Euroconsult
DHV Consulting Engineers
Agro Vision Holland

Yemen Arab Republic

Rada' water supply and sanitation project

Yemen Arab Republic
Ministry of Municipalities and Housing
Ministry of Electricity and Water
National Water and Sewerage Authority

Kingdom of the Netherlands
Ministry of Foreign Affairs
Directorate General of
Development Cooperation

Rada Water Supply and Sanitation Project

FINAL DESIGN REPORT

VOLUME II - ANNEXES

December 1989

Euroconsult
Arnhem
The Netherlands

DHV Consulting Engineers
Amersfoort
The Netherlands

Agro Vision Holland
Maarssenbroek
The Netherlands

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ANNEX A WATER SUPPLY SYSTEM

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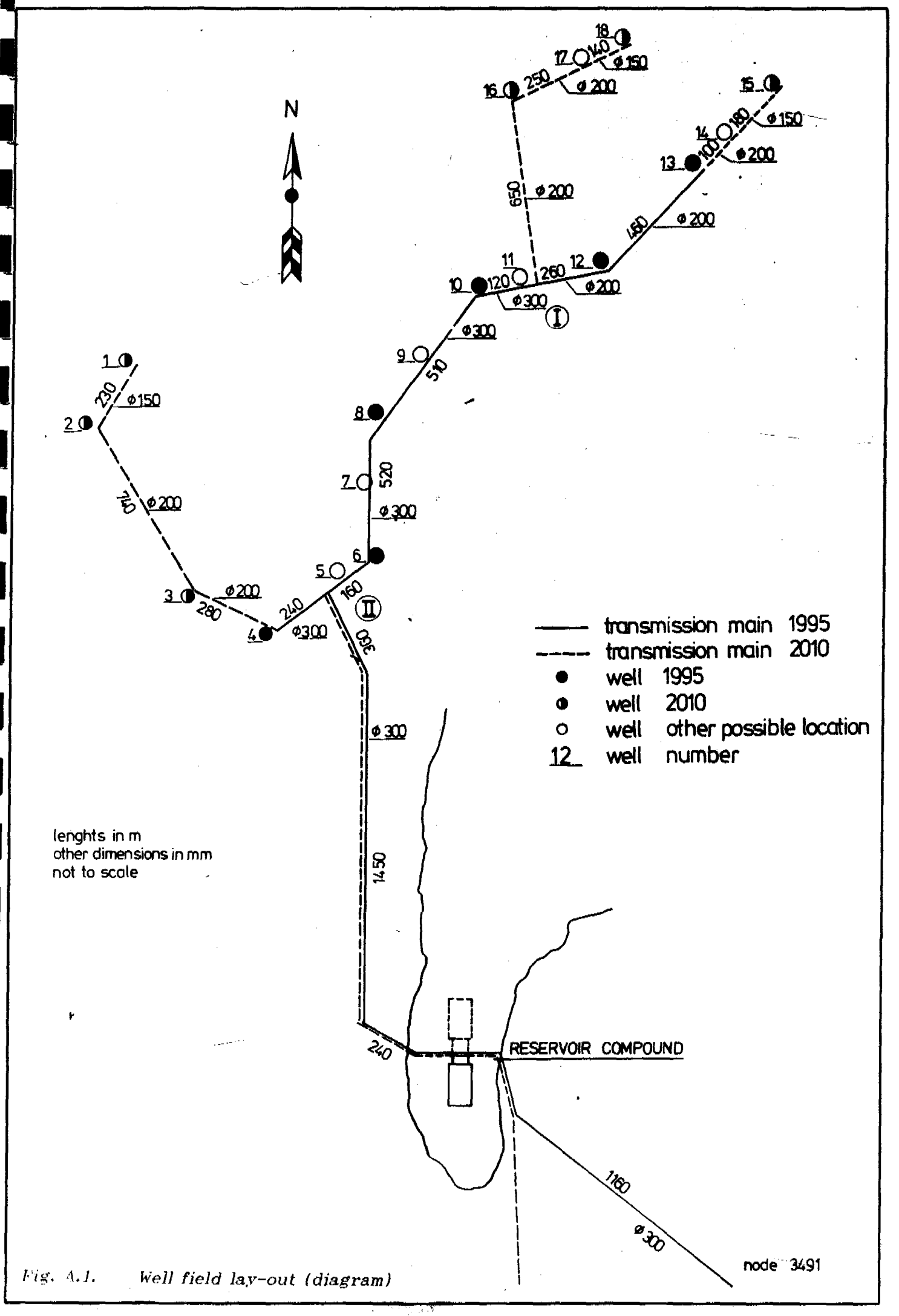

Fig. A.1. Well field lay-out (diagram)

TRANSMISSION MAIN FROM DEEPWELLS TO RESERVOIR
SITUATION 1995, TRANSMISSION MAIN TO RESERVOIR: 1*300 mm

WELL No.	FLOW *) INCR. [l/s]	CUMM. [l/s]	DIAM. [m]	L [m]	k [mm]	V [m/s]	HEAD LOSS [m]	PRESS. HEAD [m.w.k. + 2100 m.]	SURF.	EFF. PRESS.
4	10							74.76	43.90	30.86
		10	0.3	400	0.5	0.14	0.04			
II	0							74.72	42.40	32.32
13	10							77.01	71.20	5.81
		10	0.2	450	0.5	0.32	0.32			
12	10							76.69	75.00	1.69
		20	0.2	250	0.5	0.64	0.67			
I	0							76.02	70.40	5.62
		20	0.3	100	0.5	0.28	0.03			
10	10							75.98	68.60	7.38
		30	0.3	600	0.5	0.42	0.44			
8	0							75.55	57.60	17.95
		30	0.3	600	0.5	0.42	0.44			
6	10							75.11	50.00	25.11
		40	0.3	300	0.5	0.57	0.38			
II	10							74.72	42.40	32.32
		50	0.3	1500	0.5	0.71	2.97			
RESERVOIR								71.75	70.00	1.75

AVERAGE PRESSURE	76	
ESTIMATED SUNCTION LEVEL	-30	
AVERAGE PUMPHEAD	106	m.w.k
AVERAGE PUMPCAPACITY	10	l/s
PUMP EFFICIENCY	70	%
INSTALLED POWER	14.8	kW/pump
RUNNING HOURS	20	h/day
ENERGY CONSUMPTION	108,113	kWh/(year.pump)
NUMBER OF WELLS (effective)	5	IN 1995
TOTAL ENERGY CONSUMPTION	540,564	kWh/year
WATER PRODUCTION	1,314,000	m3/year
ENERGY CONSUMPTION	0.4	kWh/m3

L = LENGTH OF PIPESECTION
V = VELOCITY
k = WALL ROUHGNESS ACCORDING NIKURADSE
I and II are junctions
*) BASED ON AVERAGE DAY CONDITIONS

TRANSMISSION MAIN FROM DEEPWELLS TO RESERVOIR
Situation 2010 TRANSMISSION II - RES. 2*300 mm

WELL No.	INCR. [l/s]	FLOW CUMM. [l/s]	DIAM. [m]	L [m]	k [mm]	V [m/s]	HEAD LOSS [m]	PRESS. HEAD [m.w.k. + 2100 m.]	SURF.	EFF. PRESS.
18	10							81.65	64.90	16.75
		10	0.15	400	0.5	0.57	1.24			
16	10							80.41	68.50	11.91
		20	0.2	650	0.5	0.64	1.75			
I								78.66	70.40	8.26
1	10							79.76	58.20	21.56
		10	0.15	230	0.5	0.57	0.71			
2	10							79.05	58.30	20.75
		20	0.2	750	0.5	0.64	2.02			
3	10							77.03	45.20	31.83
		30	0.2	300	0.5	0.96	1.79			
4	10							75.23	43.90	31.33
		40	0.3	400	0.5	0.57	0.51			
II								74.72	42.40	32.32
15	10							82.29	67.20	15.09
		10	0.15	300	0.5	0.57	0.93			
13	10							81.36	71.20	10.16
		20	0.2	450	0.5	0.64	1.21			
12	10							80.15	75.00	5.15
		30	0.2	250	0.5	0.96	1.49			
I	20							78.66	70.40	8.26
		50	0.3	100	0.5	0.71	0.20			
10	0							78.46	68.60	9.86
		50	0.3	600	0.5	0.71	1.19			
8	10							77.27	57.60	19.67
		60	0.3	600	0.5	0.85	1.70			
6	0							75.57	50.00	25.57
		60	0.3	300	0.5	0.85	0.85			
II								74.72	42.40	32.32
II								74.72	42.40	32.32
		50	0.3	1500	0.5	0.71	2.97			
RESERVOIR								71.75	70.00	1.75

AVERAGE PRESSURE	79.02	
ESTIMATED SUNCTION LEVEL	-30	

AVERAGE PUMPHEAD	109	m.w.k
AVERAGE PUMPCAPACITY	10	l/s
PUMP EFFICIENCY	70	%
INSTALLED POWER	15.3	kW/pump
RUNNING HOURS	20	h/day
ENERGY CONSUMPTION	111,532	kWh/(year.pump)
NUMBER OF WELLS (effective)	10	
TOTAL ENERGY CONSUMPTION	1,115,322	kWh/year
WATER PRODUCTION	2,628,000	m3/year
ENERGY CONSUMPTION	0.4	kWh/m3

TRANSMISSION MAIN FROM DEEPWELLS TO RESERVOIR
Situation 2010 TRANSMISSION II - RES. ; 400 mm

WELL No.	INCR. [l/s]	FLOW CUMM. [l/s]	DIAM. [m]	L [m]	k [mm]	V [m/s]	HEAD LOSS [m]	PRESS. HEAD [m.w.k. + 2100 m.]	SURF.	EFF. PRESS.
18	10							81.29	64.90	16.39
		10	0.15	400	0.5	0.57	1.24			
16	10							80.05	68.50	11.55
		20	0.2	650	0.5	0.64	1.75			
I								78.30	70.40	7.90
1	10							79.40	58.20	21.20
		10	0.15	230	0.5	0.57	0.71			
2	10							78.68	58.30	20.38
		20	0.2	750	0.5	0.64	2.02			
3	10							76.66	45.20	31.46
		30	0.2	300	0.5	0.96	1.79			
4	10							74.87	43.90	30.97
		40	0.3	400	0.5	0.57	0.51			
II								74.36	42.40	31.96
15	10							81.93	67.20	14.73
		10	0.15	300	0.5	0.57	0.93			
13	10							81.00	71.20	9.80
		20	0.2	450	0.5	0.64	1.21			
12	10							79.79	75.00	4.79
		30	0.2	250	0.5	0.96	1.49			
I	20							78.30	70.40	7.90
		50	0.3	100	0.5	0.71	0.20			
10	0							78.10	68.60	9.50
		50	0.3	600	0.5	0.71	1.19			
8	10							76.91	57.60	19.31
		60	0.3	600	0.5	0.85	1.70			
6	0							75.21	50.00	25.21
		60	0.3	300	0.5	0.85	0.85			
II	40							74.36	42.40	31.96
		100	0.4	1500	0.5	0.80	2.61			
RESERVOIR								71.75	70.00	1.75

AVERAGE PRESSURE	78.66	
ESTIMATED SUNCTION LEVEL	-30	
AVERAGE PUMPHEAD	109	m.w.k
AVERAGE PUMPCAPACITY	10	l/s
PUMP EFFICIENCY	70	%
INSTALLED POWER	15.2	kW/pump
RUNNING HOURS	20	h/day
ENERGY CONSUMPTION	111,162	kWh/(year.pump)
DESIGN HORIZON	2010	
NUMBER OF WELLS (effective)	10	
TOTAL ENERGY CONSUMPTION	1,111,616	kWh/year
WATER PRODUCTION	2,628,000	m3/year
ENERGY CONSUMPTION	0.4	kWh/m3

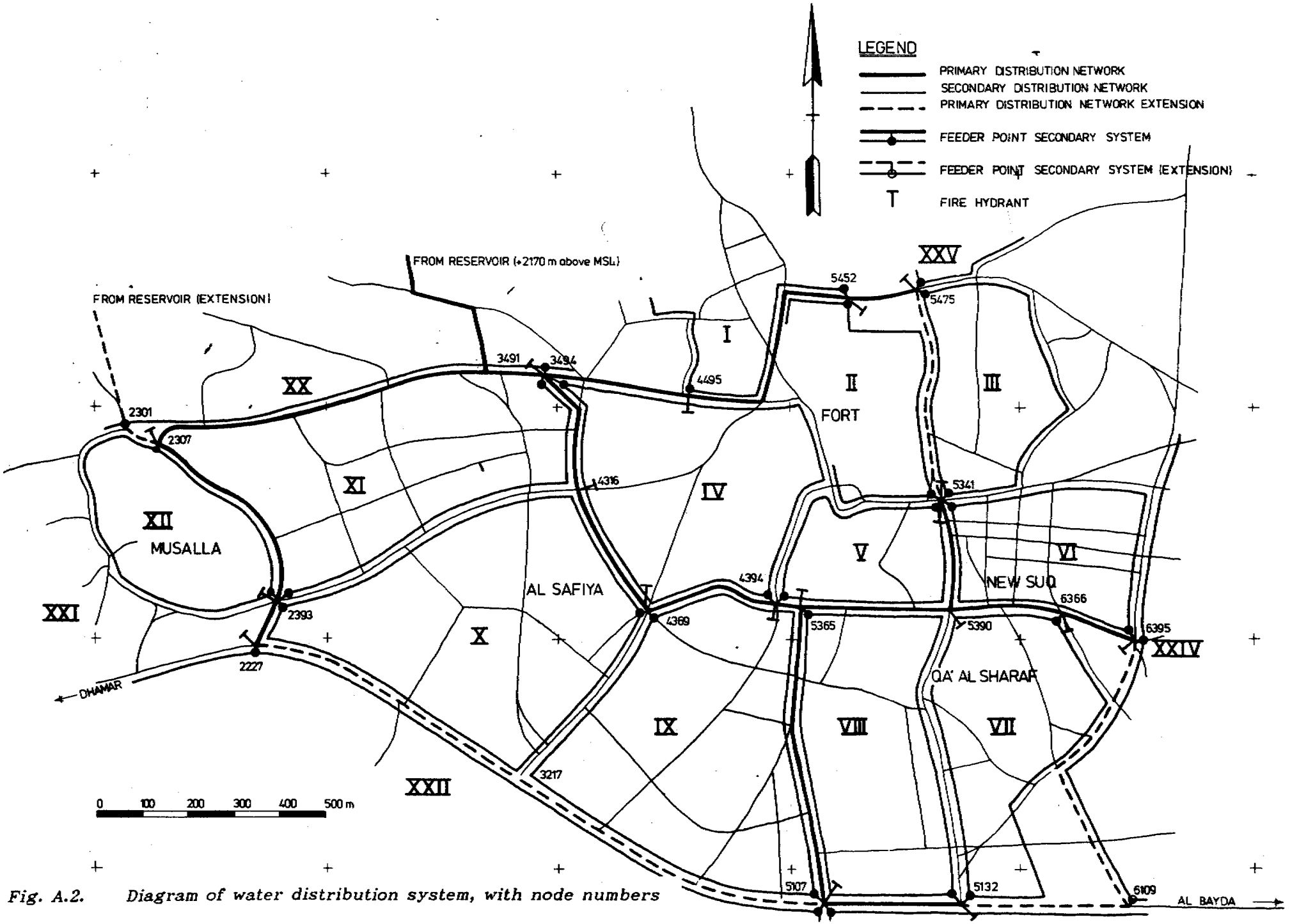

Fig. A.2. Diagram of water distribution system, with node numbers

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PRIMARY NETWORK, PEAK FLOW, 1995, PAGE 1 - 4

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE PRIMARY DISTRIBUTION SYSTEM (BRANCHED)
YEAR 1995 MAXIMUM HOUR (PEAK FLOW)
SUPPLY FROM RESERVOIR (TO NODE 3491 ONLY BY 1*300 mm)

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G E N E R A L D A T A

GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	49
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	36
NUMBER OF RESERVOIRS	:	1
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .200 M DIAM. LENGTH	:	4225.00 M
PIPES .300 M DIAM. LENGTH	:	2180.00 M
PIPES TOTAL LENGTH	:	6405.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	244.64 M3/H

W A T E R C O N S U M P T I O N I N DISTRICTS

DISTRICT NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	M3/H	M3/H	M3/H
1	11.60	2.80	26.00
2	8.10	2.00	18.20
3	6.90	1.70	15.50
4	7.30	1.80	16.40
5	7.70	1.90	17.30
6	3.20	.80	7.20
7	7.80	1.90	17.50
8	5.80	1.40	13.00
9	8.10	1.90	18.10
10	10.30	2.50	23.10
11	6.20	1.50	13.90
12	6.90	1.70	15.50
20	4.90	1.20	11.00
21	.70	.20	1.60
22	3.90	.90	8.70
23	2.40	.60	5.40
24	6.10	1.50	13.70
25	1.00	.20	2.20

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
1000	.00	.00	70.00	27.00	FIXED	244.64

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
3494	33.00	65.41	32.41	
2307	40.00	65.22	25.22	
2227	38.00	65.11	27.11	
2346	38.90	65.13	26.23	
2393	37.50	65.11	27.61	
4369	31.10	65.06	33.96	
3491	35.00	65.67	30.67	
5341	25.00	64.74	39.74	
4394	29.60	64.97	35.37	
4495	29.35	64.97	35.62	
5107	29.00	64.86	35.86	
5452	28.00	64.81	36.81	
5390	25.00	64.77	39.77	
5365	28.60	64.96	36.36	
6395	24.25	64.70	40.45	
5132	28.30	64.84	36.54	
5475	24.30	64.79	40.49	
6366	25.00	64.72	39.72	
1000		70.00	27.00	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1000	1000	3491	.3000	1200.0	4.33	244.64	.96	3.6
1010	3491	2307	.2000	660.0	.46	-35.90	.32	.7
1011	2307	2346	.2000	200.0	.09	27.99	.25	.4
1005	2393	2346	.2000	250.0	.02	12.53	.11	.1
1012	2393	2227	.2000	110.0	.00	-5.72	.05	.0
1020	3491	3494	.3000	100.0	.26	207.76	.82	2.6
1021	3494	4495	.2000	325.0	.44	50.90	.45	1.4
1022	4495	5452	.2000	470.0	.16	24.97	.22	.3
1023	5452	5475	.2000	140.0	.01	12.80	.11	.1
1030	3494	4369	.3000	550.0	.35	101.03	.40	.6
1031	4369	4394	.3000	280.0	.09	72.38	.28	.3
1034	4394	5365	.3000	50.0	.01	60.25	.24	.2
1035	5365	5390	.2000	320.0	.19	33.01	.29	.6
1036	5390	5341	.2000	240.0	.03	-14.43	.13	.1
1040	5390	6366	.2000	250.0	.05	18.58	.16	.2
1041	6366	6395	.2000	180.0	.02	13.30	.12	.1
1050	5365	5107	.2000	660.0	.09	-15.67	.14	.1
1051	5107	5132	.2000	220.0	.02	13.57	.12	.1

