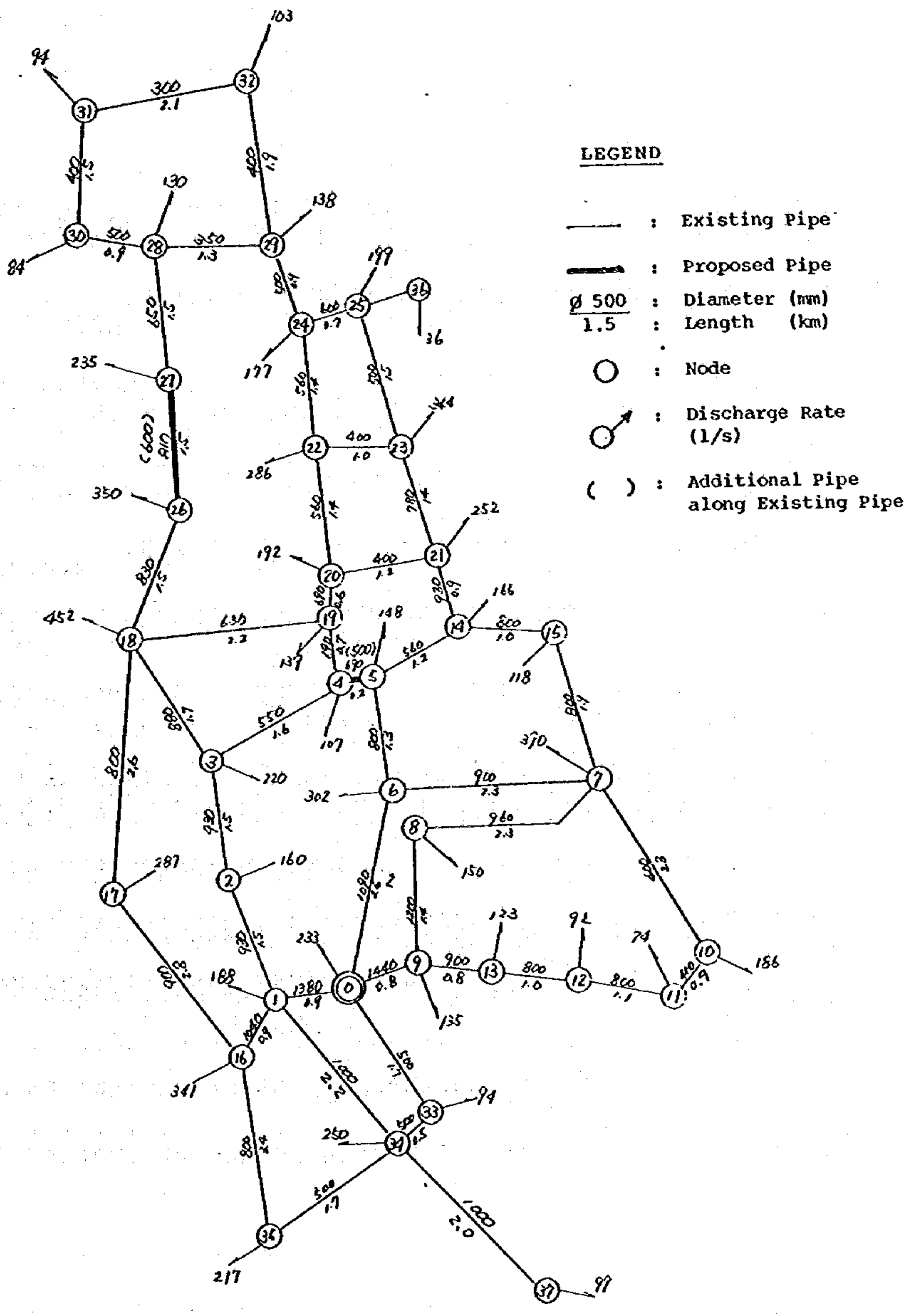


NETWORK DIAGRAM OF SUPPLY ZONE 6 (1990)

ZONE-6
1990

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
600	-	1	0	1200	3000	120	2629.000	2.325	3.74	11.21	0.00	48.79	20.00	28.79
1	-	5	0	1000	2200	120	1085.606	1.382	1.77	3.89	0.00	44.90	12.00	32.90
1	-	2	0	1100	4300	120	1399.394	1.473	1.78	7.65	0.00	41.14	20.00	21.14
2	-	3	0	1100	1100	120	1160.962	1.222	1.26	1.38	0.00	39.76	19.00	20.76
2	-	6	0	400	1400	120	118.431	0.942	2.54	3.56	0.00	37.58	20.00	17.58
4	-	3	0	900	1900	120	141.606	0.223	0.07	0.13	0.00	39.76	19.00	20.76
3	-	8	0	1000	800	120	1176.569	1.498	2.05	1.64	0.00	38.12	22.00	16.12
5	-	4	0	800	2500	120	645.606	1.284	2.00	5.01	0.00	39.89	12.00	27.89
6	-	7	0	400	2900	120	40.431	0.322	0.35	1.01	0.00	36.57	22.00	14.57
8	-	7	0	730	2400	120	274.569	0.656	0.64	1.54	0.00	36.57	22.00	14.57
7	-	18	0	730	1400	120	165.000	0.394	0.25	0.35	0.00	36.22	24.00	12.22
18	-	19	0	730	1400	120	53.000	0.127	0.03	0.04	0.00	36.18	26.00	10.18
8	-	9	0	1000	600	120	799.000	1.017	1.00	0.60	0.00	37.52	20.00	17.52
9	-	10	0	1000	1600	120	701.000	0.893	0.79	1.26	0.00	36.26	19.00	17.26
10	-	11	0	1030	1000	120	458.633	0.550	0.31	0.31	0.00	35.95	19.00	16.95
10	-	12	0	400	1400	120	119.367	0.950	2.58	3.61	0.00	32.64	15.00	17.64
11	-	12	0	600	1100	120	376.633	1.332	3.00	3.30	0.00	32.64	15.00	17.64
12	-	16	0	640	1200	120	207.000	0.643	0.72	0.87	0.00	31.77	15.00	16.77
4	-	13	0	900	1600	120	163.000	0.256	0.09	0.14	0.00	39.75	10.00	29.75
5	-	17	0	400	1800	120	127.000	1.011	2.89	5.21	0.00	39.69	10.00	29.69