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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PRIMARY NETWORK, PEAK FLOW, 2010, PAGE 1 - 4

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE PRIMARY DISTRIBUTION SYSTEM (BRANCHED)
YEAR 2010 MAXIMUM HOUR (PEAK FLOW)
SUPPLY FROM RESERVOIR (TO NODE 3491 AND 2307 BY 2*300 mm)

****

G E N E R A L D A T A

GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	50
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	36
NUMBER OF RESERVOIRS	:	1
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .200 M DIAM. LENGTH	:	4225.00 M
PIPES .300 M DIAM. LENGTH	:	3280.00 M
PIPES TOTAL LENGTH	:	7505.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	539.50 M3/H

W A T E R C O N S U M P T I O N I N DISTRICTS

DISTRICT NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	M3/H	M3/H	M3/H
1	20.90	5.00	46.80
2	12.90	3.10	28.90
3	10.90	2.60	24.40
4	11.60	2.70	25.90
5	11.70	2.80	26.20
6	5.00	1.20	11.20
7	12.40	3.00	27.80
8	9.60	2.40	21.60
9	16.00	3.90	35.90
10	17.50	4.20	39.20
11	13.10	3.20	29.40
12	10.90	2.70	24.50
20	22.50	5.40	50.40
21	3.40	.80	7.60
22	18.00	4.30	40.30
23	11.60	2.70	25.90
24	28.30	6.80	63.40
25	4.50	1.10	10.10

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
1000	.00	.00	70.00	27.00	FIXED	539.62

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
3494	33.00	62.76	29.76	
2307	40.00	66.12	26.12	
2227	38.00	63.65	25.65	
2346	38.90	64.74	25.84	
2393	37.50	63.66	26.16	
4369	31.10	61.53	30.43	
3491	35.00	63.63	28.63	
5341	25.00	60.16	35.16	
4394	29.60	61.12	31.52	
4495	29.35	61.13	31.78	
5107	29.00	60.57	31.57	
5452	28.00	60.45	32.45	
5390	25.00	60.22	35.22	
5365	28.60	61.07	32.47	
6395	24.25	59.65	35.40	
5132	28.30	60.51	32.21	
5475	24.30	60.38	36.08	
6366	25.00	59.88	34.88	
1000		70.00	27.00	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1000	1000	3491	.3000	1200.0	6.37	297.57	1.17	5.3
1001	1000	2307	.3000	1100.0	3.88	242.05	.95	3.5
1010	3491	2307	.2000	660.0	2.49	85.67	.76	3.8
1011	2307	2346	.2000	200.0	1.37	116.23	1.03	6.9
1005	2346	2393	.2000	250.0	1.08	91.76	.81	4.3
1012	2393	2227	.2000	110.0	.01	-14.22	.13	.1
1020	3491	3494	.3000	100.0	.87	382.80	1.50	8.7
1021	3494	4495	.2000	325.0	1.63	99.07	.88	5.0
1022	4495	5452	.2000	470.0	.67	52.33	.46	1.4
1023	5452	5475	.2000	140.0	.07	29.66	.26	.5
1030	3494	4369	.3000	550.0	1.22	191.39	.75	2.2
1031	4369	4394	.3000	280.0	.41	154.53	.61	1.5
1034	4394	5365	.3000	50.0	.06	134.41	.53	1.1
1035	5365	5390	.2000	320.0	.85	71.56	.63	2.6
1036	5390	5341	.2000	240.0	.06	-20.43	.18	.2
1040	5390	6366	.2000	250.0	.34	51.12	.45	1.4
1041	6366	6395	.2000	180.0	.23	49.10	.43	1.3
1050	5365	5107	.2000	660.0	.50	-37.54	.33	.8
1051	5107	5132	.2000	60.54	.06	21.98	.19	.3

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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PRIMARY NETWORK, PEAK FLOW, 2010, FIRE FIGHTING, PAGE 1 - 4

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE PRIMARY DISTRIBUTION SYSTEM (BRANCHED)
YEAR 2010 MAXIMUM HOUR (PEAK FLOW)
SUPPLY FROM RESERVOIR (TO NODE 3491 AND 2307 BY 2*300 mm)
FIRE FIGHTING FROM 4351 AND 5392

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	50
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	36
NUMBER OF RESERVOIRS	:	1
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .200 M DIAM. LENGTH	:	4225.00 M
PIPES .300 M DIAM. LENGTH	:	3280.00 M
PIPES TOTAL LENGTH	:	7505.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	611.50 M3/H

W A T E R C O N S U M P T I O N

DISTRICT NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	M3/H	M3/H	M3/H
1	20.90	5.00	46.80
2	12.90	3.10	28.90
3	10.90	2.60	24.40
4	11.60	2.70	25.90
5	11.70	2.80	26.20
6	5.00	1.20	11.20
7	12.40	3.00	27.80
8	9.60	2.40	21.60
9	16.00	3.90	35.90
10	17.50	4.20	39.20
11	13.10	3.20	29.40
12	10.90	2.70	24.50
20	22.50	5.40	50.40
21	3.40	.80	7.60
22	18.00	4.30	40.30
23	11.60	2.70	25.90
24	28.30	6.80	63.40
25	4.50	1.10	10.10

NODE NUMBER	AVG. CONS.	FIRE FIGHTING	PEAK DEMAND
	M3/H	M3/H	M3/H
5341	.00	36.00	36.00
5390	.00	36.00	36.00

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE	FLOW CHCK	NOTE
	M	M	M	M		M3/H	%	
1000	.00	.00	70.00	27.00	FIXED	611.48		

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE	
	M	M	M		
3494	48.00	60.66	27.66		
2307	32.00	65.06	25.06		
2227	27.00	61.92	23.92	*	
2346	29.00	63.35	24.45	*	
2393	28.00	61.93	24.43	*	
4369	26.00	58.99	27.89		
3491	30.00	61.79	26.79		
5341	28.00	56.54	31.54		
4394	31.00	58.37	28.77		
4495	34.00	58.38	29.03		
5107	35.00	57.81	28.81		
5452	58.00	57.16	29.16		
5390	36.00	56.61	31.61		
5365	40.00	58.29	29.69		
6395	36.00	56.12	31.87		
5132	26.00	57.69	29.39		
5475	24.00	57.05	32.75		
6366	30.00	56.37	31.37		
1000		70.00	27.00		RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1000	1000	3491	.3000	1200.0	8.21	338.19	1.33	6.8
1001	1000	2307	.3000	1100.0	4.94	273.30	1.07	4.5
1010	3491	2307	.2000	660.0	3.27	98.45	.87	5.0
1011	2307	2346	.2000	200.0	1.71	129.92	1.15	8.6
1005	2346	2393	.2000	250.0	1.42	105.45	.93	5.7
1012	2393	2227	.2000	110.0	.02	-15.71	.14	.1
1020	3491	3494	.3000	100.0	1.13	436.22	1.71	11.3
1021	3494	4495	.2000	325.0	2.28	117.53	1.04	7.0
1022	4495	5452	.2000	470.0	1.22	70.79	.63	2.6
1023	5452	5475	.2000	140.0	.11	38.76	.34	.8
1030	3494	4369	.3000	550.0	1.67	224.51	.88	3.0
1031	4369	4394	.3000	280.0	.62	190.43	.75	2.2
1034	4394	5365	.3000	50.0	.08	164.50	.65	1.7
1035	5365	5390	.2000	320.0	1.68	101.34	.90	5.2
1036	5390	5341	.2000	240.0	.07	-22.63	.20	.3
1040	5390	6366	.2000	250.0	.24	42.75	.38	1.0
1041	6366	6395	.2000	180.0	.25	51.21	.45	1.4
1050	5365	5107	.2000	660.0	.48	-36.95	.33	.7
1051	5107	5132	.2000	57.75	.12	31.56	.28	.5

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 1, PAGE 1 - 6

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 1
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

****

G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	58
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	42
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	4355.00 M
PIPES .074 M DIAM. LENGTH	:	1235.00 M
PIPES TOTAL LENGTH	:	5590.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	46.81 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
5415	387.00	92.90	866.90
4419	387.00	92.90	866.90
4427	387.00	92.90	866.90
4428	387.00	92.90	866.90
4433	387.00	92.90	866.90
4435	387.00	92.90	866.90
4437	387.00	92.90	866.90
4438	387.00	92.90	866.90
4441	387.00	92.90	866.90
4446	387.00	92.90	866.90
4447	387.00	92.90	866.90
4454	3483.00	836.00	7802.00
4457	387.00	92.90	866.90
4459	387.00	92.90	866.90
4466	387.00	92.90	866.90
4479	387.00	92.90	866.90
4480	387.00	92.90	866.90
4481	387.00	92.90	866.90
4482	387.00	92.90	866.90
4483	387.00	92.90	866.90
4485	387.00	92.90	866.90
4487	387.00	92.90	866.90
4489	387.00	92.90	866.90
4498	387.00	92.90	866.90
4593	774.10	185.80	1734.00
4595	387.00	92.90	866.90
5405	387.00	92.90	866.90
5406	387.00	92.90	866.90
5409	387.00	92.90	866.90
5416	387.00	92.90	866.90
5417	387.00	92.90	866.90
5418	387.00	92.90	866.90
5421	387.00	92.90	866.90
5423	387.00	92.90	866.90
5430	774.10	185.80	1734.00
5440	387.00	92.90	866.90
5441	387.00	92.90	866.90
4444	387.00	92.90	866.90
5445	387.00	92.90	866.90
5454	387.00	92.90	866.90
5515	774.10	185.80	1734.00
5518	774.10	185.80	1734.00

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
4495	.00	.00	61.13	30.63	FIXED	19.70
5452	.00	.00	60.45	32.45	FIXED	27.07

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE	
	M	M	M		
5415	37.00	58.81	21.81	*	
4419	31.75	57.54	25.79		
4427	29.00	57.15	28.15		
4428	35.00	57.04	22.04	*	
4433	31.25	57.28	26.03		
4435	30.00	57.46	27.46		
4437	29.25	57.50	28.25		
4438	31.00	57.55	26.55		
4441	31.00	58.23	27.23		
4446	30.50	58.36	27.86		
4447	30.50	58.37	27.87		
4454	32.00	58.01	26.01		
4457	32.25	58.44	26.19		
4459	32.00	58.40	26.40		
4466	33.00	58.91	25.91		
4479	29.50	59.24	29.74		
4480	31.50	58.87	27.37		
4481	30.75	58.73	27.98		
4482	30.00	58.74	28.74		
4483	30.25	59.03	28.78		
4485	30.00	58.73	28.73		
4487	30.00	58.88	28.88		
4489	29.50	59.17	29.67		
4498	29.75	60.63	30.88		
4593	28.25	56.53	28.28		
4595	28.00	56.86	28.86		
5405	40.00	57.75	17.75	**	
5406	39.00	59.30	20.30	*	
5409	32.00	58.53	26.53		
5416	36.00	57.55	21.55	*	
5417	34.00	59.40	25.40		
5418	30.00	60.02	30.02		
5421	34.00	59.71	25.71		
5423	28.75	59.88	31.13		
5430	31.00	57.64	26.64		
5440	28.50	58.20	29.70		
5441	28.00	58.32	30.32		
4444	30.25	59.01	28.76		
5445	27.00	60.10	33.10		
5454	28.00	60.19	32.19		
5515	30.00	56.56	26.56		
5518	29.00	56.56	27.56		
4495		61.13	30.63		RESERVOIR
5452		60.45	32.45		RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	4419	4435	.0408	120.0	.08	.48	.10	.7
2	4419	4454	.0408	105.0	.48	-1.34	.29	4.5
3	4427	4433	.0408	85.0	.14	-.78	.16	1.6
4	4427	4437	.0408	100.0	.36	-1.19	.25	3.6
5	4427	4595	.0408	90.0	.28	1.11	.24	3.1
6	4428	4595	.0408	130.0	.18	.71	.15	1.4
7	4428	5405	.0408	115.0	.71	-1.58	.34	6.2
8	4433	4438	.0408	40.0	.27	-1.64	.35	6.6
9	4435	4437	.0408	95.0	.04	-.39	.08	.4
10	4437	4438	.0408	100.0	.04	-.39	.08	.4
11	4438	5416	.0736	150.0	.00	-.15	.01	.0
12	4438	4444	.0408	80.0	1.47	-2.76	.59	18.3
13	4441	4446	.0408	65.0	.13	-.86	.18	1.9
14	4446	4447	.0408	75.0	.01	-.17	.04	.1
15	4446	4481	.0408	70.0	.37	-1.46	.31	5.3
16	4447	4444	.0408	110.0	.65	1.54	.33	5.9
17	4454	4459	.0736	45.0	.38	-9.11	.59	8.6
18	4457	4459	.0408	90.0	.04	.38	.08	.4
19	4457	4466	.0408	120.0	.47	-1.24	.26	3.9
20	4459	4480	.0736	50.0	.47	-9.59	.63	9.5
21	4466	4495	.0408	205.0	2.22	-2.11	.45	10.8
22	4479	4489	.0736	150.0	.07	2.07	.14	.5
23	4479	4444	.0736	60.0	.23	-6.03	.39	3.8
24	4479	5452	.0736	145.0	1.21	-8.98	.59	8.3
25	4480	4481	.0408	35.0	.14	1.27	.27	4.1
26	4480	4495	.0736	160.0	2.26	-11.76	.77	14.1
27	4481	4483	.0408	130.0	.30	-.95	.20	2.3
28	4481	4485	.0408	50.0	.00	-.10	.02	.0
29	4482	4485	.0408	60.0	.00	.14	.03	.1
30	4482	4487	.0408	50.0	.14	-1.05	.22	2.8
31	4485	4487	.0408	90.0	.15	-.78	.17	1.6
32	4487	4498	.0408	100.0	1.75	-2.70	.57	17.5
33	4495	4498	.0736	140.0	.50	5.83	.38	3.6
34	4593	4595	.0408	140.0	.33	-.96	.20	2.4
35	4593	5515	.0408	15.0	.02	-.77	.16	1.6
36	5405	5406	.0408	55.0	1.55	-3.44	.73	28.1
37	5405	5416	.0408	80.0	.20	1.00	.21	2.5
38	5406	5409	.0408	135.0	.76	1.51	.32	5.7
39	5406	5417	.0736	15.0	.11	-8.31	.54	7.2
40	5406	5515	.0408	180.0	2.74	2.51	.53	15.2
41	5409	5417	.0408	130.0	.87	-1.65	.35	6.7
42	5409	5430	.0408	70.0	.89	2.29	.49	12.7
43	5415	4444	.0408	105.0	.20	.86	.18	1.9
44	5417	5423	.0736	40.0	.48	-10.82	.71	12.0
45	5418	5454	.0408	90.0	.17	-.86	.18	1.9
46	5421	5423	.0408	90.0	.17	-.86	.18	1.9

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
47	5423	5452	.0736	35.0	.57	-12.59	.82	16.2
48	5430	5441	.0408	200.0	.67	-1.15	.24	3.4
49	5440	5441	.0408	60.0	.12	-.86	.18	1.9
50	5430	5518	.0408	150.0	1.09	1.72	.36	7.2
51	5441	5445	.0408	90.0	1.79	-2.88	.61	19.9
52	5445	5454	.0736	60.0	.09	-3.74	.24	1.5
53	5515	5518	.0408	150.0	.00	.03	.01	.0
54	5454	5452	.0736	80.0	.26	5.49	.36	3.2
55	4489	4498	.0408	120.0	1.46	-2.24	.48	12.2
56	4437	4447	.0408	85.0	.87	-2.05	.43	10.2
57	4447	4483	.0408	100.0	.66	-1.64	.35	6.6
58	4483	4489	.0736	105.0	.14	-3.45	.23	1.3

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 2, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 2
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	47
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	32
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	2790.00 M
PIPES .074 M DIAM. LENGTH	:	1160.00 M
PIPES TOTAL LENGTH	:	3950.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	28.67 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
4479	355.60	85.30	796.50
4484	355.60	85.30	796.50
4494	355.60	85.30	796.50
5306	355.60	85.30	796.50
5308	355.60	85.30	796.50
5311	355.60	85.30	796.50
5313	355.60	85.30	796.50
5314	711.10	170.70	1592.90
5316	355.60	85.30	796.50
5319	355.60	85.30	796.50
5322	711.10	170.70	1592.90
5324	355.60	85.30	796.50
5330	355.60	85.30	796.50
5331	355.60	85.30	796.50
5335	355.60	85.30	796.50
5336	355.60	85.30	796.50
5453	355.60	85.30	796.50
5455	711.10	170.70	1592.90
5457	355.60	85.30	796.50
5458	355.60	85.30	796.50
5459	355.60	85.30	796.50
5461	355.60	85.30	796.50
5464	355.60	85.30	796.50
5465	355.60	85.30	796.50
5468	355.60	85.30	796.50
5469	355.60	85.30	796.50
5470	355.60	85.30	796.50
5474	355.60	85.30	796.50
5475	355.60	85.30	796.50
5486	355.60	85.30	796.50
5490	711.10	170.70	1592.90
5495	355.60	85.30	796.50

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
5341	.00	.00	60.16	35.16	FIXED	12.76
5452	.00	.00	60.45	32.45	FIXED	15.87

N O D E R E S U L T S

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NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
4479	29.50	59.78	30.28	
4484	29.50	59.61	30.11	
4494	29.25	58.80	29.55	
5306	29.15	58.74	29.59	
5308	32.00	58.73	26.73	
5311	29.25	59.01	29.76	
5313	30.00	58.88	28.88	
5314	27.00	59.11	32.11	
5316	27.00	59.07	32.07	
5319	26.00	59.18	33.18	
5322	28.00	59.13	31.13	
5324	25.75	59.50	33.75	
5330	28.00	59.26	31.26	
5331	25.00	59.85	34.85	
5335	26.00	59.78	33.78	
5336	25.25	59.91	34.66	
5453	28.00	60.13	32.13	
5455	30.00	59.03	29.03	
5457	29.00	58.99	29.99	
5458	29.00	58.60	29.60	
5459	28.00	58.41	30.41	
5461	30.00	58.55	28.55	
5464	28.00	58.41	30.41	
5465	30.00	58.60	28.60	
5468	30.00	58.42	28.42	
5469	30.00	58.39	28.39	
5470	29.25	58.60	29.35	
5474	29.50	58.38	28.88	
5475	26.00	59.92	33.92	
5486	26.00	59.87	33.87	
5490	28.00	59.25	31.25	
5495	24.25	59.85	35.60	
5341		60.16	35.16	RESERVOIR
5452		60.45	32.45	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	4479	4484	.0736	50.0	.17	5.68	.37	3.4
2	4479	5452	.0736	150.0	.67	-6.51	.42	4.4
3	4484	4494	.0408	105.0	.81	1.78	.38	7.7
4	4484	5455	.0408	25.0	.58	3.12	.66	23.2
5	4494	5470	.0408	80.0	.20	.98	.21	2.5
6	5306	5308	.0408	10.0	.02	.76	.16	1.5
7	5306	5311	.0408	45.0	.27	-1.56	.33	6.0
8	5308	5313	.0408	60.0	.16	-1.00	.21	2.6
9	5308	5469	.0408	130.0	.33	1.00	.21	2.6
10	5311	5313	.0408	80.0	.13	.79	.17	1.6
11	5311	5314	.0408	160.0	.10	-.47	.10	.6
12	5311	5316	.0736	60.0	.06	-2.99	.20	1.0
13	5313	5330	.0408	140.0	.37	-1.02	.22	2.7
14	5314	5319	.0408	25.0	.07	-1.03	.22	2.7
15	5314	5330	.0408	110.0	.14	-.70	.15	1.3
16	5316	5319	.0408	155.0	.11	-.50	.11	.7
17	5316	5322	.0736	45.0	.05	-3.31	.22	1.2
18	5319	5324	.0408	25.0	.32	-2.29	.49	12.7
19	5322	5324	.0736	145.0	.37	-4.89	.32	2.5
20	5324	5341	.0736	100.0	.66	-8.00	.52	6.6
21	5330	5331	.0408	35.0	.59	-2.66	.56	17.0
22	5330	5490	.0408	135.0	.01	.12	.03	.1
23	5331	5336	.0736	50.0	.06	-3.15	.21	1.1
24	5331	5495	.0736	80.0	.00	-.24	.02	.0
25	5335	5336	.0408	75.0	.12	-.79	.17	1.6
26	5336	5341	.0736	105.0	.25	-4.76	.31	2.4
27	5457	5453	.0408	25.0	1.14	4.40	.94	45.8
28	5457	5455	.0408	130.0	.04	.34	.07	.3
29	5457	5458	.0408	25.0	.39	2.55	.54	15.6
30	5457	5461	.0408	90.0	.44	1.40	.30	4.9
31	5452	5453	.0736	35.0	.32	9.36	.61	9.0
32	5453	5475	.0736	120.0	.22	4.09	.27	1.8
33	5455	5465	.0408	120.0	.44	1.20	.26	3.6
34	5458	5459	.0408	80.0	.18	.95	.20	2.3
35	5458	5464	.0408	110.0	.19	.81	.17	1.7
36	5459	5464	.0408	80.0	.00	.12	.03	.1
37	5461	5465	.0408	50.0	.05	-.61	.13	1.0
38	5461	5468	.0408	115.0	.12	.63	.13	1.1
39	5464	5474	.0408	70.0	.03	.41	.09	.5
40	5465	5470	.0408	80.0	.01	-.14	.03	.1
41	5468	5461	.0408	135.0	.12	.58	.12	.9
42	5468	5469	.0408	50.0	.03	.45	.10	.6
43	5468	5464	.0408	65.0	.01	-.25	.05	.2
44	5469	5474	.0408	40.0	.02	.39	.08	.4
45	5475	5486	.0736	125.0	.05	1.87	.12	.4
46	5475	5490	.0408	130.0	.67	1.44	.31	5.1
47	5486	5495	.0736	95.0	.01	1.08	.07	.1

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 3, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 3
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	36
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	26
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	1990.00 M
PIPES .074 M DIAM. LENGTH	:	1375.00 M
PIPES TOTAL LENGTH	:	3365.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	23.64 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
5328	294.60	70.70	659.90
5329	294.60	70.70	659.90
5331	589.20	141.40	1319.80
5333	1118.00	282.80	2518.80
5448	294.60	70.70	659.90
5478	294.60	70.70	659.90
5481	294.60	70.70	659.90
5484	883.80	212.10	1979.70
5486	294.60	70.70	659.90
5487	294.60	70.70	659.90
5490	294.60	70.70	659.90
5493	294.60	70.70	659.90
5494	294.60	70.70	659.90
5495	294.60	70.70	659.90
5498	294.60	70.70	659.90
6300	294.60	70.70	659.90
6303	294.60	70.70	659.90
6306	294.60	70.70	659.90
6310	883.80	212.10	1979.70
6420	294.60	70.70	659.90
6450	294.60	70.70	659.90
6457	294.60	70.70	659.90
6458	294.60	70.70	659.90
6461	883.80	212.10	1979.70
6465	294.60	70.70	659.90
6472	294.60	70.70	659.90

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
5340	.00	.00	60.16	35.91	FIXED	10.46
5475	.00	.00	60.38	34.88	FIXED	13.12

N O D E R E S U L T S

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NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
5328	26.00	59.41	33.41	
5329	25.50	58.79	33.29	
5331	24.25	59.90	35.65	
5333	24.00	59.30	35.30	
5448	23.75	59.59	35.84	
5478	23.50	59.41	35.91	
5481	24.50	59.37	34.87	
5484	23.50	58.91	35.41	
5486	26.00	59.95	33.95	
5487	25.50	59.38	33.88	
5490	24.75	59.89	35.14	
5493	25.00	59.20	34.20	
5494	24.75	58.91	34.16	
5495	24.75	59.88	35.13	
5498	26.00	59.29	33.29	
6300	25.00	58.99	33.99	
6303	24.50	59.12	34.62	
6306	24.75	59.17	34.42	
6310	24.50	59.32	34.82	
6420	25.00	59.25	34.25	
6450	25.00	59.21	34.21	
6457	24.50	58.98	34.48	
6458	24.25	58.98	34.73	
6461	24.25	59.12	34.87	
6465	24.50	58.91	34.41	
6472	24.25	59.12	34.87	
5340		60.16	35.91	RESERVOIR
5475		60.38	34.88	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	5328	5333	.0408	105.0	.10	.60	.13	1.0
2	5328	5495	.0408	120.0	.48	-1.26	.27	4.0
3	5329	5494	.0408	110.0	.13	-.66	.14	1.2
4	5331	5333	.0408	105.0	.60	1.51	.32	5.7
5	5331	5340	.0736	140.0	.26	-4.14	.27	1.8
6	5331	5495	.0736	80.0	.02	1.30	.08	.2
7	5333	6310	.0408	115.0	.02	-.21	.05	.1
8	5340	6310	.0736	200.0	.84	6.32	.41	4.2
9	5448	5475	.0736	135.0	.79	-7.52	.49	5.9
10	5448	5478	.0408	60.0	.18	1.08	.23	3.0
11	5448	6420	.0736	95.0	.33	5.75	.38	3.5
12	5475	5486	.0736	130.0	.43	5.60	.37	3.3
13	5478	5481	.0408	70.0	.04	.43	.09	.5
14	5481	5487	.0408	95.0	.01	-.16	.03	.1
15	5484	5494	.0408	85.0	.00	.06	.01	.0
16	5484	6420	.0408	120.0	.34	-1.05	.22	2.8
17	5484	6461	.0408	85.0	.20	-.96	.20	2.4
18	5486	5487	.0408	50.0	.57	2.17	.46	11.4
19	5486	5490	.0736	75.0	.06	2.74	.18	.8
20	5487	5493	.0408	45.0	.18	1.28	.27	4.1
21	5490	5495	.0736	30.0	.00	.61	.04	.1
22	5490	5498	.0408	110.0	.59	1.47	.31	5.4
23	5493	5494	.0408	55.0	.28	1.44	.31	5.1
24	5493	5498	.0408	55.0	.10	-.82	.17	1.8
25	5494	6465	.0408	55.0	.00	.13	.03	.1
26	6300	6306	.0408	55.0	.18	-1.14	.24	3.3
27	6300	6465	.0408	125.0	.08	.48	.10	.6
28	6303	6306	.0736	90.0	.05	-2.14	.14	.5
29	6303	6458	.0408	175.0	.14	.54	.12	.8
30	6303	6472	.0736	30.0	.00	.96	.06	.1
31	6306	6310	.0736	90.0	.15	-3.94	.26	1.7
32	6420	6450	.0736	25.0	.04	4.05	.26	1.8
33	6450	6457	.0408	145.0	.23	.77	.16	1.6
34	6450	6461	.0736	120.0	.09	2.62	.17	.8
35	6457	6458	.0408	50.0	.00	.10	.02	.0
36	6461	6472	.0736	135.0	.00	-.24	.02	.0

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 4, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 4
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	33
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	25
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	2045.00 M
PIPES .074 M DIAM. LENGTH	:	1840.00 M
PIPES TOTAL LENGTH	:	3885.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	25.85 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
4310	374.20	89.80	838.20
4313	374.20	89.80	838.20
4316	374.20	89.80	838.20
4318	374.20	89.80	838.20
4321	374.20	89.80	838.20
4323	374.20	89.80	838.20
4326	374.20	89.80	838.20
4330	374.20	89.80	838.20
4331	374.20	89.80	838.20
4333	374.20	89.80	838.20
4336	374.20	89.80	838.20
4344	1054.50	269.40	2378.40
4364	748.40	179.60	1676.40
4369	374.20	89.80	838.20
4375	748.40	179.60	1676.40
4382	374.20	89.80	838.20
4384	748.40	179.60	1676.40
4387	374.20	89.80	838.20
4472	374.20	89.80	838.20
4495	374.20	89.80	838.20
4498	374.20	89.80	838.20
5306	748.40	179.60	1676.40
5316	374.20	89.80	838.20
5320	374.20	89.80	838.20
5470	374.20	89.80	838.20

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
3494	.00	.00	62.76	29.76	FIXED	11.27
4394	.00	.00	61.12	31.37	FIXED	14.69

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
4310	33.50	62.55	29.05	
4313	31.25	61.07	29.82	
4316	33.25	59.48	26.23	
4318	32.25	59.36	27.11	
4321	32.50	59.50	27.00	
4323	32.00	59.21	27.21	
4326	30.00	60.07	30.07	
4330	31.25	60.61	29.36	
4331	31.00	59.90	28.90	
4333	30.50	60.33	29.83	
4336	31.50	59.37	27.87	
4344	29.00	60.03	31.03	
4364	31.50	59.37	27.87	
4369	31.50	59.74	28.24	
4375	31.50	59.20	27.70	
4382	31.00	59.80	28.80	
4384	29.75	60.69	30.94	
4387	30.50	60.26	29.76	
4472	32.25	61.77	29.52	
4495	30.75	61.08	30.33	
4498	29.50	60.53	31.03	
5306	29.25	60.47	31.22	
5316	28.00	60.48	32.48	
5320	29.50	60.53	31.03	
5470	29.50	60.49	30.99	
3494		62.76	29.76	RESERVOIR
4394		61.12	31.37	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	3494	4310	.0736	210.0	.21	3.01	.20	1.0
2	3494	4472	.0736	140.0	.99	8.25	.54	7.1
3	4310	4313	.0408	135.0	1.48	2.12	.45	10.9
4	4313	4330	.0408	110.0	.46	1.29	.27	4.2
5	4316	4318	.0408	130.0	.12	.57	.12	.9
6	4316	4321	.0736	70.0	.02	-1.41	.09	.2
7	4318	4336	.0408	115.0	.01	-.17	.04	.1
8	4321	4323	.0408	110.0	.29	1.01	.21	2.6
9	4321	4369	.0736	215.0	.25	-3.23	.21	1.2
10	4323	4375	.0408	80.0	.00	.13	.03	.1
11	4326	4331	.0408	100.0	.17	.79	.17	1.7
12	4326	4498	.0408	70.0	.46	-1.63	.35	6.5
13	4330	4331	.0408	90.0	.71	1.79	.38	7.9
14	4330	4495	.0408	100.0	.46	-1.36	.29	4.6
15	4331	4336	.0408	70.0	.53	1.76	.37	7.6
16	4333	4498	.0408	110.0	.20	-.83	.18	1.8
17	4336	4375	.0408	145.0	.17	.66	.14	1.2
18	4344	4384	.0408	175.0	.67	-1.23	.26	3.8
19	4344	5316	.0408	140.0	.46	-1.13	.24	3.3
20	4364	4369	.0408	70.0	.38	-1.47	.31	5.4
21	4364	4375	.0408	80.0	.16	.89	.19	2.1
22	4364	4382	.0408	160.0	.43	-1.02	.22	2.7
23	4369	4387	.0736	160.0	.52	-5.55	.36	3.3
24	4382	4387	.0408	55.0	.47	-1.86	.40	8.5
25	4384	4394	.0736	100.0	.43	-6.39	.42	4.3
26	4384	5320	.0736	125.0	.16	3.44	.22	1.3
27	4387	4394	.0736	120.0	.86	-8.30	.54	7.1
28	4472	4495	.0736	125.0	.70	7.32	.48	5.6
29	4495	4498	.0736	195.0	.55	5.14	.34	2.8
30	4498	5470	.0736	100.0	.04	1.86	.12	.4
31	5306	5316	.0736	125.0	.01	-.66	.04	.1
32	5306	5470	.0736	95.0	.01	-1.02	.07	.1
33	5316	5320	.0736	60.0	.05	-2.65	.17	.8

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 5, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 5
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	34
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	22
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	1285.00 M
PIPES .074 M DIAM. LENGTH	:	1615.00 M
PIPES TOTAL LENGTH	:	2900.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	27.26 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

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NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
4384	468.00	112.30	1048.30
5315	936.00	224.60	2096.60
5321	468.00	112.30	1048.30
5323	468.00	112.30	1048.30
5324	468.00	112.30	1048.30
5351	468.00	112.30	1048.30
5352	468.00	112.30	1048.30
5354	936.00	224.60	2096.60
5357	468.00	112.30	1048.30
5358	468.00	112.30	1048.30
5360	468.00	112.30	1048.30
5361	468.00	112.30	1048.30
5362	468.00	112.30	1048.30
5363	468.00	112.30	1048.30
5364	468.00	112.30	1048.30
5367	468.00	112.30	1048.30
5369	936.00	224.60	2096.60
5376	468.00	112.30	1048.30
5378	468.00	112.30	1048.30
5382	936.00	224.60	2096.60
5385	468.00	112.30	1048.30
5391	468.00	112.30	1048.30

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
4394	.00	.00	61.12	32.12	FIXED	21.69
5346	.00	.00	60.16	35.16	FIXED	5.59

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
4384	29.75	60.74	30.99	
5315	29.50	60.43	30.93	
5321	27.75	60.24	32.49	
5323	26.00	60.16	34.16	
5324	26.00	60.15	34.15	
5351	27.50	59.48	31.98	
5352	25.25	59.19	33.94	
5354	26.00	57.89	31.89	
5357	25.25	58.85	33.60	
5358	25.25	59.25	34.00	
5360	28.00	60.20	32.20	
5361	28.00	59.48	31.48	
5362	27.50	58.92	31.42	
5363	26.50	59.41	32.91	
5364	25.50	59.25	33.75	
5367	27.00	60.22	33.22	
5369	25.25	60.03	34.78	
5376	25.00	60.05	35.05	
5378	25.75	59.48	33.73	
5382	25.00	60.03	35.03	
5385	25.00	59.56	34.56	
5391	24.75	60.03	35.28	
4394		61.12	32.12	RESERVOIR
5346		60.16	35.16	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S
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PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	4384	4394	.0736	100.0	.38	-6.02	.39	3.8
2	4384	5315	.0736	135.0	.30	4.58	.30	2.3
3	5315	5321	.0736	140.0	.19	3.54	.23	1.4
4	5321	5323	.0736	60.0	.09	3.63	.24	1.4
5	5323	5324	.0736	85.0	.00	.43	.03	.0
6	5324	5346	.0736	110.0	.01	-.62	.04	.1
7	5346	5376	.0736	40.0	.11	4.97	.32	2.6
8	5376	5382	.0736	40.0	.03	2.46	.16	.7
9	5382	5391	.0736	150.0	.00	.28	.02	.0
10	5369	5391	.0736	140.0	.01	.67	.04	.1
11	5367	5369	.0736	90.0	.18	4.36	.28	2.0
12	4394	5367	.0736	150.0	.90	7.61	.50	6.0
13	4384	4394	.0736	100.0	.38	-6.02	.39	3.8
14	4384	5315	.0736	135.0	.30	4.58	.30	2.3
15	5315	5321	.0736	140.0	.19	3.54	.23	1.4
16	4384	5360	.0408	70.0	.53	1.76	.37	7.6
17	4394	5360	.0408	90.0	.92	2.04	.43	10.2
18	5360	5361	.0408	40.0	.73	2.76	.59	18.2
19	5351	5361	.0408	75.0	.00	.09	.02	.0
20	5321	5351	.0408	55.0	.76	2.40	.51	13.9
21	5323	5352	.0408	85.0	.96	2.16	.46	11.3
22	5351	5352	.0408	70.0	.28	1.27	.27	4.1
23	5352	5357	.0408	25.0	.34	2.39	.51	13.8
24	5357	5362	.0408	50.0	.07	-.75	.16	1.5
25	5361	5362	.0408	70.0	.55	1.79	.38	7.9
26	5354	5357	.0408	90.0	.96	-2.09	.44	10.6
27	5364	5358	.0408	25.0	.00	.07	.01	.0
35	5363	5367	.0408	70.0	.81	-2.18	.46	11.5
28	5358	5363	.0408	50.0	.16	-1.13	.24	3.3
29	5358	5364	.0408	45.0	.00	.05	.01	.0
30	5364	5378	.0408	100.0	.24	-.95	.20	2.4
31	5376	5378	.0408	110.0	.57	1.44	.31	5.2
32	5378	5385	.0408	90.0	.08	-.55	.12	.8
33	5369	5385	.0408	75.0	.47	1.60	.34	6.3

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 6, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 6
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	35
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	29
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	1536.00 M
PIPES .074 M DIAM. LENGTH	:	1395.00 M
PIPES TOTAL LENGTH	:	2931.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR 1	:	2.00
TOTAL WATER CONSUMPTION	:	11.20 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
5343	156.20	37.50	349.90
5344	156.20	37.50	349.90
5347	156.20	37.50	349.90
5348	156.20	37.50	349.90
5349	156.20	37.50	349.90
5377	156.20	37.50	349.90
5378	156.20	37.50	349.90
5379	156.20	37.50	349.90
5383	156.20	37.50	349.90
5384	156.20	37.50	349.90
5392	312.50	75.00	700.00
5393	156.20	37.50	349.90
5394	156.20	37.50	349.90
6316	156.20	37.50	349.90
6321	156.20	37.50	349.90
6322	156.20	37.50	349.90
6323	156.20	37.50	349.90
6340	156.20	37.50	349.90
6345	156.20	37.50	349.90
6351	156.20	37.50	349.90
6353	156.20	37.50	349.90
6356	156.20	37.50	349.90
6358	156.20	37.50	349.90
6363	156.20	37.50	349.90
6366	156.20	37.50	349.90
6373	312.50	75.00	700.00
6375	156.20	37.50	349.90
6380	156.20	37.50	349.90
6385	312.50	75.00	700.00