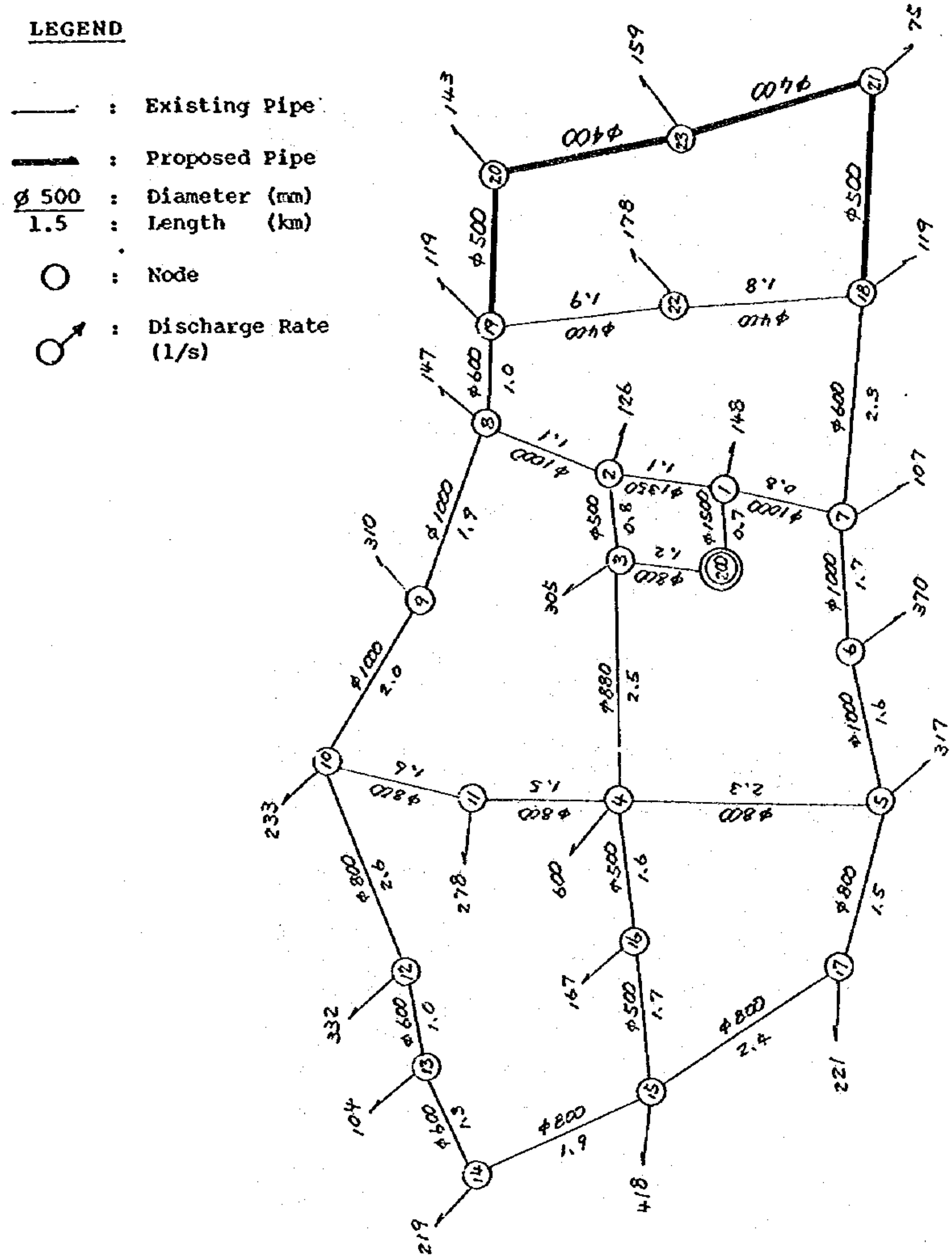

JAKARTA BARAT
UTARA
DISTRIBUTION CENTER
PUSAT
PEJOMPONGAN
PULOGADUNG
JAKARTA TIMUR
BUARAN
JAKARTA SELATAN
LEBAKBULUS
LEGEND.
EXISTING TREATMENT PLANT
PROPOSED TREATMENT PLANT
PROPOSED DISTRIBUTION CENTER
EXISTING TRUNK MAIN
PROPOSED TRUNK MAIN (1st Phase;1990)
SUPPLY ZONE
PROPOSED TRUNK MAIN (2nd Phase;1995)
GENERAL LAYOUT OF MAIN GRID
N
SCALE 1 : 50 000
0 1 2 3 4 KM



NETWORK DIAGRAM OF SUPPLY ZONE 1 (1995)