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
5346	.00	.00	60.16	35.16	FIXED	10.66
6395	.00	.00	59.65	35.40	FIXED	.16

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
5343	25.00	60.00	35.00	
5344	25.00	59.90	34.90	
5347	25.00	59.99	34.99	
5348	26.50	59.75	33.25	
5349	26.00	59.65	33.65	
5377	25.00	59.92	34.92	
5378	26.50	59.71	33.21	
5379	26.00	59.62	33.62	
5383	26.50	59.56	33.06	
5384	26.00	59.52	33.52	
5392	24.75	59.73	34.98	
5393	25.75	59.69	33.94	
5394	25.75	59.68	33.93	
6316	24.50	59.81	35.31	
6321	25.00	59.62	34.62	
6322	24.50	59.74	35.24	
6323	25.00	59.67	34.67	
6340	23.75	59.69	35.94	
6345	24.00	59.67	35.67	
6351	25.25	59.60	34.35	
6353	25.00	59.62	34.62	
6356	25.50	59.52	34.02	
6358	25.00	59.60	34.60	
6363	25.00	59.55	34.55	
6366	25.00	59.66	34.66	
6373	24.50	59.65	35.15	
6375	24.00	59.65	35.65	
6380	24.00	59.64	35.64	
6385	24.00	59.64	35.64	
5346		60.16	35.16	RESERVOIR
6395		59.65	35.40	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	5343	5344	.0736	70.0	.10	3.61	.24	1.4
2	5343	5346	.0736	85.0	.16	-4.23	.28	1.9
3	5344	6316	.0736	75.0	.09	3.28	.21	1.2
4	5346	5347	.0736	40.0	.17	6.43	.42	4.3
5	5347	5348	.0408	80.0	.24	1.08	.23	3.0
6	5347	5377	.0736	30.0	.07	4.60	.30	2.3
7	5348	5349	.0408	65.0	.10	.74	.16	1.5
8	5349	6321	.0408	70.0	.03	.41	.09	.5
9	5377	5378	.0408	75.0	.20	1.03	.22	2.7
10	5377	5392	.0736	160.0	.19	3.27	.21	1.2
11	5378	5379	.0408	70.0	.09	.70	.15	1.3
12	5379	6351	.0408	70.0	.03	.36	.08	.4
13	5383	5384	.0408	65.0	.03	.42	.09	.5
14	5383	5393	.0408	95.0	.14	-.74	.16	1.5
15	5384	6356	.0408	70.0	.00	.07	.02	.0
16	5392	5393	.0736	45.0	.03	2.62	.17	.8
17	5393	5394	.0736	60.0	.02	1.56	.10	.3
18	5394	6366	.0736	90.0	.02	1.23	.08	.2
19	6316	6322	.0408	40.0	.07	.81	.17	1.7
20	6316	6340	.0736	220.0	.12	2.17	.14	.5
21	6322	6323	.0408	105.0	.07	.47	.10	.6
22	6321	6353	.0408	100.0	.00	.06	.01	.0
23	6323	6345	.0408	106.0	.00	.10	.02	.0
24	6340	6345	.0736	50.0	.02	1.84	.12	.4
25	6345	6375	.0736	55.0	.02	1.64	.11	.3
26	6351	6358	.0408	100.0	.00	-.03	.01	.0
27	6353	6375	.0408	110.0	.03	-.31	.07	.3
28	6358	6380	.0408	110.0	.05	-.39	.08	.4
29	6363	6385	.0408	110.0	.10	-.57	.12	.9
30	6363	6356	.0408	95.0	.02	-.27	.06	.2
31	6366	6373	.0736	75.0	.01	.90	.06	.1
32	6373	6395	.0736	110.0	.00	.36	.02	.0
33	6375	6380	.0736	50.0	.01	1.03	.07	.1
34	6380	6385	.0736	30.0	.00	.33	.02	.0
35	6385	6395	.0736	150.0	.01	-.52	.03	.0

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 7, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 7
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

LENGTH OF A COORDINATE-UNIT	:	1.000 M
GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	43
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	33
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	2790.00 M
PIPES .074 M DIAM. LENGTH	:	1840.00 M
PIPES TOTAL LENGTH	:	4630.00 M
VALVES TOTAL LENGTH	:	.00 M
TOTAL LENGTH OF NETWORK	:	4630.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
NUMBER WATERCONSUMPTION CATEG.	:	1
CALCULATION FOR YEAR	:	2010
CONSUMPTION FACTOR CATEGORY 1	:	2.00
HOUR OF DAY OF CALCULATION	:	7
TOTAL WATER CONSUMPTION	:	27.06 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
5134	317.90	76.30	712.10
5226	317.90	76.30	712.10
5228	635.90	152.60	1424.40
5231	317.90	76.30	712.10
5232	317.90	76.30	712.10
5233	317.90	76.30	712.10
5241	317.90	76.30	712.10
5242	317.90	76.30	712.10
5248	317.90	76.30	712.10
5276	317.90	76.30	712.10
5278	317.90	76.30	712.10
5284	317.90	76.30	712.10
5287	317.90	76.30	712.10
5289	317.90	76.30	712.10
5294	317.90	76.30	712.10
5297	317.90	76.30	712.10
5392	317.90	76.30	712.10
5394	317.90	76.30	712.10
6106	317.90	76.30	712.10
6109	635.90	152.60	1424.40
6200	635.90	152.60	1424.40
6201	317.90	76.30	712.10
6202	317.90	76.30	712.10
6211	317.90	76.30	712.10
6213	317.90	76.30	712.10
6215	635.90	152.60	1424.40
6223	317.90	76.30	712.10
6225	317.90	76.30	712.10
6250	317.90	76.30	712.10
6251	317.90	76.30	712.10
6255	317.90	76.30	712.10
6267	635.90	152.60	1424.40
6270	317.90	76.30	712.10

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
5132	.00	.00	60.51	32.26	FIXED	14.88
6366	.00	.00	59.88	34.88	FIXED	12.07

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	
	M	M	M	
5134	27.00	59.83	32.83	
5226	25.50	58.95	33.45	
5228	27.75	58.55	30.80	
5231	25.50	58.95	33.45	
5232	26.50	59.08	32.58	
5233	24.50	58.61	34.11	
5241	27.50	59.39	31.89	
5242	27.00	59.17	32.17	
5248	26.00	59.17	33.17	
5276	27.75	59.47	31.72	
5278	26.00	59.17	33.17	
5284	26.00	59.23	33.23	
5287	27.25	59.60	32.35	
5289	25.50	59.26	33.76	
5294	25.00	59.35	34.35	
5297	27.50	59.98	32.48	
5392	24.75	59.03	34.28	
5394	25.75	59.22	33.47	
6106	27.00	59.56	32.56	
6109	28.00	58.51	30.51	
6200	26.00	58.87	32.87	
6201	25.25	58.92	33.67	
6202	25.00	59.59	34.59	
6211	27.00	58.92	31.92	
6213	24.00	59.35	35.35	
6215	26.50	58.56	32.06	
6223	24.50	59.22	34.72	
6225	24.50	59.01	34.51	
6250	25.00	59.18	34.18	
6251	24.75	59.17	34.42	
6255	25.00	59.20	34.20	
6267	25.50	58.50	33.00	
6270	26.00	59.38	33.38	
5132		59.51	32.26	RESERVOIR
6366		59.88	34.88	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	5132	5134	.0736	100.0	.68	8.10	.53	6.8
2	5134	5294	.0408	120.0	.48	1.26	.27	4.0
3	5134	6106	.0736	70.0	.27	6.08	.40	3.9
4	5226	5231	.0736	165.0	.00	.40	.03	.0
5	5226	5233	.0408	120.0	.35	1.06	.23	2.9
6	5226	5392	.0736	115.0	.08	-2.48	.16	.7
7	5228	5392	.0408	130.0	.48	-1.21	.26	3.7
8	5228	6215	.0408	140.0	.01	-.15	.03	.1
10	5132	5297	.0736	110.0	.53	6.78	.44	4.8
11	6201	5394	.0408	160.0	.30	.84	.18	1.8
12	5241	5242	.0408	35.0	.22	1.61	.34	6.4
13	5241	5276	.0736	130.0	.08	-2.30	.15	.6
14	5242	5248	.0408	80.0	.01	.14	.03	.1
15	5242	5232	.0408	70.0	.09	-.71	.15	1.3
17	5248	5278	.0408	60.0	.00	-.14	.03	.1
18	5248	6250	.0408	100.0	.01	-.20	.04	.1
19	5276	5278	.0408	100.0	.30	1.09	.23	3.0
20	5276	5287	.0736	70.0	.13	-4.10	.27	1.8
21	5278	6225	.0408	120.0	.16	.71	.15	1.3
22	5278	5284	.0408	80.0	.06	-.51	.11	.7
23	5284	5287	.0408	100.0	.37	-1.22	.26	3.7
24	5287	5297	.0736	100.0	.38	-6.02	.39	3.8
25	5289	5294	.0408	110.0	.09	-.55	.12	.8
26	5289	6255	.0736	60.0	.06	2.94	.19	1.0
27	5289	6270	.0736	110.0	.12	-3.09	.20	1.1
28	5392	5394	.0736	90.0	.19	-4.39	.29	2.1
29	5394	6200	.0408	125.0	.35	1.05	.22	2.8
30	5394	6366	.0736	130.0	.66	-6.97	.46	5.1
31	6106	6109	.0408	170.0	1.05	1.58	.34	6.2
32	6106	6270	.0736	115.0	.18	3.80	.25	1.6
33	6109	6267	.0408	160.0	.01	.13	.03	.1
34	6200	6211	.0408	120.0	.05	-.37	.08	.4
35	6201	6211	.0408	120.0	.01	.11	.02	.1
36	6202	6213	.0736	115.0	.24	4.40	.29	2.1
37	6202	6366	.0736	105.0	.29	-5.10	.33	2.8
38	6211	6223	.0408	130.0	.30	-.94	.20	2.3
39	6213	6223	.0736	90.0	.13	3.69	.24	1.5
40	6215	5233	.0408	120.0	.04	.35	.07	.4
41	6215	6251	.0408	150.0	.61	-1.27	.27	4.1
42	6223	6251	.0736	90.0	.04	2.07	.14	.5
43	6250	6251	.0736	35.0	.01	1.19	.08	.2
44	6250	6255	.0736	40.0	.02	-2.23	.15	.6
45	6251	6267	.0408	170.0	.67	1.25	.27	4.0

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 8, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 8
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	41
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	32
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	2140.00 M
PIPES .074 M DIAM. LENGTH	:	1860.00 M
PIPES TOTAL LENGTH	:	4000.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	21.95 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
5107	280.00	67.20	627.20
5109	280.00	67.20	627.20
5201	280.00	67.20	627.20
5203	280.00	67.20	627.20
5204	280.00	67.20	627.20
5205	280.00	67.20	627.20
5206	280.00	67.20	627.20
5213	280.00	67.20	627.20
5214	280.00	67.20	627.20
5217	280.00	67.20	627.20
5218	280.00	67.20	627.20
5220	280.00	67.20	627.20
5223	280.00	67.20	627.20
5226	560.00	34.40	1254.40
5258	280.00	67.20	627.20
5230	280.00	67.20	627.20
5231	280.00	67.20	627.20
5235	280.00	67.20	627.20
5240	280.00	67.20	627.20
5245	280.00	67.20	627.20
5246	280.00	67.20	627.20
5252	280.00	67.20	627.20
5270	560.00	34.40	1254.40
5374	280.00	67.20	627.20
5280	280.00	67.20	627.20
5281	280.00	67.20	627.20
5290	560.00	34.40	1254.40
5291	280.00	67.20	627.20
5367	280.00	67.20	627.20
5372	280.00	67.20	627.20
5390	280.00	67.20	627.20
5391	280.00	67.20	627.20

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
5132	.00	.00	60.51	32.26	FIXED	8.07
5365	.00	.00	61.07	32.32	FIXED	13.92

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	
	M	M	M	
5107	29.00	60.29	31.29	
5109	29.00	60.37	31.37	
5201	27.50	60.30	32.80	
5203	26.00	59.30	33.30	
5204	26.25	59.20	32.95	
5205	28.50	60.46	31.96	
5206	27.75	59.87	32.12	
5213	27.00	59.68	32.68	
5214	27.00	59.75	32.75	
5217	26.50	59.64	33.14	
5218	27.00	59.54	32.54	
5220	28.75	60.32	31.57	
5223	27.25	59.32	32.07	
5226	28.50	60.24	31.74	
5258	27.50	59.23	31.73	
5230	26.00	59.80	33.80	
5231	25.50	60.08	34.58	
5235	27.25	59.82	32.57	
5240	26.25	60.06	33.81	
5245	27.50	59.77	32.27	
5246	27.75	60.09	32.34	
5252	28.00	59.75	31.75	
5270	28.00	60.24	32.24	
5374	26.00	59.25	33.25	
5280	27.50	59.78	32.28	
5281	27.75	60.14	32.39	
5290	27.00	59.99	32.99	
5291	27.25	60.22	32.97	
5367	26.00	60.42	34.42	
5372	26.00	59.73	33.73	
5390	25.50	60.15	34.65	
5391	25.00	60.12	35.12	
5132		60.51	32.26	RESERVOIR
5365		61.07	32.32	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	5365	5205	.0736	160.0	.61	-6.02	.39	3.8
2	5365	5367	.0736	100.0	.65	7.90	.52	6.5
3	5107	5109	.0736	105.0	.08	-2.67	.17	.8
4	5107	5270	.0736	100.0	.05	2.05	.13	.5
5	5109	5132	.0736	115.0	.14	-3.33	.22	1.2
6	5132	5291	.0736	120.0	.29	4.73	.31	2.4
7	5203	5204	.0408	95.0	.10	.62	.13	1.1
8	5203	5372	.0408	50.0	.43	-1.87	.40	8.6
9	5203	5374	.0408	50.0	.05	.62	.13	1.1
10	5205	5206	.0408	45.0	.59	2.32	.49	13.0
11	5205	5220	.0736	140.0	.14	3.04	.20	1.0
12	5206	5213	.0408	105.0	.19	.84	.18	1.9
13	5206	5217	.0408	120.0	.23	.85	.18	1.9
14	5201	5367	.0408	120.0	.13	-.62	.13	1.1
15	5213	5214	.0408	70.0	.07	-.60	.13	1.0
16	5213	5218	.0408	55.0	.14	1.00	.21	2.6
17	5213	5372	.0408	145.0	.05	-.34	.07	.3
18	5214	5230	.0408	80.0	.05	-.48	.10	.6
19	5214	5235	.0408	40.0	.07	-.80	.17	1.7
21	5217	5218	.0408	55.0	.11	.87	.18	2.0
22	5217	5252	.0408	100.0	.11	-.64	.13	1.1
23	5218	5223	.0408	55.0	.22	1.25	.26	3.9
24	5220	5226	.0736	120.0	.08	2.41	.16	.7
25	5223	5258	.0408	90.0	.09	.62	.13	1.1
26	5226	5252	.0408	120.0	.48	1.26	.27	4.0
27	5226	5270	.0736	140.0	.00	-.11	.01	.0
28	5230	5390	.0408	130.0	.35	-1.03	.22	2.7
29	5231	5240	.0736	110.0	.01	1.01	.07	.1
30	5231	5391	.0736	120.0	.04	-1.63	.11	.3
31	5235	5240	.0408	30.0	.25	-1.83	.39	8.2
32	5235	5245	.0408	90.0	.04	.40	.09	.5
33	5240	5246	.0736	100.0	.03	-1.48	.10	.3
34	5245	5280	.0408	110.0	.01	-.15	.03	.1
35	5246	5281	.0736	105.0	.05	-2.06	.13	.5
36	5270	5290	.0408	185.0	.25	.71	.15	1.4
37	5280	5290	.0408	110.0	.20	-.84	.18	1.9
38	5281	5291	.0736	100.0	.08	-2.69	.18	.8
39	5290	5291	.0408	50.0	.24	-1.38	.29	4.7
40	5367	5372	.0408	40.0	.69	2.69	.57	17.4
41	5367	5390	.0736	165.0	.27	3.90	.25	1.7
42	5390	5391	.0736	60.0	.03	2.25	.15	.6

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 9, PAGE 1 - 6

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 9
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	54
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	37
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	3795.00 M
PIPES .074 M DIAM. LENGTH	:	2295.00 M
PIPES TOTAL LENGTH	:	6090.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	35.85 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
3278	381.00	91.40	853.40
4125	381.00	91.40	853.40
4132	381.00	91.40	853.40
4206	381.00	91.40	853.40
4207	381.00	91.40	853.40
4211	381.00	91.40	853.40
4214	761.90	182.90	1706.70
4215	381.00	91.40	853.40
4222	381.00	91.40	853.40
4224	381.00	91.40	853.40
4233	381.00	91.40	853.40
4236	381.00	91.40	853.40
4237	381.00	91.40	853.40
4243	381.00	91.40	853.40
4244	381.00	91.40	853.40
4245	381.00	91.40	853.40
4247	381.00	91.40	853.40
4249	381.00	91.40	853.40
4255	381.00	91.40	853.40
4259	381.00	91.40	853.40
4266	761.90	182.90	1706.70
4275	381.00	91.40	853.40
4277	381.00	91.40	853.40
4283	381.00	91.40	853.40
4285	381.00	91.40	853.40
4289	761.90	182.90	1706.70
4291	381.00	91.40	853.40
4227	381.00	91.40	853.40
4228	381.00	91.40	853.40
4373	381.00	91.40	853.40
4387	761.90	182.90	1706.70
4394	381.00	91.40	853.40
4396	381.00	91.40	853.40
5105	381.00	91.40	853.40
5205	381.00	91.40	853.40
5261	761.90	182.90	1706.70
5215	381.00	91.40	853.40

R E S E R V O I R R E S U L T S

RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
4369	.00	.00	61.53	30.03	FIXED	21.74
5107	.00	.00	60.57	31.32	FIXED	14.11

N O D E R E S U L T S

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NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE
	M	M	M	
3278	33.00	59.13	26.13	
4125	30.75	59.17	28.42	
4132	30.25	59.48	29.23	
4206	31.50	59.40	27.90	
4207	31.50	59.72	28.22	
4211	31.50	59.23	27.73	
4214	31.00	59.17	28.17	
4215	32.25	59.15	26.90	
4222	31.00	57.97	26.97	
4224	31.00	59.06	28.06	
4233	30.00	58.98	28.98	
4236	30.50	59.06	28.56	
4237	30.50	57.86	27.36	
4243	30.00	57.86	27.86	
4244	29.25	58.36	29.11	
4245	30.50	57.56	27.06	
4247	30.00	57.71	27.71	
4249	30.00	58.25	28.25	
4255	32.00	58.91	26.91	
4259	30.50	57.55	27.05	
4266	32.00	59.13	27.13	
4275	30.00	57.28	27.28	
4277	30.00	57.55	27.55	
4283	30.00	57.70	27.70	
4285	29.75	57.45	27.70	
4289	28.50	59.02	30.52	
4291	29.00	57.71	28.71	
4227	30.50	59.14	28.64	
4228	30.00	59.14	29.14	
4373	31.50	61.01	29.51	
4387	30.50	60.35	29.85	
4394	29.50	59.64	30.14	
4396	30.75	59.18	28.43	
5105	29.75	59.83	30.08	
5205	29.00	59.39	30.39	
5261	28.50	59.62	31.12	
5215	28.50	59.37	30.87	
4369		61.53	30.03	RESERVOIR
5107		60.57	31.32	RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	3278	4215	.0736	140.0	.02	-1.12	.07	.2
2	3278	4266	.0736	230.0	.00	.23	.01	.0
3	4125	4132	.0736	145.0	.30	-4.41	.29	2.1
4	4125	4266	.0736	185.0	.05	1.43	.09	.2
5	4125	4291	.0408	130.0	1.47	2.15	.46	11.3
6	4132	5105	.0736	120.0	.35	-5.28	.34	3.0
7	4206	4207	.0736	55.0	.32	-7.46	.49	5.8
8	4206	4211	.0736	50.0	.17	5.75	.38	3.5
9	4206	4224	.0408	175.0	.34	.86	.18	1.9
10	4207	4214	.0408	95.0	.55	1.53	.32	5.8
11	4207	4373	.0736	130.0	1.29	-9.83	.64	9.9
12	4211	4215	.0736	85.0	.08	2.82	.18	.9
13	4211	4222	.0408	120.0	1.26	2.08	.44	10.5
50	4224	4236	.0408	145.0	.00	.02	.00	.0
51	4227	4236	.0408	150.0	.08	.42	.09	.5
52	4214	4396	.0408	95.0	.01	-.13	.03	.1
53	4228	4394	.0408	110.0	.50	-1.34	.29	4.5
54	4227	4228	.0408	65.0	.01	-.16	.03	.1
55	4227	4396	.0408	40.0	.04	-.61	.13	1.0
56	4227	4236	.0408	150.0	.08	.42	.09	.5
57	4224	4236	.0408	145.0	.00	.02	.00	.0
14	4215	4255	.0408	130.0	.25	.85	.18	1.9
15	4222	4259	.0408	110.0	.42	1.23	.26	3.8
16	4233	4237	.0408	120.0	1.12	1.95	.41	9.3
17	4233	4228	.0408	35.0	.16	1.37	.29	4.7
18	4233	5205	.0408	80.0	.41	-1.44	.30	5.1
19	4237	4243	.0408	65.0	.00	.07	.01	.0
20	4237	4245	.0408	110.0	.31	1.04	.22	2.8
21	4243	4244	.0408	75.0	.50	-1.64	.35	6.7
22	4243	4247	.0408	80.0	.15	.85	.18	1.9
23	4244	4249	.0408	45.0	.11	.99	.21	2.5
24	4244	5215	.0408	35.0	1.01	-3.49	.74	28.9
25	4245	4259	.0408	125.0	.01	.14	.03	.1
26	4249	4283	.0408	95.0	.55	1.53	.32	5.8
27	4249	4289	.0408	160.0	.77	-1.39	.29	4.8
28	4259	4285	.0408	110.0	.10	.57	.12	.9
29	4275	4285	.0408	90.0	.17	-.85	.18	1.9
30	4277	4283	.0408	80.0	.15	-.85	.18	1.9
31	4283	4291	.0408	135.0	.01	-.13	.03	.1
32	4285	4291	.0408	80.0	.26	-1.13	.24	3.2
33	4289	5105	.0408	170.0	.82	-1.39	.29	4.8
34	4289	5261	.0408	85.0	.60	-1.70	.36	7.1
35	4227	4228	.0408	60.0	.01	-.16	.03	.1
36	4227	4396	.0408	40.0	.04	-.61	.13	1.0
37	4228	4394	.0408	110.0	.50	-1.34	.29	4.5
38	4369	4373	.0736	30.0	.52	13.02	.85	17.2

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
39	4369	4387	.0736	150.0	1.18	8.72	.57	7.9
40	4373	4396	.0408	150.0	1.83	2.25	.48	12.2
41	4387	4394	.0736	140.0	.71	6.98	.46	5.1
42	4394	5205	.0736	190.0	.25	3.45	.23	1.3
43	5105	5107	.0736	125.0	.74	-7.53	.49	5.9
44	5107	5261	.0736	210.0	.95	6.58	.43	4.5
45	5205	5215	.0736	90.0	.02	1.17	.08	.2
46	5261	5215	.0736	220.0	.24	-3.17	.21	1.1

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 10, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 10
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	46
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	34
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	2965.00 M
PIPES .074 M DIAM. LENGTH	:	2190.00 M
PIPES TOTAL LENGTH	:	5155.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	38.08 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
2227	500.00	120.00	1120.00
3206	500.00	120.00	1120.00
3209	500.00	120.00	1120.00
3213	500.00	120.00	1120.00
3225	500.00	120.00	1120.00
3228	500.00	120.00	1120.00
3236	500.00	120.00	1120.00
3239	500.00	120.00	1120.00
3243	500.00	120.00	1120.00
3245	500.00	120.00	1120.00
3246	500.00	120.00	1120.00
3249	500.00	120.00	1120.00
3277	500.00	120.00	1120.00
3343	500.00	120.00	1120.00
3346	500.00	120.00	1120.00
3353	500.00	120.00	1120.00
3357	500.00	120.00	1120.00
3360	500.00	120.00	1120.00
3370	500.00	120.00	1120.00
3373	500.00	120.00	1120.00
3378	500.00	120.00	1120.00
3381	500.00	120.00	1120.00
3391	500.00	120.00	1120.00
3393	500.00	120.00	1120.00
4201	500.00	120.00	1120.00
4206	500.00	120.00	1120.00
4215	500.00	120.00	1120.00
4357	500.00	120.00	1120.00
4315	500.00	120.00	1120.00
4321	500.00	120.00	1120.00
4350	500.00	120.00	1120.00
4360	500.00	120.00	1120.00
4365	500.00	120.00	1120.00
4370	500.00	120.00	1120.00

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
2393	.00	.00	63.66	25.91	FIXED	20.80
4373	.00	.00	61.53	30.03	FIXED	17.32

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE	
	M	M	M		
2227	38.00	62.71	24.71	*	
3206	36.00	61.21	25.21		
3209	34.75	59.11	24.36	*	
3213	35.25	60.27	25.02		
3225	34.00	58.92	24.92	*	
3228	33.00	58.97	25.97		
3236	34.00	58.92	24.92	*	
3239	32.50	59.42	26.92		
3243	32.50	59.23	26.73		
3245	34.25	60.07	25.82		
3246	34.00	58.92	24.92	*	
3249	32.25	59.93	27.68		
3277	33.50	59.96	26.46		
3343	34.00	60.53	26.53		
3346	34.50	60.54	26.04		
3353	35.25	60.70	25.45		
3357	35.75	60.95	25.20		
3360	36.50	61.86	25.36		
3370	34.50	61.27	26.77		
3373	34.00	60.42	26.42		
3378	33.50	58.78	25.28		
3381	34.00	60.24	26.24		
3391	33.50	58.95	25.45		
3393	33.00	58.83	25.83		
4201	32.00	59.64	27.64		
4206	31.50	60.33	28.83		
4215	31.00	59.98	28.98		
4357	32.00	60.95	28.95		
4315	32.25	60.53	28.28		
4321	32.50	60.55	28.05		
4350	33.00	58.91	25.91		
4360	32.00	58.48	26.48		
4365	32.00	58.60	26.60		
4370	32.25	58.85	26.60		
2393		63.66	25.91		RESERVOIR
4373		61.53	30.03		RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	2393	3360	.0736	140.0	1.80	11.20	.73	12.8
50	2227	2393	.0736	100.0	.95	-9.60	.63	9.5
51	2227	3206	.0736	205.0	1.50	8.41	.55	7.3
52	3206	3213	.0736	150.0	.94	7.77	.51	6.3
53	3213	3245	.0736	125.0	.20	3.83	.25	1.6
54	3245	3277	.0736	135.0	.11	2.71	.18	.8
2	3206	3370	.0408	95.0	.06	-.48	.10	.6
3	3209	3213	.0408	60.0	1.16	-2.84	.60	19.3
4	3209	3225	.0408	105.0	.19	.84	.18	1.8
5	3209	3236	.0408	95.0	.19	.88	.19	2.0
6	3225	3391	.0408	105.0	.03	-.28	.06	.2
7	3228	3236	.0408	150.0	.05	.33	.07	.3
8	3228	3239	.0408	90.0	.45	-1.42	.30	5.0
9	3228	3243	.0408	175.0	.26	-.74	.16	1.5
10	3228	3393	.0408	100.0	.14	.73	.15	1.4
11	3236	3246	.0408	95.0	.00	.08	.02	.0
12	3239	4201	.0408	110.0	.22	-.88	.19	2.0
13	3239	4215	.0408	80.0	.56	-1.69	.36	7.0
14	3243	3246	.0408	110.0	.31	1.04	.22	2.8
15	3243	3249	.0408	35.0	.71	-2.90	.62	20.2
16	3249	3277	.0736	85.0	.03	-1.59	.10	.3
17	3249	4215	.0736	75.0	.05	-2.42	.16	.7
18	3343	3346	.0736	130.0	.01	-.86	.06	.1
19	3343	4315	.0736	105.0	.00	-.22	.01	.0
20	3346	3353	.0736	150.0	.16	-3.09	.20	1.1
21	3346	3381	.0408	95.0	.30	1.12	.24	3.2
22	3353	3357	.0736	60.0	.24	-6.20	.40	4.0
23	3353	3391	.0408	180.0	1.76	2.00	.43	9.8
24	3357	3360	.0736	125.0	.92	-8.43	.55	7.4
25	3357	3373	.0408	165.0	.52	1.12	.24	3.2
26	3360	3370	.0408	95.0	.59	1.59	.34	6.3
27	3378	3393	.0408	155.0	.05	-.32	.07	.3
28	3378	4350	.0408	75.0	.12	-.79	.17	1.7
29	3391	3393	.0408	115.0	.12	.61	.13	1.0
30	3393	4370	.0408	110.0	.02	-.26	.06	.2
31	4201	4370	.0408	60.0	.79	2.33	.50	13.1
32	4201	4373	.0408	150.0	1.89	-2.28	.48	12.6
62	4201	4206	.0408	70.0	.69	-2.01	.43	9.9
33	4206	4215	.0736	120.0	.35	5.23	.34	2.9
34	4206	4373	.0736	165.0	1.20	-8.38	.55	7.3
35	4357	4321	.0736	125.0	.40	-5.51	.36	3.2
36	4357	4373	.0736	125.0	.58	-6.66	.43	4.6
37	4315	4321	.0736	70.0	.02	-1.36	.09	.2
38	4321	4350	.0408	75.0	1.64	3.03	.64	21.9
39	4350	4360	.0408	135.0	.43	1.12	.24	3.2
40	4365	4370	.0408	80.0	.25	-1.12	.24	3.2

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 11, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 11
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	25
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	20
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	1680.00 M
PIPES .074 M DIAM. LENGTH	:	1465.00 M
PIPES TOTAL LENGTH	:	3145.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
PEAK FACTOR	:	2.00
TOTAL WATER CONSUMPTION	:	29.57 M3/H

W A T E R C O N S U M P T I O N I N N O D E S

NODE NUMBER	AVG. CONS.	LEA-KAGE	PEAK DEMAND
	L/H	L/H	L/H
2329	600.00	144.00	1344.00
2339	600.00	144.00	1344.00
2347	600.00	144.00	1344.00
2377	600.00	144.00	1344.00
3320	600.00	144.00	1344.00
3307	600.00	144.00	1344.00
3318	600.00	144.00	1344.00
3338	1200.00	288.00	2688.00
3334	600.00	144.00	1344.00
3343	600.00	144.00	1344.00
3346	600.00	144.00	1344.00
3354	600.00	144.00	1344.00
3361	600.00	144.00	1344.00
3469	1200.00	288.00	2688.00
3471	600.00	144.00	1344.00
3492	600.00	144.00	1344.00
4305	600.00	144.00	1344.00
3314	600.00	144.00	1344.00
3336	600.00	144.00	1344.00
4315	600.00	144.00	1344.00

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
2393	.00	.00	63.66	26.41	FIXED	11.79
3494	.00	.00	62.76	29.51	FIXED	17.82

N O D E R E S U L T S

NODE NUMBER	STREET LEVEL	PRESS	PRESS-STRTLEV	CODE	
	M	M	M		
2329	36.00	59.93	23.93	*	
2339	36.25	59.44	23.19	*	
2347	38.00	59.53	21.53	*	
2377	38.00	59.84	21.84	*	
3320	36.00	59.44	23.44	*	
3307	35.25	59.53	24.28	*	
3318	35.00	59.53	24.53	*	
3338	34.25	59.51	25.26		
3334	34.75	58.93	24.18	*	
3343	34.00	61.76	27.76		
3346	34.50	61.78	27.28		
3354	33.25	61.85	28.60		
3361	36.00	62.56	26.56		
3469	34.50	60.50	26.00		
3471	35.50	60.05	24.55	*	
3492	33.25	61.48	28.23		
4305	33.25	62.17	28.92		
3314	35.00	59.17	24.17	*	
3336	35.00	58.95	23.95	*	
4315	33.25	61.91	28.66		
2393		63.66	26.41		RESERVOIR
3494		62.76	29.51		RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	LENGTH	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	2329	2339	.0408	125.0	.49	1.25	.27	4.0
2	2329	3471	.0736	160.0	.12	-2.59	.17	.8
3	2339	3320	.0408	120.0	.00	-.09	.02	.0
4	2347	2377	.0408	70.0	.31	-1.34	.28	4.5
5	2377	2393	.0408	120.0	3.82	-3.66	.78	31.8
6	2377	3320	.0408	155.0	.40	1.00	.21	2.6
7	2393	3361	.0736	160.0	1.10	8.13	.53	6.9
8	3320	3318	.0408	150.0	.09	.45	.10	.6
9	3307	3318	.0408	120.0	.00	.02	.01	.0
10	3307	3471	.0408	115.0	.53	-1.35	.29	4.6
11	3314	3318	.0408	80.0	.36	-1.34	.28	4.5
12	3318	3354	.0408	100.0	2.32	-3.12	.66	23.2
13	3338	3334	.0408	130.0	.58	-1.34	.28	4.5
14	3338	3343	.0408	90.0	2.25	-3.24	.69	25.0
15	3338	3492	.0408	180.0	1.97	-2.12	.45	10.9
16	3343	3346	.0736	140.0	.02	-.95	.06	.1
17	3343	4315	.0736	100.0	.14	-3.62	.24	1.4
18	3346	3354	.0736	120.0	.07	-2.29	.15	.6
19	3354	3361	.0736	150.0	.71	-6.74	.44	4.7
20	3469	3471	.0736	150.0	.44	5.28	.34	3.0
21	3469	3492	.0736	150.0	.98	-7.95	.52	6.6
22	3492	3494	.0736	95.0	1.28	-11.47	.75	13.5
23	4305	4315	.0736	100.0	.26	4.96	.32	2.6
24	4305	3494	.0736	140.0	.59	6.35	.41	4.2
25	3336	3338	.0408	125.0	.56	-1.34	.28	4.5

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

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SECONDARY NETWORK, PEAK FLOW, 2010, DISTRICT 12, PAGE 1 - 5

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RADA WATER SUPPLY AND SANITATION PROJECT
CALCULATION OF THE SEC./TERT. DISTRIBUTION SYSTEM DISTRICT 12
YEAR 2010 MAXIMUM HOUR ON THE MAXIMUM DAY
INPUT FROM BOOSTER STATION MUSHALLA

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G E N E R A L D A T A

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GENERAL PIPE ROUGHNESS VALUE	:	.500 MM
START VALUE FOR PRESSURES	:	60.00 M
NUMBER OF PIPES	:	53
NUMBER OF VALVES	:	0
NUMBER OF NODES	:	40
NUMBER OF RESERVOIRS	:	2
NUMBER OF PUMPS	:	0
NUMBER OF HYDRANTS	:	0
NUMBER OF BOOSTERS	:	0
NUMBER OF PRESSURE REDUCERS	:	0
PIPES .041 M DIAM. LENGTH	:	3325.00 M
PIPES .074 M DIAM. LENGTH	:	1285.00 M
PIPES TOTAL LENGTH	:	4610.00 M
TOLERATION PRESSURE / NODE	:	.025 M
WATER TEMPERATURE	:	25.00 C
CALCULATION FOR YEAR	:	2010
CONSUMPTION FACTOR CATEGORY 1	:	2.00
TOTAL WATER CONSUMPTION	:	23.87 M3/H

R E S E R V O I R R E S U L T S

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RESERV NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	STATUS	DIS-CHARGE
	M	M	M	M		M3/H
392	.00	.00	63.66	26.16	FIXED	2.12
306	.00	.00	66.12	26.12	FIXED	22.15