ZONE-1
1995

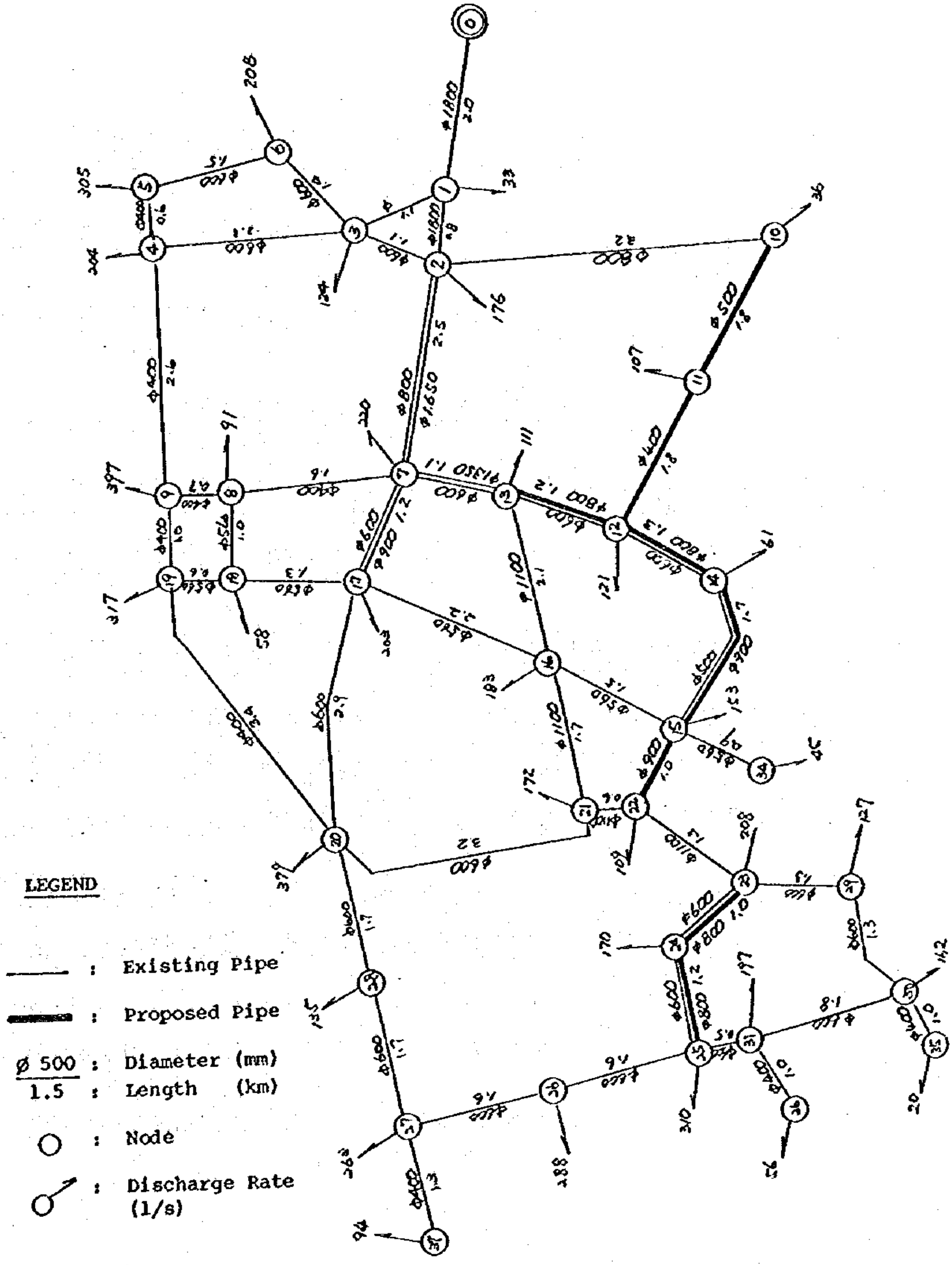
Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
100	-	1	0	1380	900	120	3195.637	2.137	2.71	2.44	0.00	49.56	10.00	39.56
100	-	6	0	1090	2600	120	1687.013	1.808	2.63	6.83	0.00	45.17	6.00	39.17
100	-	9	0	1440	800	120	1874.236	1.151	0.82	0.66	0.00	51.34	8.00	43.34
100	-	33	0	500	1700	120	301.114	1.534	4.82	8.20	0.00	43.80	13.00	30.80
1	-	2	0	930	1500	120	1384.790	2.039	3.95	5.92	0.00	43.63	8.00	35.63
1	-	16	0	1040	900	120	1619.381	1.906	3.06	2.75	0.00	46.80	11.00	35.80
1	-	34	0	100	2200	120	3.466	0.441	3.16	6.96	0.00	42.60	13.00	29.60
2	-	3	0	930	1500	120	1224.790	1.803	3.15	4.72	0.00	38.91	6.00	32.91
3	-	4	0	550	1600	120	188.983	0.795	1.28	2.05	0.00	36.86	4.00	32.86
3	-	18	0	880	1700	120	815.807	1.341	1.94	3.30	0.00	35.61	4.00	31.61
5	-	4	0	690	200	120	647.089	1.731	4.14	0.83	0.00	36.86	4.00	32.86
4	-	19	0	690	700	120	729.073	1.950	5.16	3.61	0.00	33.25	3.00	30.25
6	-	5	0	800	1300	120	1141.760	2.271	5.75	7.48	0.00	37.69	4.00	33.69
5	-	14	0	560	1200	120	346.671	1.408	3.60	4.32	0.00	33.37	4.00	29.37
6	-	7	0	900	2300	120	243.253	0.382	0.19	0.43	0.00	44.74	6.00	38.74
8	-	7	0	960	2300	120	1118.232	1.545	2.28	5.24	0.00	44.74	6.00	38.74
7	-	10	0	400	2300	120	3.996	0.032	0.00	0.01	0.00	44.73	8.00	36.73
7	-	15	0	800	1900	120	967.489	1.925	4.24	8.05	0.00	36.70	4.00	32.70
9	-	8	0	1200	1400	120	1268.232	1.121	0.97	1.36	0.00	49.98	6.00	43.98
9	-	13	0	900	800	120	471.004	0.740	0.63	0.50	0.00	50.84	8.00	42.84
12	-	11	0	800	1100	120	256.004	0.509	0.36	0.40	0.00	49.80	8.00	41.80
13	-	12	0	800	1000	120	348.004	0.692	0.64	0.64	0.00	50.20	8.00	42.20
15	-	14	0	800	1000	120	849.490	1.690	3.33	3.33	0.00	33.37	4.00	29.37
14	-	21	0	930	900	120	1030.160	1.517	2.28	2.06	0.00	31.31	3.00	28.31
16	-	17	0	900	2800	120	922.960	1.451	2.19	6.12	0.00	40.68	8.00	32.68
16	-	35	0	800	3400	120	355.421	0.707	0.66	2.26	0.00	44.54	15.00	29.54
17	-	18	0	800	2600	120	635.960	1.265	1.95	5.07	0.00	35.61	4.00	31.61
21	-	20	0	400	1200	120	23.211	0.185	0.12	0.15	0.00	31.16	3.00	28.16
20	-	22	0	560	1400	120	421.283	1.710	5.17	7.23	0.00	23.93	2.00	21.93
21	-	23	0	780	1400	120	754.949	1.580	3.03	4.24	0.00	27.07	2.00	25.07
23	-	22	0	400	1000	120	132.843	1.057	3.15	3.15	0.00	23.93	2.00	21.93
23	-	25	0	500	1500	120	278.107	1.416	4.16	6.24	0.00	20.83	1.00	19.83
25	-	24	0	600	700	120	43.107	0.152	0.05	0.04	0.00	20.79	1.00	19.79
24	-	29	0	500	900	120	134.233	0.684	1.08	0.97	0.00	19.82	0.40	19.42
25	-	36	0	400	2400	120	36.000	0.286	0.28	0.67	0.00	20.15	1.00	19.15
26	-	27	0	810	1500	120	649.767	1.261	1.91	2.86	0.00	27.10	1.00	26.10
27	-	28	0	650	1500	120	414.767	1.250	2.43	3.64	0.00	23.46	0.40	23.06
28	-	29	0	350	1300	120	87.812	0.913	2.80	3.64	0.00	19.82	0.40	19.42
28	-	30	0	500	900	120	196.955	1.003	2.20	1.98	0.00	21.48	0.40	21.08
29	-	32	0	400	1900	120	84.045	0.669	1.35	2.56	0.00	17.25	0.40	16.85
30	-	31	0	400	1500	120	112.955	0.899	2.33	3.50	0.00	17.98	0.40	17.58
31	-	32	0	300	2100	120	18.955	0.268	0.35	0.73	0.00	17.25	0.40	16.85
33	-	34	0	500	500	120	207.114	1.055	2.41	1.21	0.00	42.60	13.00	29.60
35	-	34	0	500	1700	120	138.421	0.705	1.14	1.95	0.00	42.60	13.00	29.60
34	-	37	0	1000	2000	120	99.000	0.126	0.02	0.04	0.00	42.55	18.00	24.55
100	-	111	0	543	1234	120	233.000	1.006	2.01	2.48	0.00	49.52	10.00	39.52
19	-	20	0	690	600	120	590.073	1.578	3.49	2.09	0.00	31.16	3.00	28.16
22	-	24	0	560	1400	120	268.126	1.089	2.24	3.14	0.00	20.79	1.00	19.79
11	-	10	0	400	900	120	182.004	1.448	5.63	5.07	0.00	44.73	8.00	36.73
18	-	26	0	830	1500	120	999.768	1.848	3.76	5.64	0.00	29.97	2.00	27.97