N O D E R E S U L T S

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NODE NUMBER	X-COORD	Y-COORD	PRESS	PRESS-STRTLEV	CODE	
	M	M	M	M		
1278	.00	.00	61.97	17.22	**	
1279	.00	.00	62.01	17.51	**	
1286	.00	.00	61.97	16.72	**	
1287	.00	.00	62.02	17.02	**	
1339	.00	.00	64.76	19.01	**	
1349	.00	.00	64.20	17.20	**	
1378	.00	.00	63.84	17.84	**	
1379	.00	.00	63.89	15.89	**	
2203	.00	.00	62.45	19.70	**	
2206	.00	.00	62.45	17.95	**	
2225	.00	.00	62.75	22.25	*	
2310	.00	.00	63.99	16.24	**	
2313	.00	.00	65.13	25.13		
2315	.00	.00	63.74	13.99	***	
2316	.00	.00	63.61	15.61	**	
2317	.00	.00	65.00	19.00	**	
2318	.00	.00	64.59	18.59	**	
2322	.00	.00	63.50	11.25	***	
2323	.00	.00	63.34	13.84	***	
2340	.00	.00	64.30	25.80		
2346	.00	.00	64.02	24.52	*	
2347	.00	.00	63.87	25.87		
2348	.00	.00	63.39	9.14	***	
2349	.00	.00	63.41	12.41	***	
2352	.00	.00	63.53	11.28	***	
2355	.00	.00	63.66	16.41	**	
2358	.00	.00	63.39	9.39	***	
2360	.00	.00	63.54	18.79	**	
2362	.00	.00	63.40	14.40	***	
2364	.00	.00	63.40	10.40	***	
2366	.00	.00	63.51	18.01	**	
2367	.00	.00	63.51	23.01	*	
2370	.00	.00	62.25	18.25	**	
2375	.00	.00	63.67	15.67	**	
2377	.00	.00	63.80	26.05		
2380	.00	.00	63.63	9.13	***	
2382	.00	.00	63.70	25.95		
2385	.00	.00	63.56	13.81	***	
2395	.00	.00	63.55	21.55	*	
2320	.00	.00	63.57	13.07	***	
2392	.00	.00	63.66	26.16		RESERVOIR
2306	.00	.00	66.12	26.12		RESERVOIR

CODE: *** PRESSURE BELOW 15M+ STREET LEVEL
** PRESSURE BETWEEN 20M+ AND 15M+ STREET LEVEL
* PRESSURE BETWEEN 25M+ AND 20M+ STREET LEVEL

P I P E R E S U L T S

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PIPE NUMBER	NODE NUMBER BEGIN	END	DIA-METER	MEAN PRESS	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
1	1278	1279	.0408	61.99	.04	-.54	.11	.8
2	1279	1287	.0408	62.01	.00	-.02	.01	.0
3	1279	2370	.0408	62.13	.23	-1.07	.23	2.9
4	1286	1287	.0408	61.99	.05	-.54	.11	.8
5	1287	2206	.0408	62.23	.44	-1.09	.23	3.0
6	1339	1349	.0736	64.48	.56	7.55	.49	5.9
7	1339	2306	.0736	65.44	1.36	-11.54	.75	13.6
8	1339	2310	.0408	64.38	.76	3.27	.69	25.5
9	1349	1379	.0736	64.04	.31	7.02	.46	5.1
10	1378	1379	.0408	63.86	.05	-.54	.11	.8
11	1379	2355	.0736	63.78	.22	5.94	.39	3.7
12	2203	2206	.0408	62.45	.00	-.11	.02	.0
13	2203	2225	.0408	62.60	.31	-.95	.20	2.3
14	2206	2367	.0408	62.98	1.05	-1.75	.37	7.5
15	2225	2392	.0408	63.21	.91	-1.51	.32	5.7
16	2306	2313	.0736	65.63	.99	8.57	.56	7.6
17	2306	2317	.0408	65.56	1.12	2.04	.43	10.2
18	2310	2315	.0408	63.87	.25	1.43	.30	5.1
19	2310	2316	.0408	63.80	.38	1.30	.28	4.3
20	2313	2340	.0736	64.72	.84	7.87	.51	6.4
21	2315	2352	.0408	63.64	.21	.89	.19	2.1
22	2316	2322	.0408	63.56	.11	.76	.16	1.5
23	2317	2318	.0408	64.80	.41	1.48	.31	5.4
24	2318	2340	.0408	64.45	.30	.94	.20	2.3
25	2322	2348	.0408	63.45	.11	.65	.14	1.1
26	2322	2352	.0408	63.52	.03	-.45	.09	.6
27	2323	2349	.0408	63.38	.07	-.54	.11	.8
28	2340	2346	.0736	64.16	.28	8.27	.54	7.1
29	2346	2347	.0736	63.94	.14	6.22	.41	4.1
30	2346	2349	.0408	63.71	.60	1.52	.32	5.7
31	2347	2375	.0408	63.77	.20	1.00	.21	2.6
32	2347	2377	.0736	63.84	.07	4.69	.31	2.4
33	2348	2349	.0408	63.40	.02	-.44	.09	.6
34	2348	2358	.0408	63.39	.00	-.01	.00	.0
35	2352	2360	.0408	63.54	.00	-.07	.02	.0
36	2355	2360	.0736	63.60	.13	4.87	.32	2.5
37	2355	2320	.0408	63.62	.10	-.54	.11	.8
38	2358	2362	.0408	63.39	.01	-.27	.06	.2
39	2358	2364	.0408	63.39	.01	-.17	.04	.1
40	2360	2366	.0736	63.52	.03	2.12	.14	.5
41	2360	2370	.0408	62.89	1.29	2.15	.46	11.2
42	2362	2364	.0408	63.40	.00	.01	.00	.0
43	2362	2366	.0408	63.45	.11	-.85	.18	1.9
44	2364	2385	.0408	63.48	.16	-.81	.17	1.7
45	2366	2367	.0736	63.51	.00	.78	.05	.1
46	2367	2395	.0736	63.53	.04	-1.51	.10	.3

OSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

PIPE NUMBER	NODE NUMBER BEGIN	NODE NUMBER END	DIA-METER	MEAN PRESS	HEAD LOSS	DIS-CHARGE	VELO-CITY	PRESSURE GRADIENT
			M	M	M	M3/H	M/S	M/KM
47	2375	2380	.0408	63.65	.04	.46	.10	.6
48	2377	2380	.0408	63.72	.17	.73	.16	1.4
49	2377	2382	.0736	63.75	.10	3.42	.22	1.3
50	2380	2385	.0408	63.60	.07	.65	.14	1.1
51	2382	2385	.0408	63.63	.14	.70	.15	1.3
52	2382	2392	.0736	63.68	.04	2.07	.13	.5
53	2392	2395	.0736	63.60	.11	2.68	.17	.8

POSITIVE DISCHARGE FROM LOW TO HIGH NODE-NUMBER

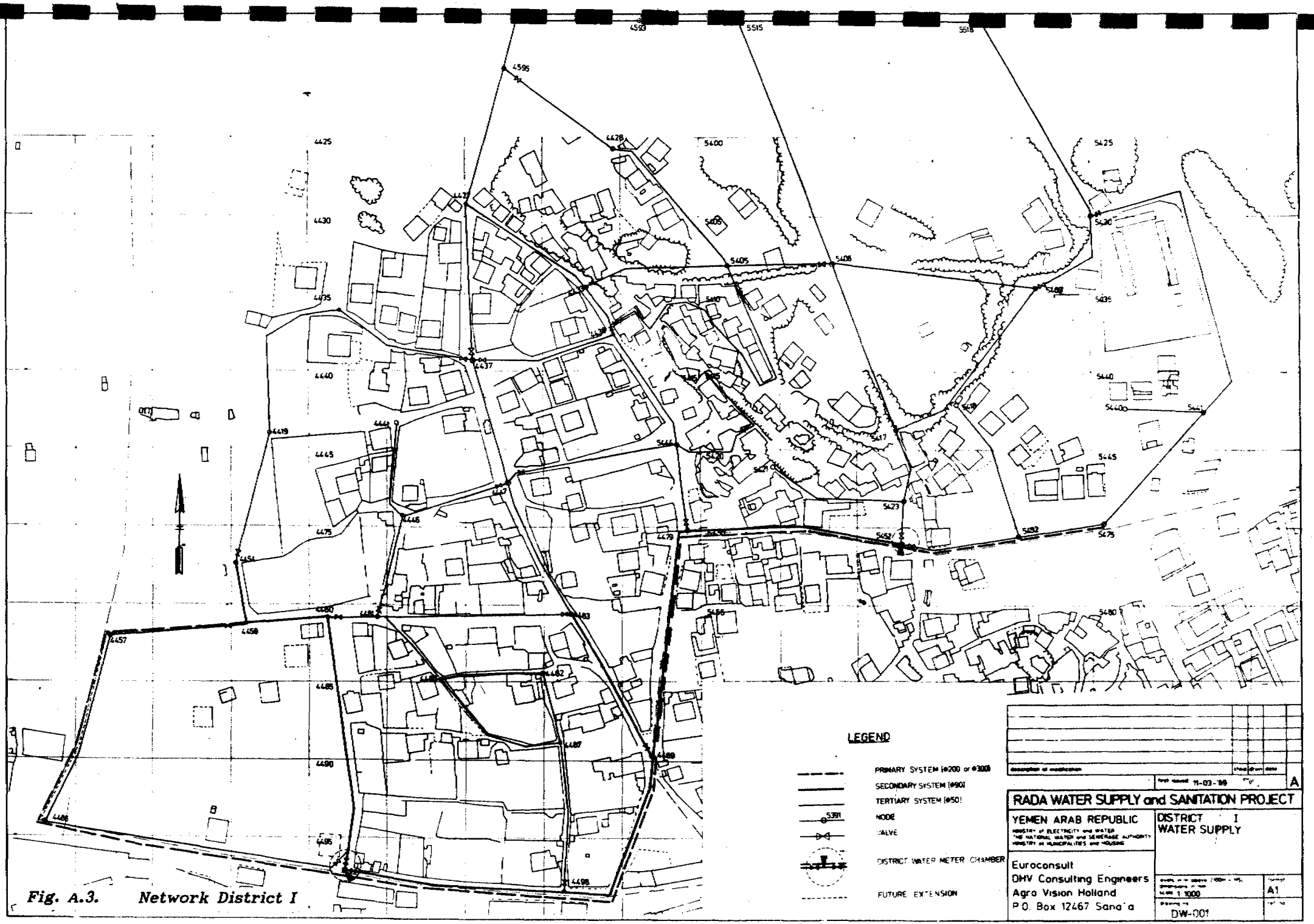


Fig. A.3. Network District I

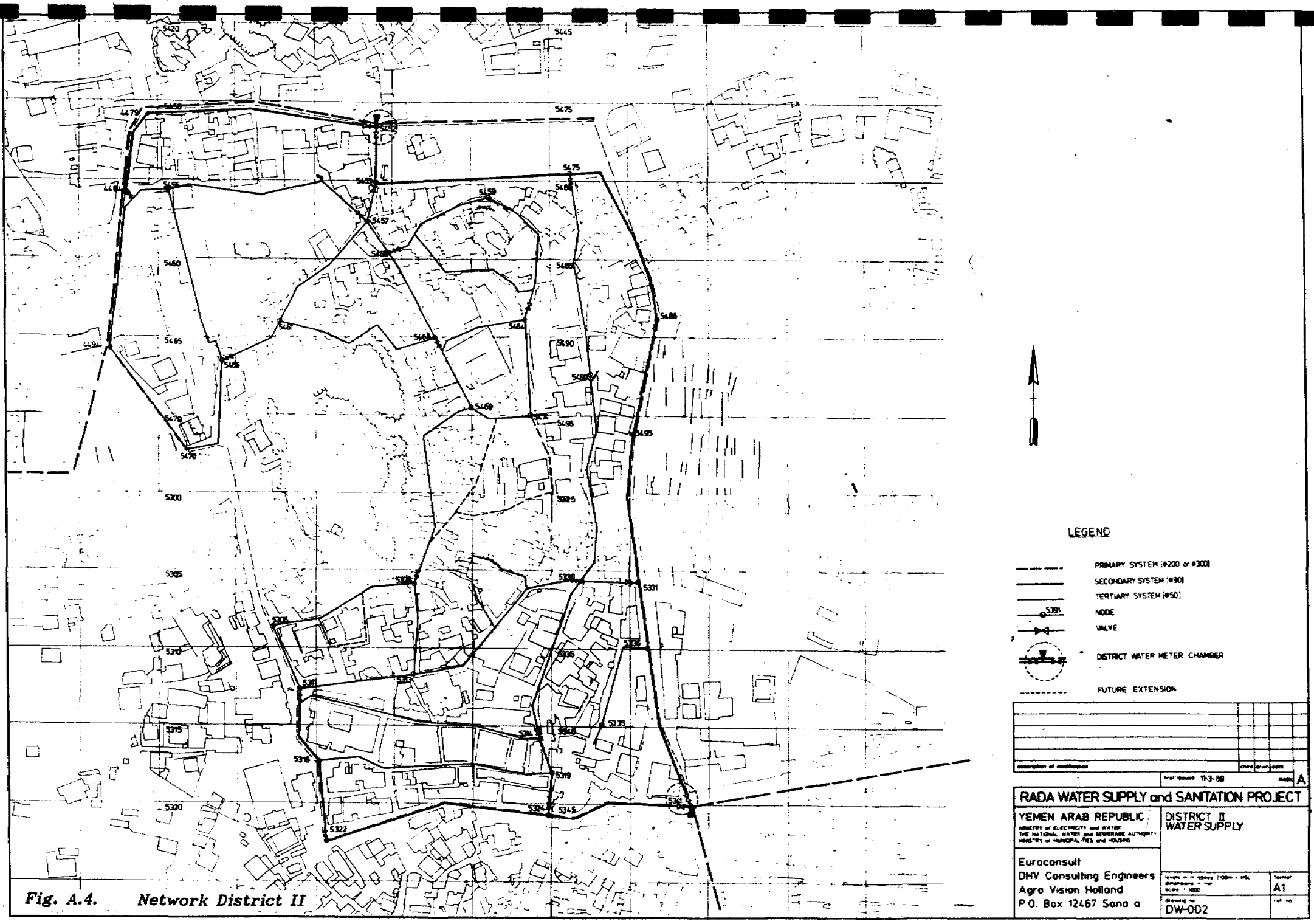


Fig. A.4. Network District II

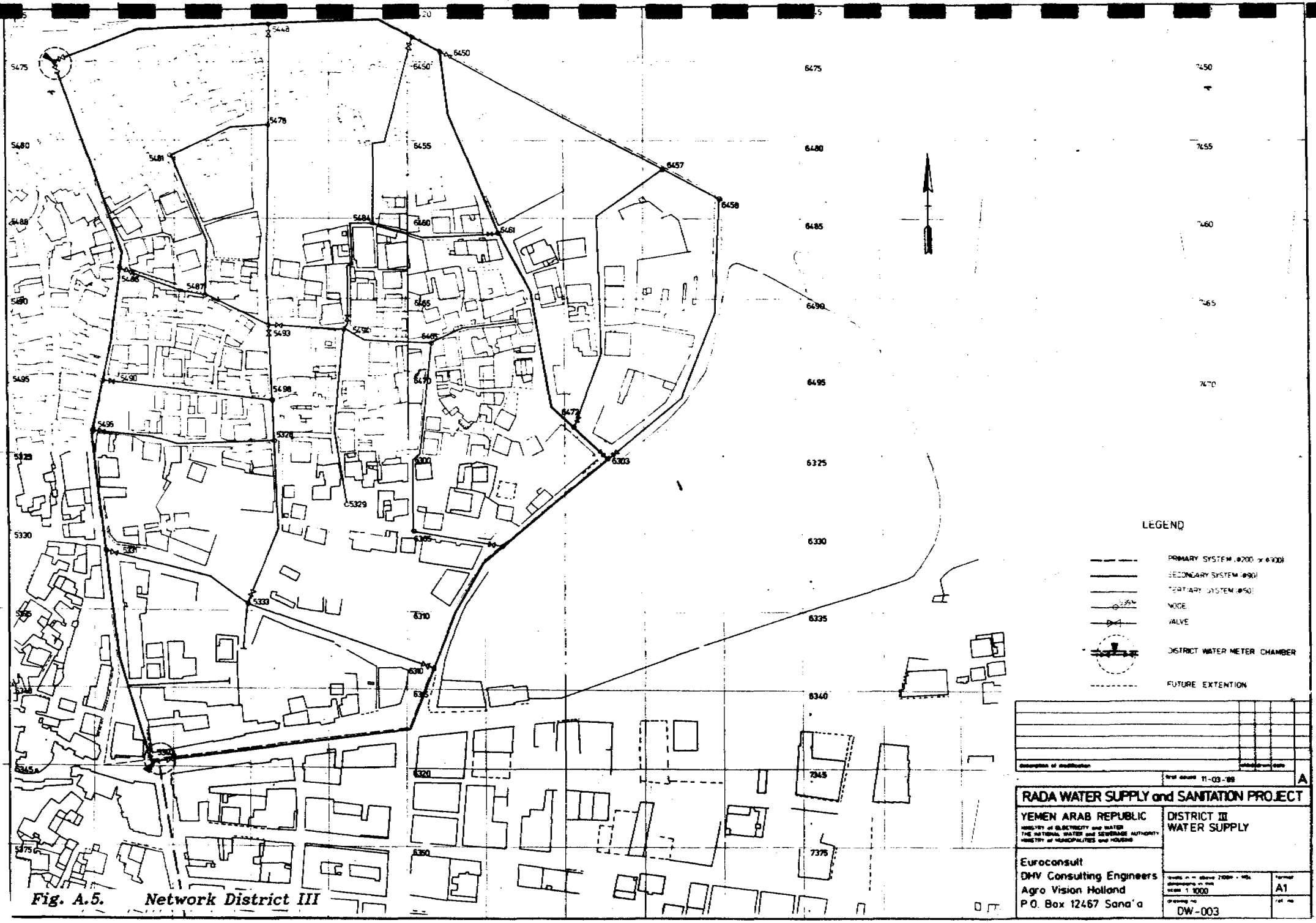


Fig. A.5. Network District III

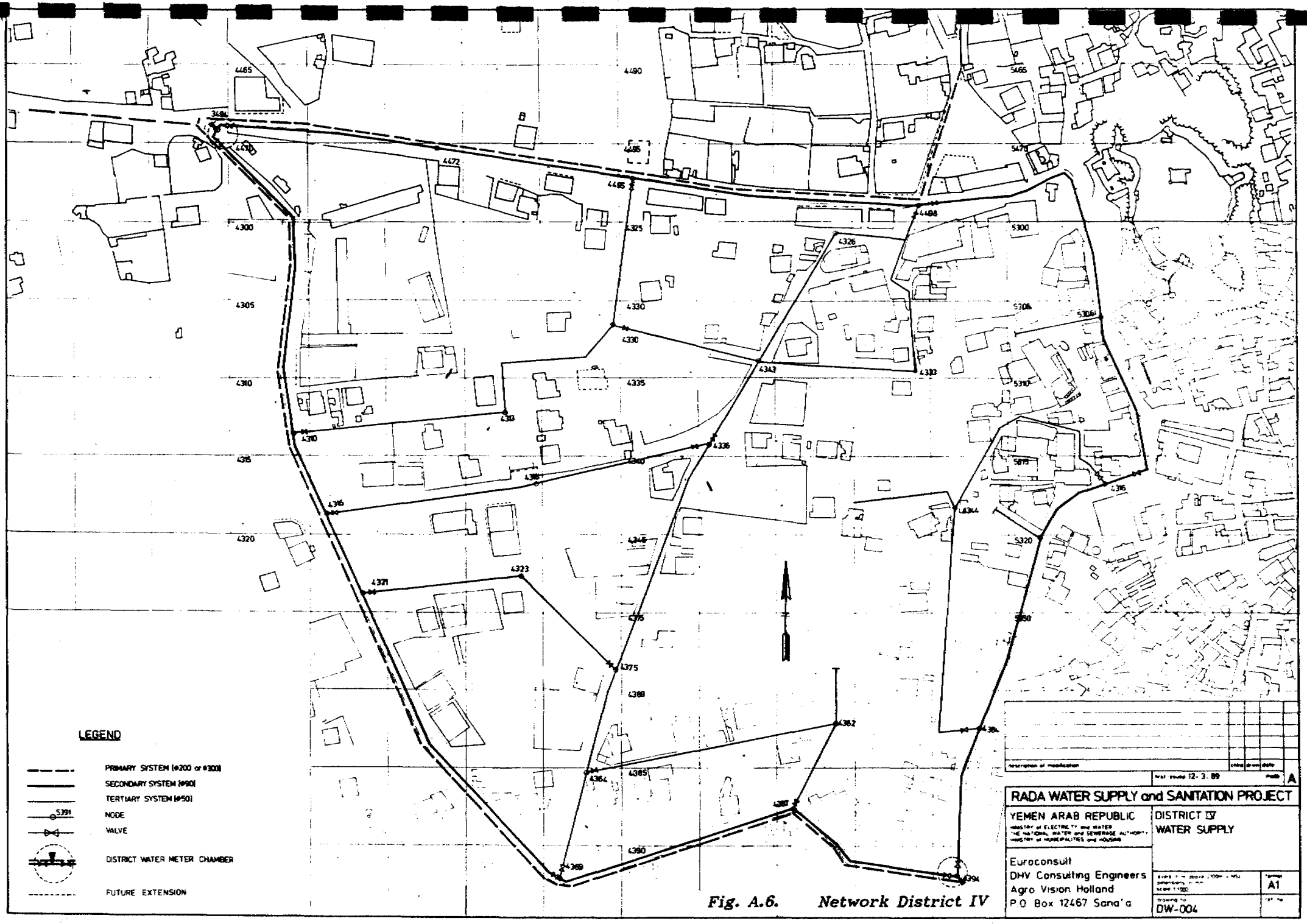
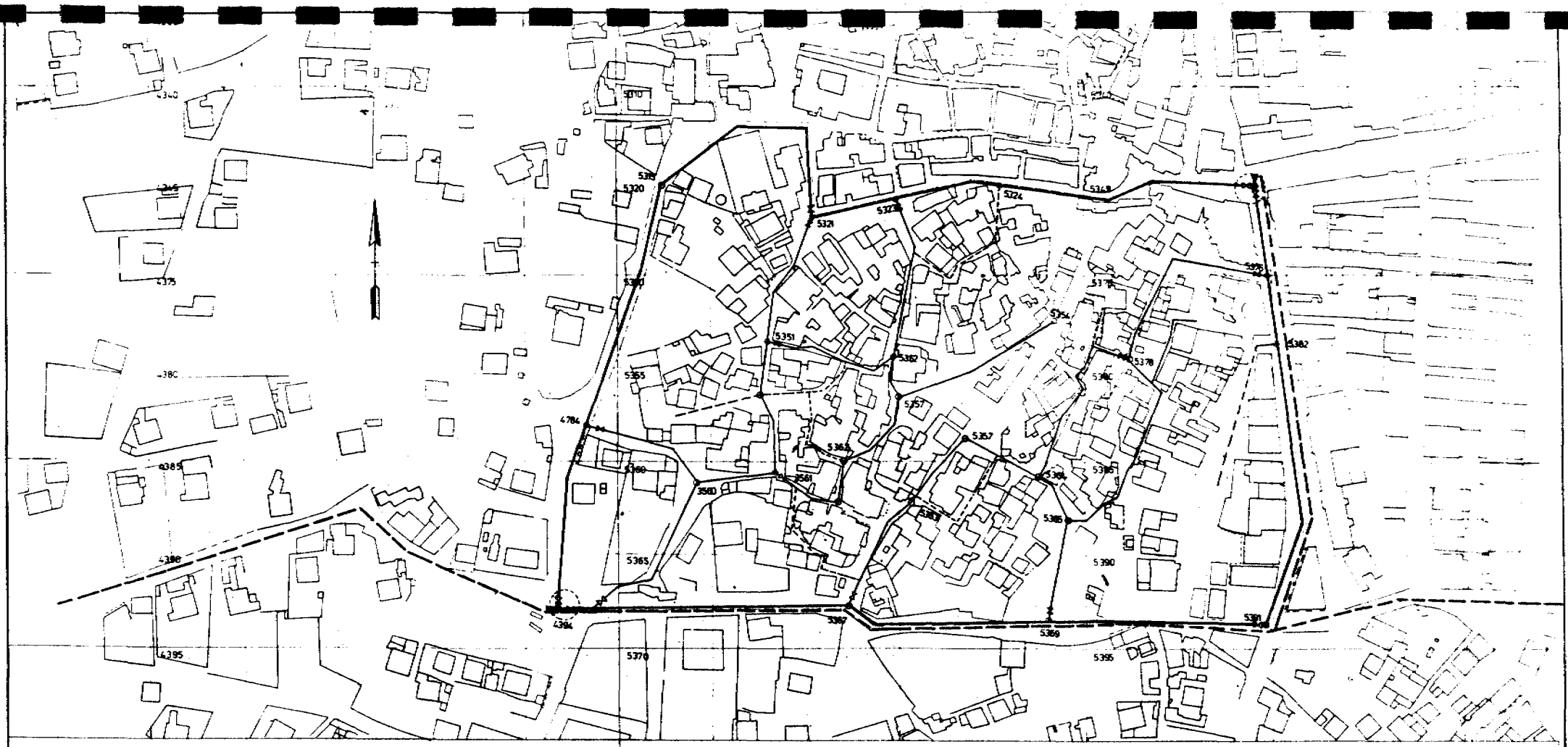


Fig. A.6. Network District IV



LEGEND

- PRIMARY SYSTEM (ø300 or ø200)
- SECONDARY SYSTEM (ø150)
- TERTIARY SYSTEM (ø90)
- NODE
- VALVE
- DISTRICT WATER METER CHAMBER
- FUTURE EXTENTION