NETWORK DIAGRAM OF SUPPLY ZONE 2 (1995)

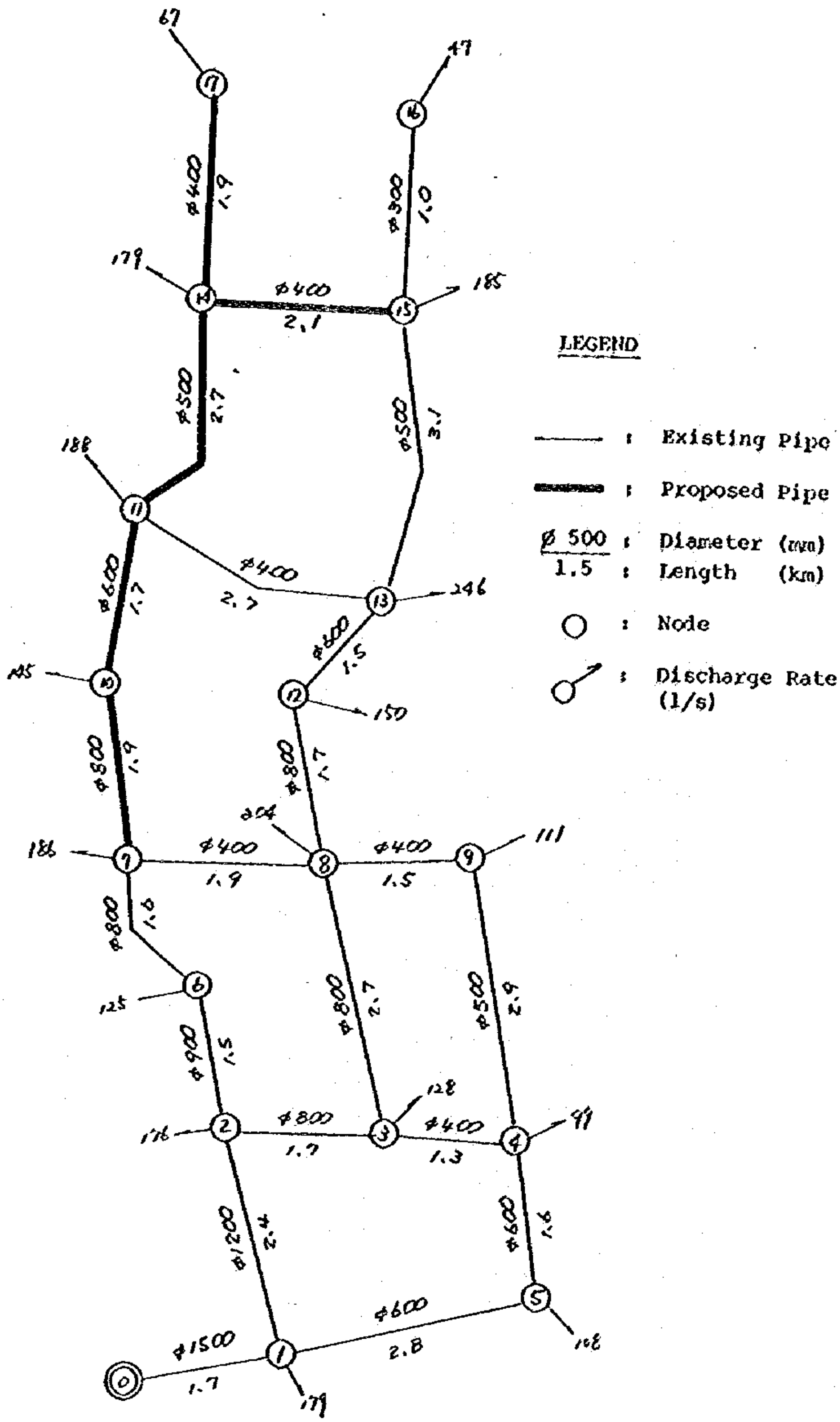
ZONE-2
1995

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
200	-	1	0	1500	700	120	4118.802	2.331	2.89	2.02	0.00	49.98	7.00	42.98
200	-	3	0	800	1200	120	1076.198	2.141	5.16	6.19	0.00	45.81	4.00	41.81
1	-	2	0	1350	1100	120	2088.535	1.459	1.38	1.51	0.00	48.46	4.00	44.46
1	-	7	0	1000	800	120	1882.267	2.397	4.89	3.92	0.00	46.06	9.00	37.06
2	-	3	0	500	800	120	245.887	1.252	3.31	2.65	0.00	45.81	4.00	41.81
2	-	8	0	1000	1100	120	1716.648	2.186	4.13	4.54	0.00	43.92	3.00	40.92
3	-	4	0	880	2500	120	1017.085	1.672	2.92	7.30	0.00	38.51	4.00	34.51
5	-	4	0	800	2300	120	52.946	0.105	0.02	0.05	0.00	38.51	4.00	34.51
4	-	11	0	800	1500	120	230.103	0.458	0.30	0.45	0.00	38.06	3.00	35.06
4	-	16	0	500	1600	120	239.928	1.222	3.17	5.07	0.00	33.44	4.00	29.44
6	-	5	0	1000	1600	120	1041.589	1.326	1.64	2.62	0.00	38.55	13.00	25.55
5	-	17	0	800	1500	120	671.643	1.336	2.16	3.23	0.00	35.32	14.00	21.32
7	-	6	0	1000	1700	120	1411.589	1.797	2.87	4.89	0.00	41.17	15.00	26.17
7	-	18	0	600	2300	120	363.678	1.286	2.81	6.47	0.00	39.59	11.00	28.59
8	-	9	0	1000	1900	120	1140.327	1.452	1.94	3.68	0.00	40.24	2.00	38.24
8	-	19	0	600	1000	120	429.322	1.518	3.82	3.82	0.00	40.10	3.00	37.10
9	-	10	0	1000	2000	120	830.326	1.057	1.08	2.15	0.00	38.09	1.50	36.59
10	-	11	0	800	1600	120	47.897	0.095	0.02	0.03	0.00	38.06	3.00	35.06
10	-	12	0	800	2600	120	549.430	1.093	1.49	3.87	0.00	34.22	2.00	32.22
12	-	13	0	600	1000	120	217.430	0.769	1.09	1.09	0.00	33.14	2.00	31.14
13	-	14	0	600	1300	120	113.430	0.401	0.33	0.42	0.00	32.71	2.00	30.71
15	-	14	0	800	1900	120	105.570	0.210	0.07	0.13	0.00	32.71	2.00	30.71
16	-	15	0	500	1700	120	72.928	0.371	0.35	0.59	0.00	32.85	4.00	28.85
17	-	15	0	800	2400	120	450.643	0.897	1.03	2.47	0.00	32.85	4.00	28.85
18	-	21	0	500	2100	120	158.788	0.809	1.48	3.10	0.00	36.49	10.00	26.49
18	-	22	0	400	1800	120	85.890	0.683	1.40	2.53	0.00	37.06	10.00	27.06
19	-	20	0	500	1600	120	218.212	1.111	2.66	4.25	0.00	35.85	3.00	32.85
19	-	22	0	400	1900	120	92.110	0.733	1.60	3.04	0.00	37.06	10.00	27.06
20	-	23	0	400	2100	120	75.212	0.599	1.10	2.31	0.00	33.54	10.00	23.54
21	-	23	0	400	2200	120	83.788	0.667	1.34	2.95	0.00	33.54	10.00	23.54



NETWORK DIAGRAM OF SUPPLY ZONE 3 (1995)

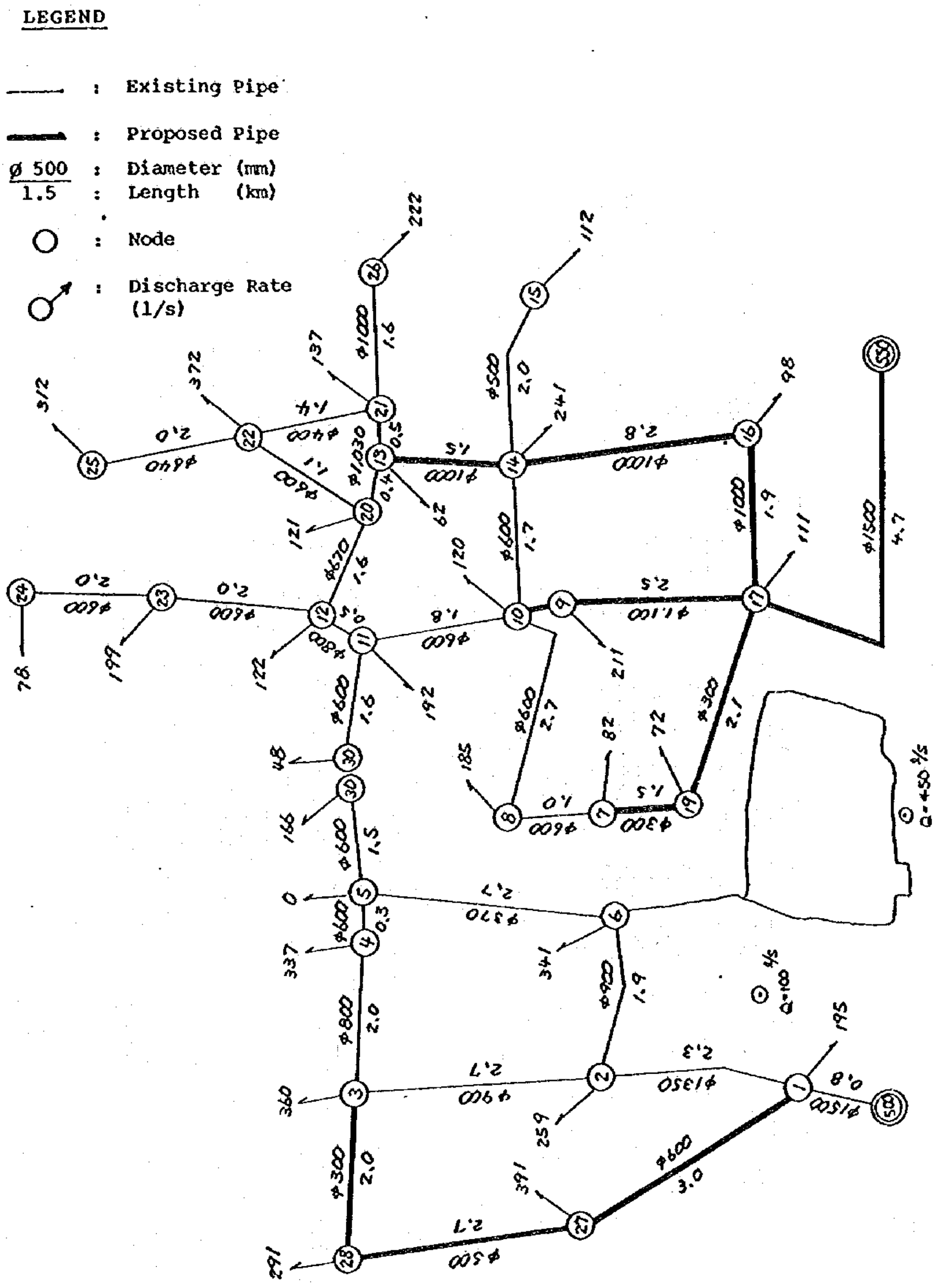
Node	- Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
300	1	0	1800	2000	120	5843.000	2.296	2.27	4.55	0.00	50.45	3.00	47.45
1	2	0	1800	800	120	4969.592	1.953	1.68	1.35	0.00	49.11	3.00	46.11
1	3	0	900	1100	120	840.408	1.321	1.84	2.02	0.00	48.43	2.00	46.43
2	7	0	800	2500	120	569.589	1.133	1.59	3.97	0.00	45.13	3.00	42.13
2	10	0	800	3200	120	234.408	0.466	0.31	0.98	0.00	48.12	3.00	45.12
3	4	0	600	2300	120	411.370	1.455	3.53	8.13	0.00	40.30	1.00	39.30
3	6	0	600	1400	120	464.776	1.644	4.43	6.20	0.00	42.23	1.00	41.23
4	5	0	400	600	120	48.224	0.384	0.48	0.29	0.00	40.01	1.00	39.01
4	9	0	400	2600	120	159.146	1.266	4.39	11.42	0.00	28.88	1.00	27.88
6	5	0	600	1500	120	256.776	0.908	1.48	2.22	0.00	40.01	1.00	39.01
7	8	0	400	1600	120	218.792	1.741	7.92	12.67	0.00	32.47	1.00	31.47
7	13	0	600	1100	120	272.553	0.964	1.65	1.82	0.00	43.32	3.00	40.32
7	17	0	600	1200	120	354.112	1.252	2.68	3.21	0.00	41.92	2.00	39.92
8	9	0	400	700	120	172.922	1.376	5.12	3.59	0.00	28.88	1.00	27.88
18	8	0	560	1000	120	45.130	0.183	0.08	0.08	0.00	32.47	1.00	31.47
19	9	0	400	1000	120	64.932	0.517	0.84	0.84	0.00	28.88	1.00	27.88
10	11	0	500	1800	120	198.408	1.010	2.23	4.01	0.00	44.11	3.00	41.11
11	12	0	400	1800	120	91.408	0.727	1.58	2.84	0.00	41.28	3.00	38.28
13	12	0	600	1200	120	277.114	0.980	1.70	2.04	0.00	41.28	3.00	38.28
12	14	0	600	1300	120	267.668	0.947	1.60	2.07	0.00	39.20	3.00	36.20
13	16	0	1100	2100	120	1597.830	1.681	2.27	4.77	0.00	38.55	3.00	35.55
14	15	0	900	1700	120	777.474	1.222	1.59	2.71	0.00	36.49	3.00	33.49
16	15	0	560	1500	120	205.385	0.834	1.37	2.05	0.00	36.49	3.00	33.49
15	34	0	560	900	120	45.000	0.183	0.08	0.07	0.00	36.42	3.00	33.42
17	16	0	560	2200	120	218.443	0.887	1.53	3.37	0.00	38.55	3.00	35.55
16	21	0	1100	1700	120	1427.889	1.503	1.85	3.14	0.00	35.41	3.00	32.41
17	18	0	560	1300	120	504.288	2.047	7.21	9.37	0.00	32.55	1.00	31.55
17	20	0	600	2900	120	458.026	1.620	4.31	12.50	0.00	29.42	1.00	28.42
18	19	0	560	600	120	401.159	1.629	4.72	2.83	0.00	29.72	1.00	28.72
19	20	0	400	3400	120	19.226	0.153	0.09	0.30	0.00	29.42	1.00	28.42
21	20	0	600	3200	120	291.808	1.032	1.87	5.99	0.00	29.42	1.00	28.42
20	28	0	600	1700	120	390.060	1.380	3.20	5.44	0.00	23.97	1.00	22.97
21	22	0	1100	600	120	964.080	1.014	0.89	0.54	0.00	34.87	3.00	31.87
22	23	0	1100	1300	120	1639.940	1.726	2.38	3.10	0.00	31.77	3.00	28.77
23	24	0	600	1000	120	343.166	1.214	2.53	2.53	0.00	29.25	3.00	26.25
23	29	0	600	1300	120	356.966	1.263	2.72	3.53	0.00	28.24	3.00	25.24
24	25	0	600	1200	120	288.896	1.022	1.84	2.21	0.00	27.04	3.00	24.04
25	26	0	600	1600	120	389.940	1.379	3.20	5.12	0.00	21.92	2.00	19.92
25	31	0	600	500	120	205.034	0.725	0.97	0.49	0.00	26.55	3.00	23.55
26	27	0	600	1600	120	101.940	0.361	0.27	0.43	0.00	21.49	1.00	20.49
28	27	0	600	1700	120	255.060	0.902	1.46	2.48	0.00	21.49	1.00	20.49
27	37	0	400	1300	120	94.000	0.748	1.66	2.16	0.00	19.33	1.00	18.33
29	30	0	600	1300	120	229.966	0.813	1.21	1.57	0.00	26.67	5.00	21.67
30	31	0	600	1800	120	47.966	0.170	0.07	0.12	0.00	26.55	3.00	23.55
30	35	0	400	1000	120	20.000	0.159	0.09	0.09	0.00	26.58	5.00	21.58
31	36	0	400	1000	120	56.000	0.446	0.64	0.64	0.00	25.92	3.00	22.92
15	22	0	900	1000	120	784.859	1.234	1.62	1.62	0.00	34.87	3.00	31.87
2	3	0	600	1100	120	159.738	0.565	0.61	0.68	0.00	48.43	2.00	46.43
2	7	0	1650	2500	120	3829.857	1.791	1.59	3.97	0.00	45.13	3.00	42.13
7	13	0	1350	1100	120	2304.344	1.610	1.65	1.82	0.00	43.32	3.00	40.32
7	17	0	900	1200	120	1029.646	1.619	2.68	3.21	0.00	41.92	2.00	39.92
13	12	0	800	1200	120	590.952	1.176	1.70	2.04	0.00	41.28	3.00	38.28
12	14	0	800	1300	120	570.806	1.136	1.60	2.07	0.00	39.20	3.00	36.20
23	24	0	800	1000	120	731.807	1.456	2.53	2.53	0.00	29.25	3.00	26.25
24	25	0	800	1200	120	616.077	1.226	1.84	2.21	0.00	27.04	3.00	24.04



NETWORK DIAGRAM SUPPLY ZONE 4 (1995)

ZONE-4
1995

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
400	-	1	0	1500	1700	120	2523.000	1.428	1.17	1.99	0.00	54.01	7.00	47.01
1	-	5	0	600	2800	120	368.604	1.304	2.88	8.08	0.00	45.94	7.00	38.94
1	-	2	0	1200	2400	120	1975.396	1.747	2.20	5.29	0.00	48.73	6.00	42.73
2	-	3	0	800	1700	120	811.321	1.614	3.06	5.20	0.00	43.53	6.00	37.53
2	-	6	0	900	1500	120	988.076	1.553	2.48	3.72	0.00	45.01	5.00	40.01
3	-	4	0	400	1300	120	7.860	0.063	0.02	0.02	0.00	43.51	6.00	37.51
3	-	8	0	800	2700	120	675.460	1.344	2.18	5.88	0.00	37.65	5.00	32.65
4	-	9	0	500	2900	120	169.464	0.863	1.66	4.83	0.00	38.68	5.00	33.68
5	-	4	0	600	1600	120	260.604	0.922	1.52	2.43	0.00	43.51	6.00	37.51
6	-	7	0	800	1600	120	863.076	1.717	3.43	5.49	0.00	39.52	5.00	34.52
7	-	10	0	800	1900	120	606.115	1.206	1.78	3.39	0.00	36.13	3.00	33.13
7	-	8	0	400	1900	120	70.961	0.565	0.99	1.87	0.00	37.65	5.00	32.65
9	-	8	0	400	1500	120	58.464	0.465	0.69	1.03	0.00	37.65	5.00	32.65
8	-	12	0	800	1700	120	600.885	1.195	1.75	2.98	0.00	34.66	4.00	30.66
10	-	11	0	600	1700	120	461.115	1.631	4.36	7.42	0.00	28.71	1.00	27.71
11	-	13	0	400	2700	120	22.934	0.183	0.12	0.33	0.00	28.38	4.00	24.38
11	-	14	0	500	2700	120	250.181	1.274	3.42	9.24	0.00	19.47	1.00	18.47
12	-	13	0	600	1500	120	450.885	1.595	4.19	6.28	0.00	28.38	4.00	24.38
13	-	15	0	500	3100	120	227.819	1.160	2.88	8.92	0.00	19.46	1.00	18.46
14	-	15	0	400	2100	120	4.181	0.033	0.01	0.01	0.00	19.46	1.00	18.46
14	-	17	0	400	1900	120	67.000	0.533	0.89	1.68	0.00	17.79	0.50	17.29
15	-	16	0	300	1000	120	47.000	0.665	1.87	1.87	0.00	17.59	0.50	17.09

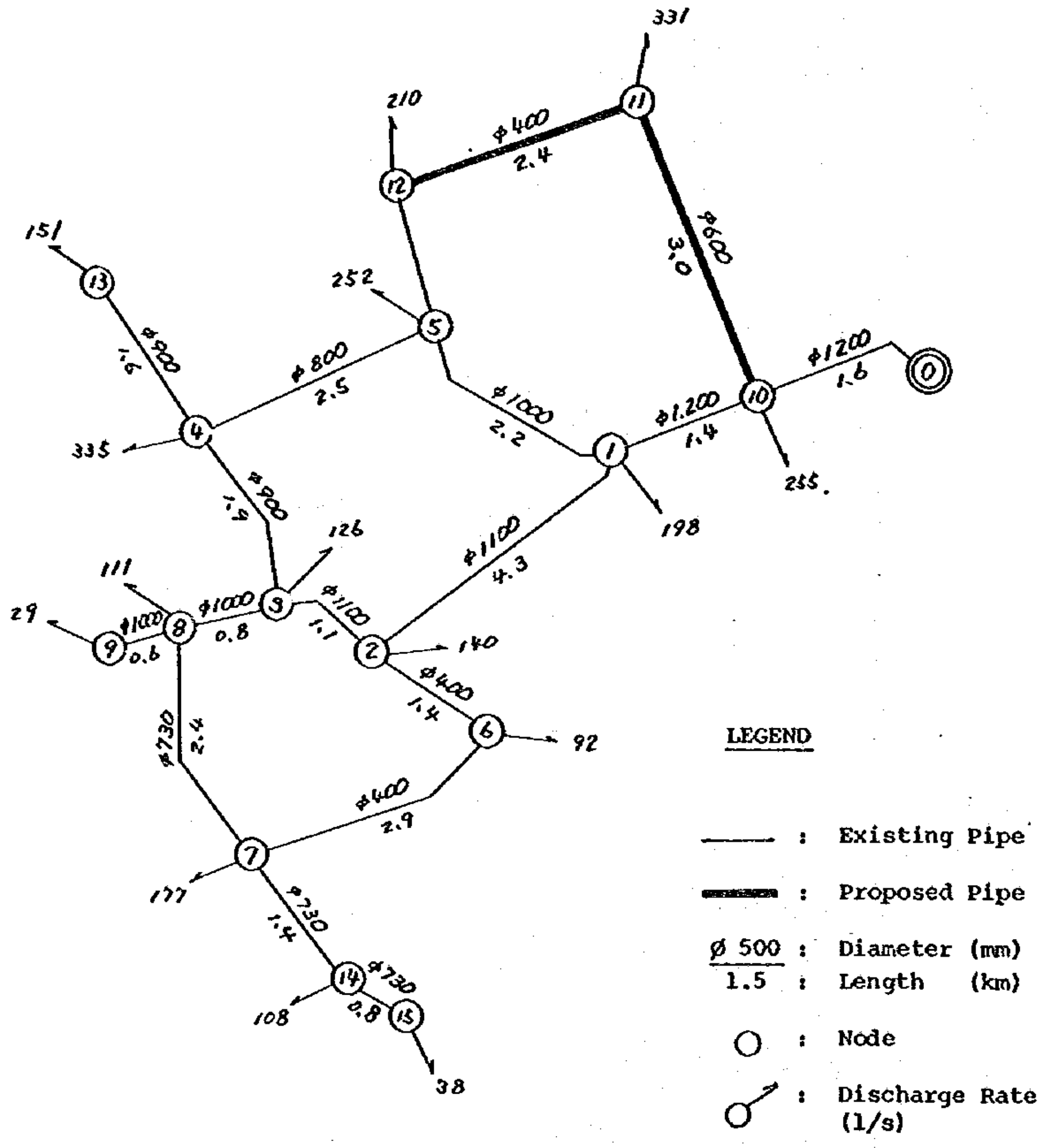


NETWORK DIAGRAM OF SUPPLY ZONE 5 (1995)

ZONE-5L
1995

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
500	-	1	0	1500	800	120	2340.000	1.324	1.02	0.81	0.00	74.19	32.00	42.19
1	-	2	0	1350	2300	120	1571.307	1.098	0.81	1.87	0.00	72.32	30.00	42.32
2	-	3	0	900	2700	120	880.194	1.384	2.00	5.41	0.00	66.91	23.00	43.91
3	-	28	0	300	2000	120	108.307	1.532	8.75	17.50	0.00	49.41	20.00	29.41
1	-	27	0	600	3000	120	573.693	2.029	6.54	19.62	0.00	54.57	24.00	30.57
27	-	28	0	500	2700	120	182.693	0.930	1.91	5.17	0.00	49.41	20.00	29.41
2	-	6	0	900	1900	120	432.113	0.679	0.54	1.02	0.00	71.30	32.00	39.30
3	-	4	0	800	2000	120	411.887	0.819	0.87	1.75	0.00	65.16	17.00	48.16
4	-	5	0	600	300	120	74.887	0.265	0.15	0.05	0.00	65.12	17.00	48.12
6	-	5	0	370	2700	120	91.113	0.847	2.29	6.18	0.00	65.12	17.00	48.12
5	-	30	0	600	1500	120	166.000	0.587	0.66	0.99	0.00	64.13	17.00	47.13

Node	-	Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
550	-	17	0	1500	4700	120	3097.000	1.753	1.71	8.02	0.00	52.98	28.00	24.98
17	-	9	0	1100	2500	120	1537.472	1.618	2.12	5.29	0.00	47.69	24.00	23.69
17	-	16	0	1000	1900	120	1370.644	1.745	2.72	5.17	0.00	47.81	30.00	17.81
9	-	10	0	1100	300	120	1326.472	1.396	1.61	0.48	0.00	47.20	24.00	23.20
10	-	11	0	600	1800	120	532.747	1.884	5.70	10.26	0.00	36.94	12.00	24.94
10	-	14	0	600	1700	120	412.609	1.459	3.55	6.04	0.00	41.16	24.00	17.16
11	-	12	0	800	500	120	292.747	0.582	0.46	0.23	0.00	36.71	12.00	24.71
14	-	13	0	1000	1500	120	1332.253	1.696	2.58	3.87	0.00	37.29	19.00	18.29
14	-	15	0	500	2000	120	112.000	0.570	0.77	1.55	0.00	39.62	24.00	15.62
16	-	14	0	1000	2800	120	1272.644	1.620	2.37	6.64	0.00	41.16	24.00	17.16
20	-	12	0	670	1600	120	106.253	0.301	0.17	0.27	0.00	36.71	12.00	24.71
12	-	23	0	600	2000	120	277.000	0.980	1.70	3.40	0.00	33.31	10.00	23.31
13	-	20	0	1030	400	120	751.413	0.902	0.78	0.31	0.00	36.98	19.00	17.98
13	-	21	0	1030	500	120	518.840	0.623	0.39	0.20	0.00	37.09	19.00	18.09
20	-	22	0	600	1100	120	524.160	1.854	5.53	6.09	0.00	30.89	15.00	15.89
21	-	22	0	400	1400	120	159.840	1.272	4.43	6.20	0.00	30.89	15.00	15.89
21	-	26	0	1000	1600	120	222.000	0.283	0.09	0.15	0.00	36.94	20.00	16.94
22	-	25	0	640	2000	120	312.000	0.970	1.55	3.09	0.00	27.80	11.00	16.80
23	-	24	0	600	2000	120	78.000	0.276	0.16	0.33	0.00	32.98	8.00	24.98
17	-	19	0	300	2100	120	77.884	1.102	4.75	9.98	0.00	42.99	26.00	16.99
19	-	7	0	300	1500	120	5.884	0.083	0.04	0.06	0.00	42.93	24.00	18.93
8	-	7	0	600	1000	120	76.116	0.269	0.16	0.16	0.00	42.93	24.00	18.93
10	-	8	0	600	2700	120	261.116	0.924	1.52	4.12	0.00	43.09	20.00	23.09
11	-	30	0	600	1600	120	48.000	0.170	0.07	0.11	0.00	36.84	17.00	19.84



NETWORK DIAGRAM OF SUPPLY ZONE 6 (1995)

ZONE-6
1995

Node - Node	Type	D(mm)	L(m)	C	Q(l/sec)	V(m/sec)	i(*10-3)	dH(m)	Hb/r(m)	H(m)	GL(m)	He(m)
600 - 10	0	1200	1600	120	2553.000	2.257	3.54	5.66	0.00	54.34	20.00	34.34
1 - 5	0	1000	2200	120	794.711	1.012	0.99	2.18	0.00	49.24	12.00	37.24
1 - 2	0	1100	4300	120	921.601	0.970	0.82	3.53	0.00	47.90	20.00	27.90
2 - 3	0	1100	1100	120	679.783	0.715	0.47	0.51	0.00	47.38	19.00	28.38
2 - 6	0	400	1400	120	101.819	0.810	1.92	2.69	0.00	45.21	20.00	25.21
3 - 8	0	1000	800	120	453.181	0.577	0.35	0.28	0.00	47.10	22.00	25.10
5 - 4	0	800	2500	120	385.399	0.767	0.77	1.93	0.00	47.31	12.00	35.31
6 - 7	0	400	2900	120	9.819	0.078	0.03	0.07	0.00	45.13	22.00	23.13
8 - 7	0	730	2400	120	313.181	0.748	0.82	1.97	0.00	45.13	22.00	23.13
7 - 14	0	730	1400	120	146.000	0.349	0.20	0.28	0.00	44.85	24.00	20.85
14 - 15	0	730	800	120	38.000	0.091	0.02	0.01	0.00	44.84	24.00	20.84
8 - 9	0	1000	600	120	29.000	0.037	0.00	0.00	0.00	47.10	20.00	27.10
10 - 1	0	1200	1400	120	1914.312	1.693	2.08	2.91	0.00	51.43	20.00	31.43
10 - 11	0	600	3000	120	383.688	1.357	3.11	9.32	0.00	45.02	10.00	35.02
11 - 12	0	400	2400	120	52.688	0.419	0.57	1.36	0.00	43.65	12.00	31.65
5 - 12	0	400	1300	120	157.312	1.252	4.30	5.59	0.00	43.65	12.00	31.65
4 - 13	0	900	1600	120	151.000	0.237	0.08	0.12	0.00	47.19	10.00	37.19
600 - 99	0	321	1000	120	46.000	0.568	1.29	1.29	0.00	58.71	0.00	58.71
3 - 4	0	900	1900	120	100.601	0.158	0.04	0.07	0.00	47.31	12.00	35.31