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

DISTRICT V
WATER SUPPLY

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P O Box 12467 Sana'a

A1

DW 005

Fig. A.7. Network District V

Fig. A.8. *Network District VI*

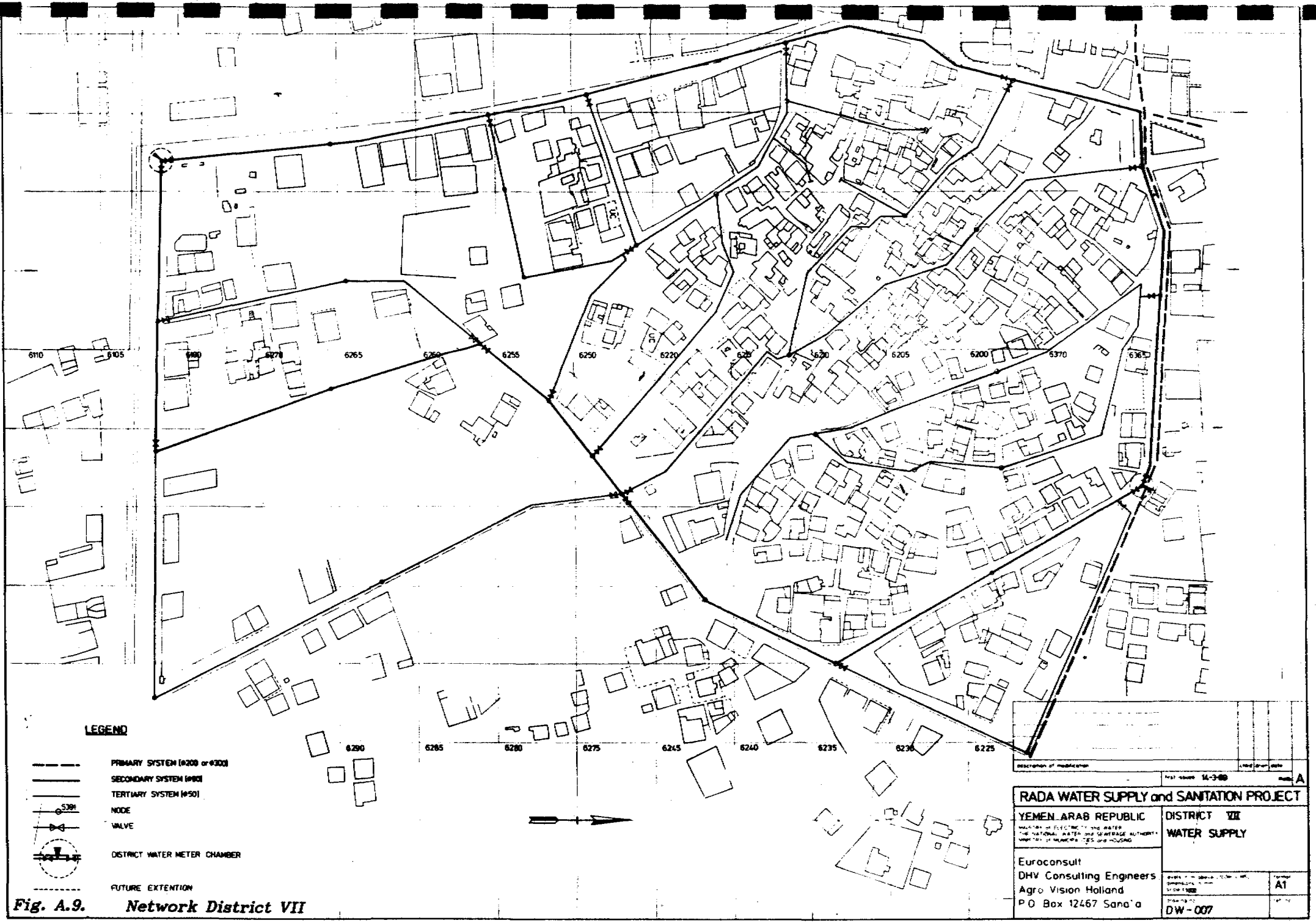


Fig. A.9. ***Network District VII***

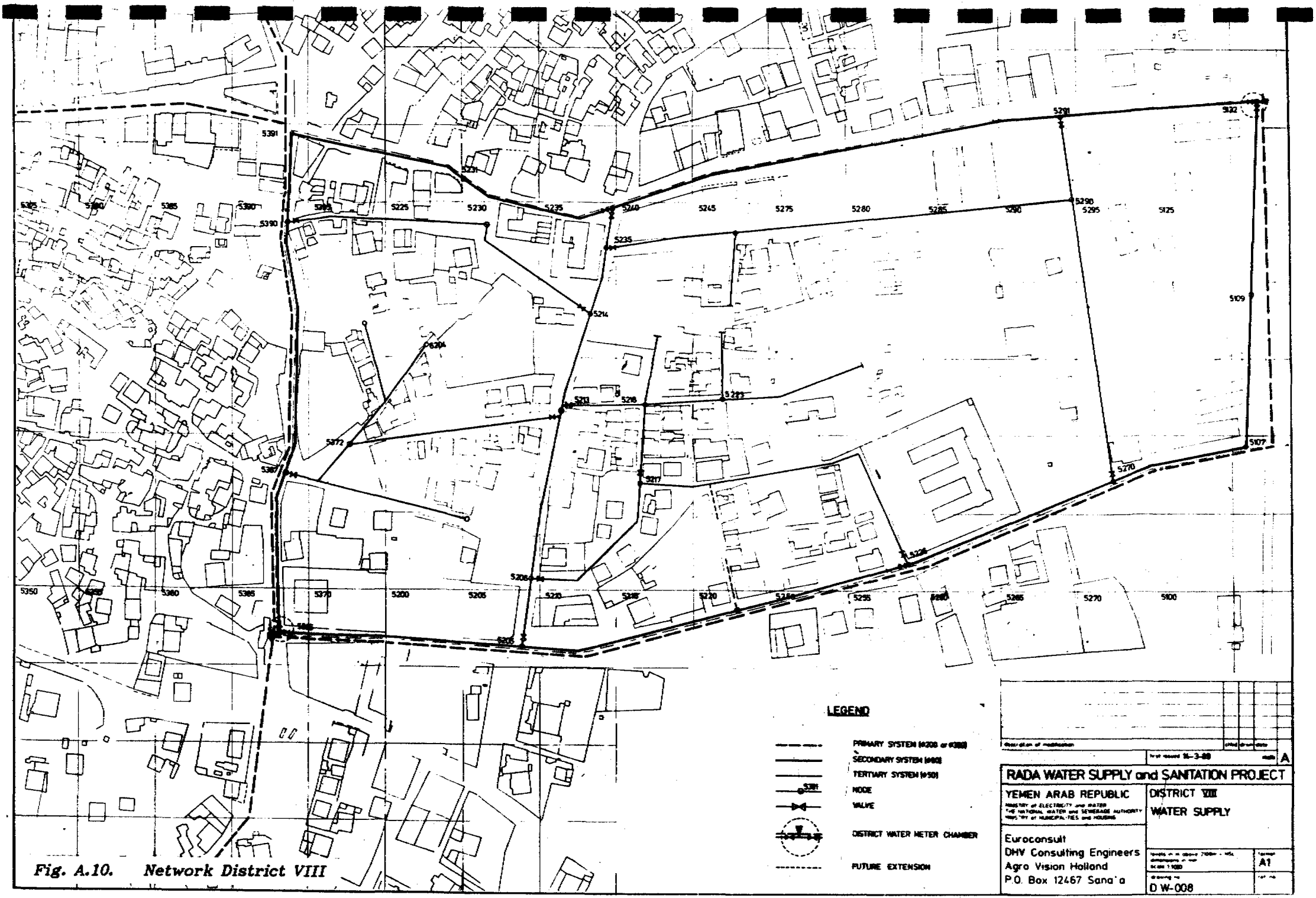


Fig. A.10. Network District VIII

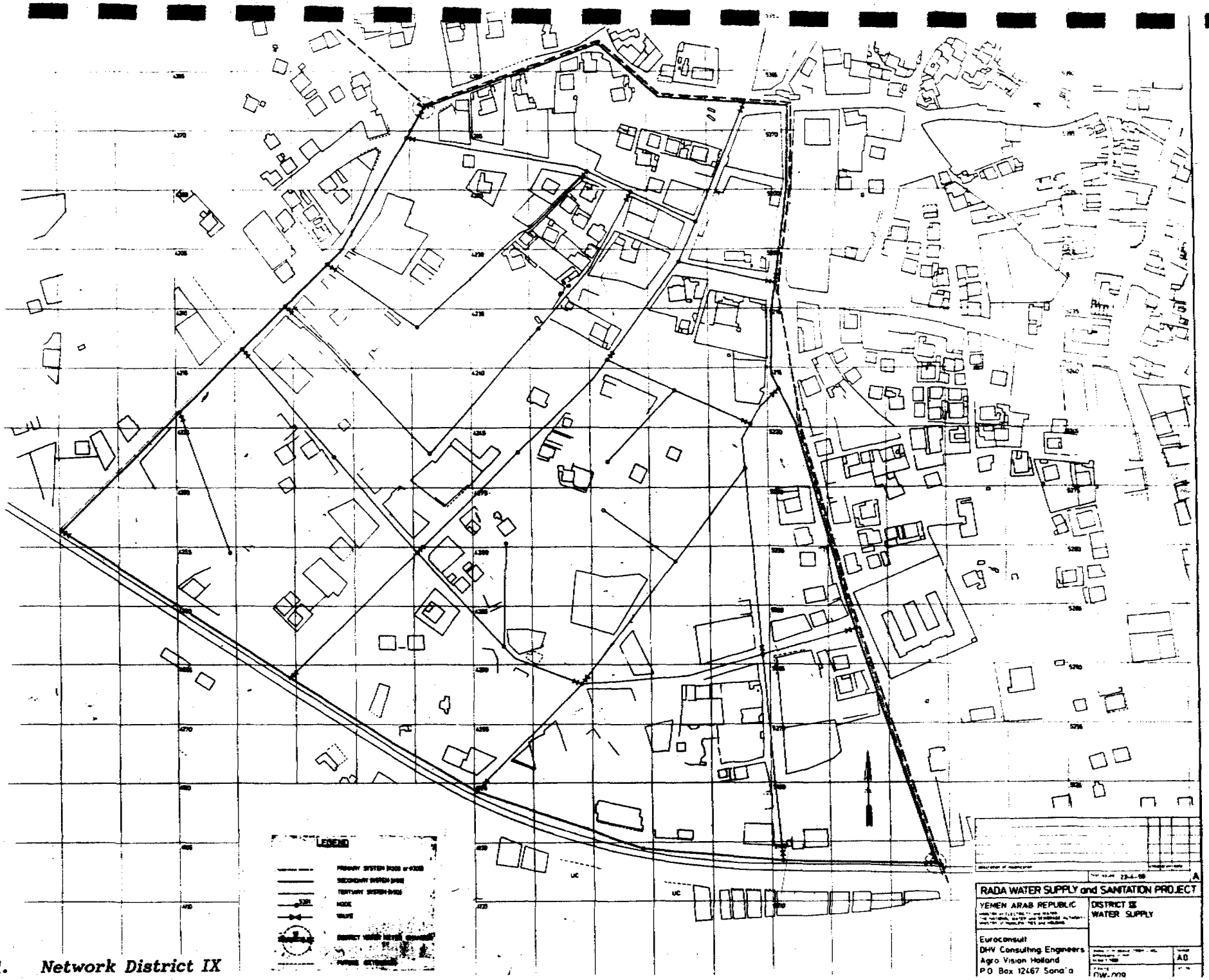


Fig. A.11. Network District IX

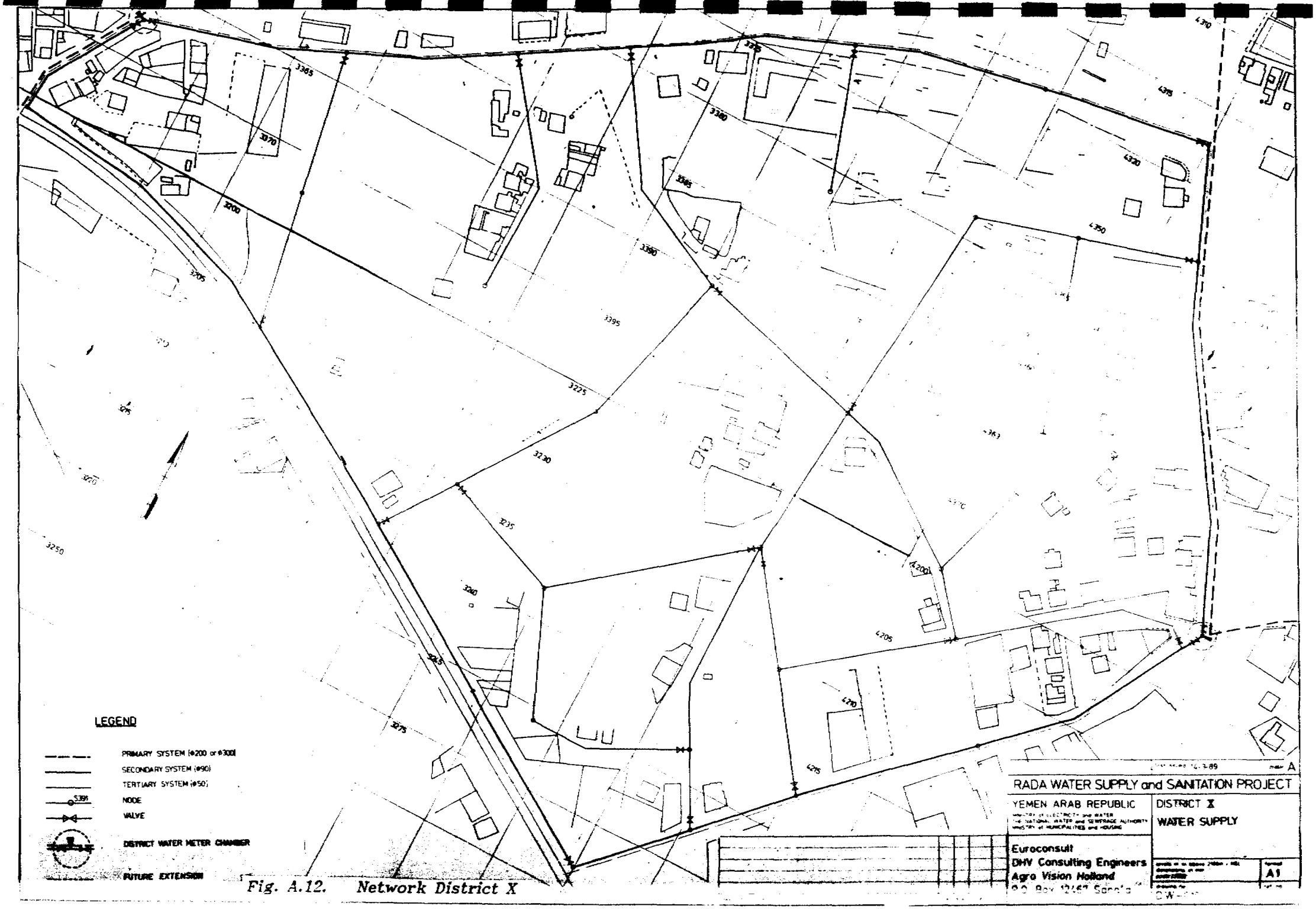


Fig. A.12. Network District X

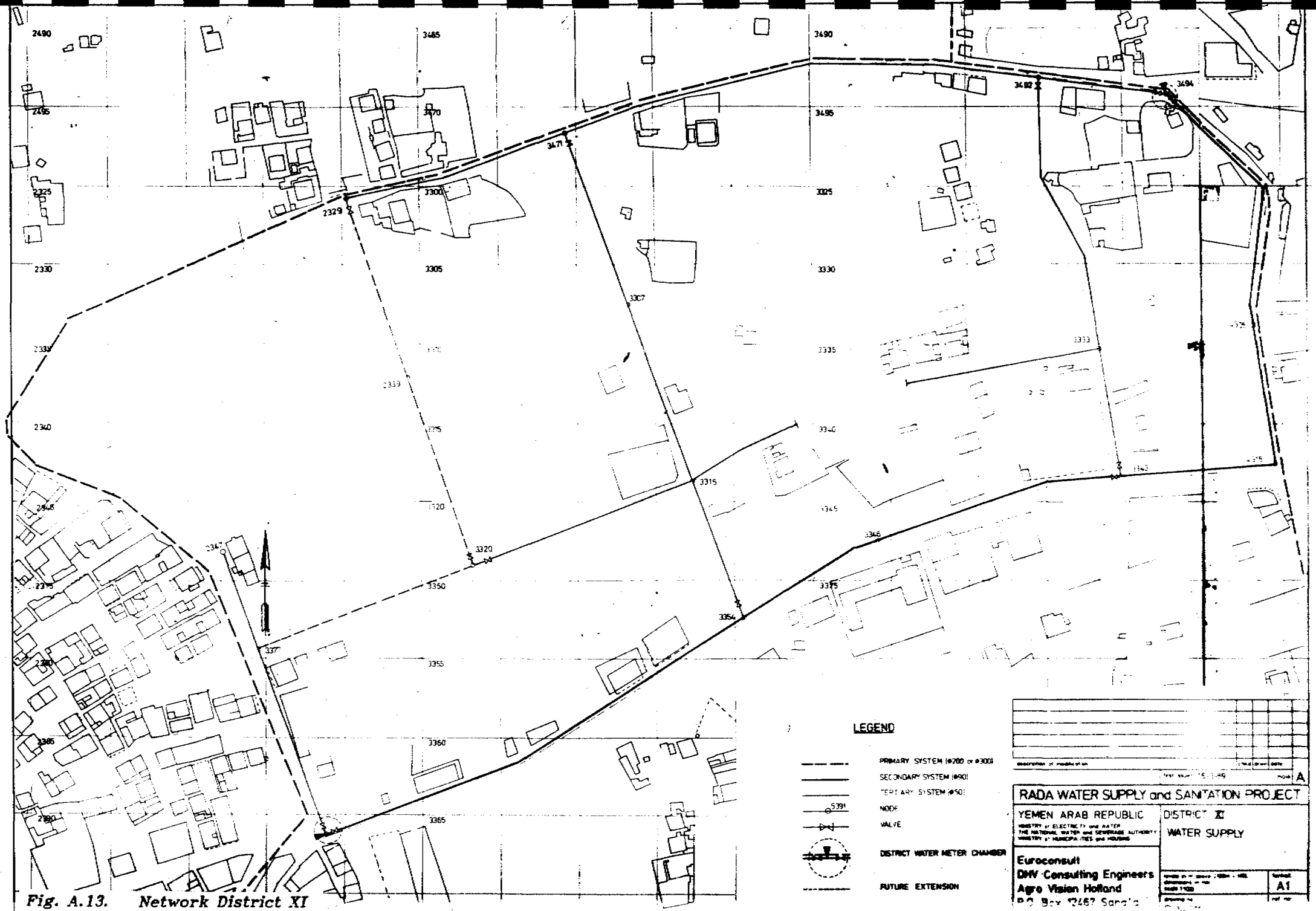


Fig. A.13. Network District XI

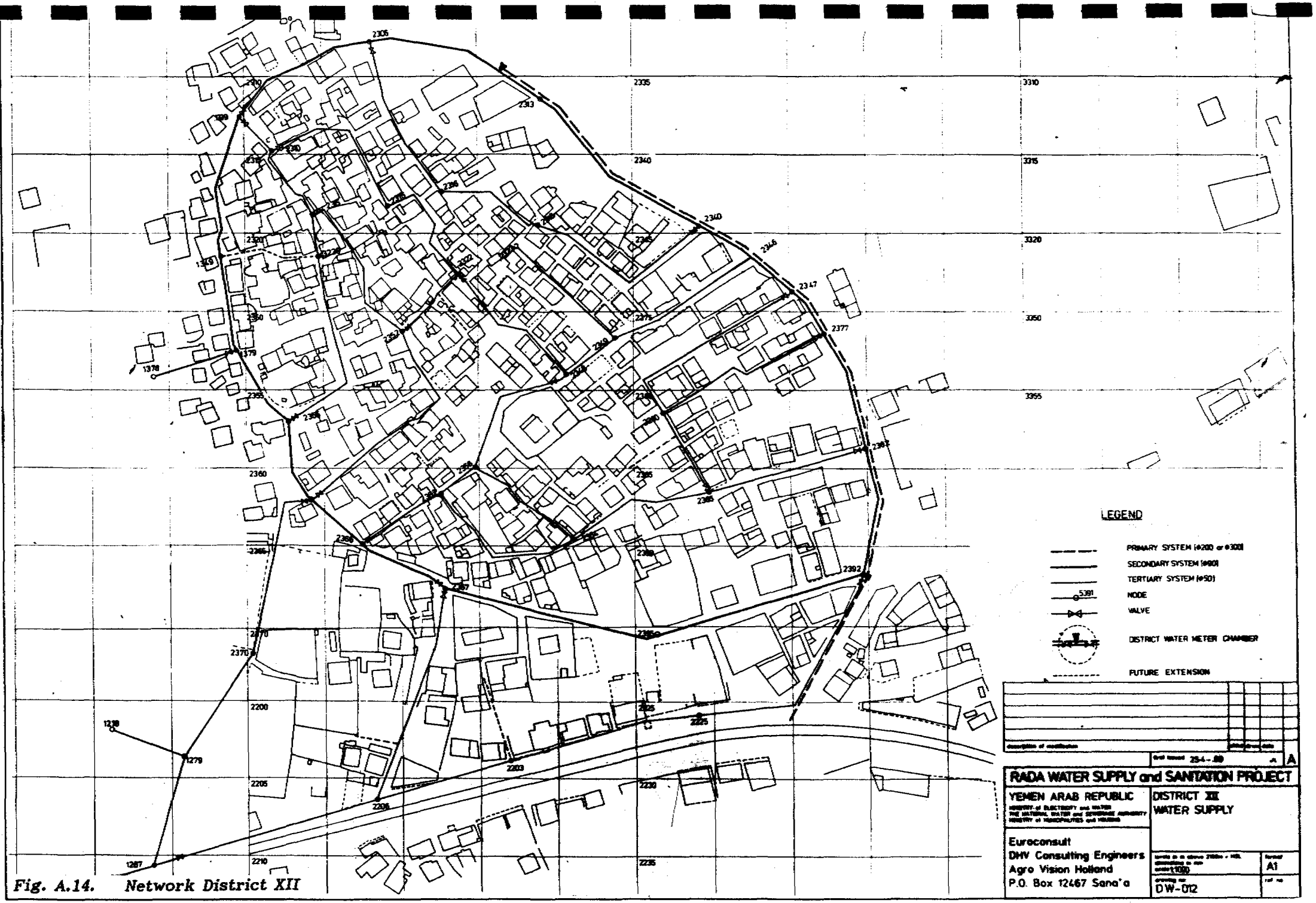
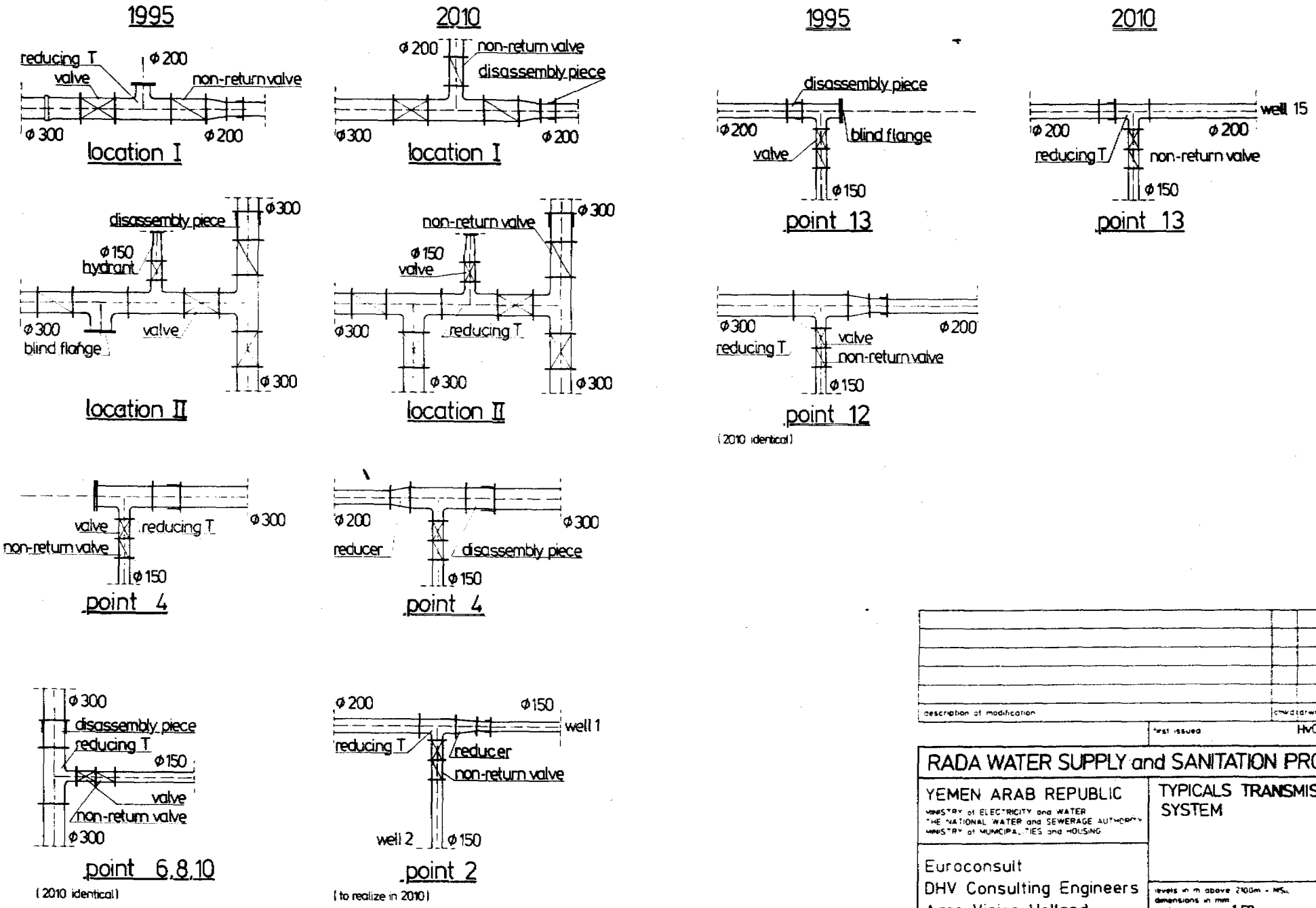


Fig. A.14. Network District XII

District network drawings of district XX - XXV are only available on A1 size. (drawings corresponding with Fig. no. A.15 thru A.19 a+b).
They are not included in this annex, because they show not any details of the networks yet.
The extension to these districts is planned after 1992 and the present development is yet too uncertain, to make final details now.



description of modification	chk'd/drwn	date
first issued	HvO	160489

A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

TYPICALS TRANSMISSION SYSTEM

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 12467 Sana'a

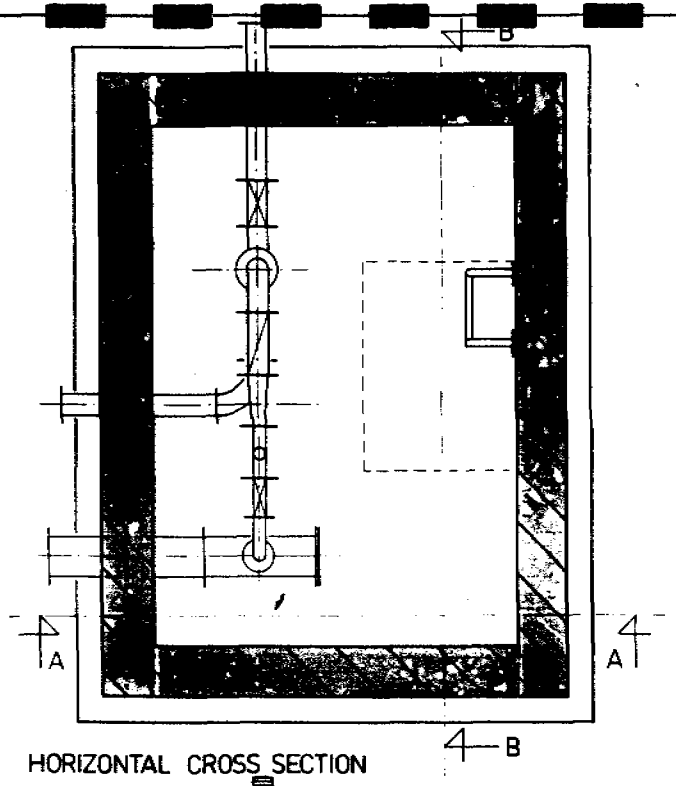
levels in m above 2400m - MSL
dimensions in mm
scale 1:50

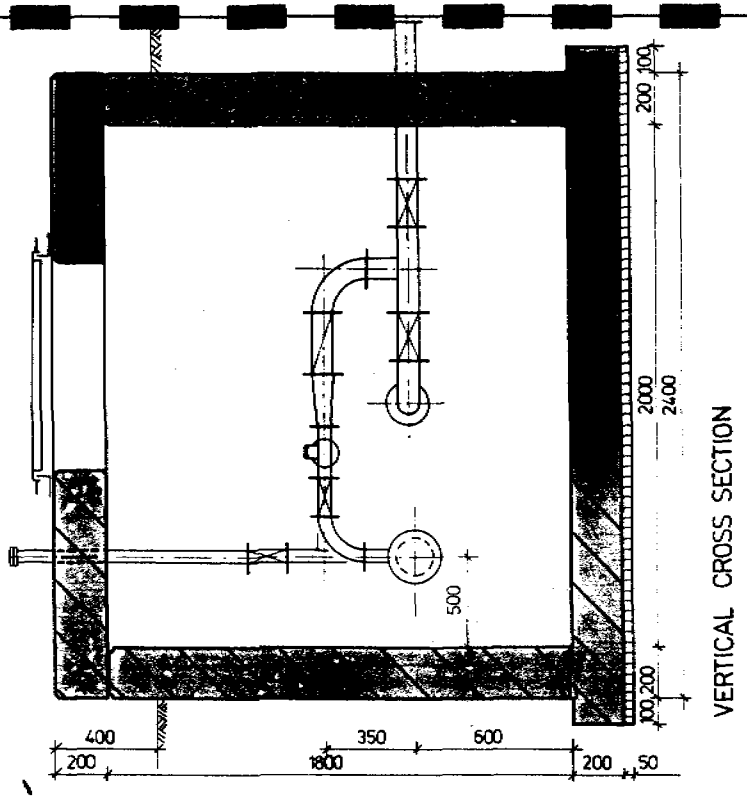
format A3

drawing no W-0217

ref no

Fig. A.20. Typicals, transmission system





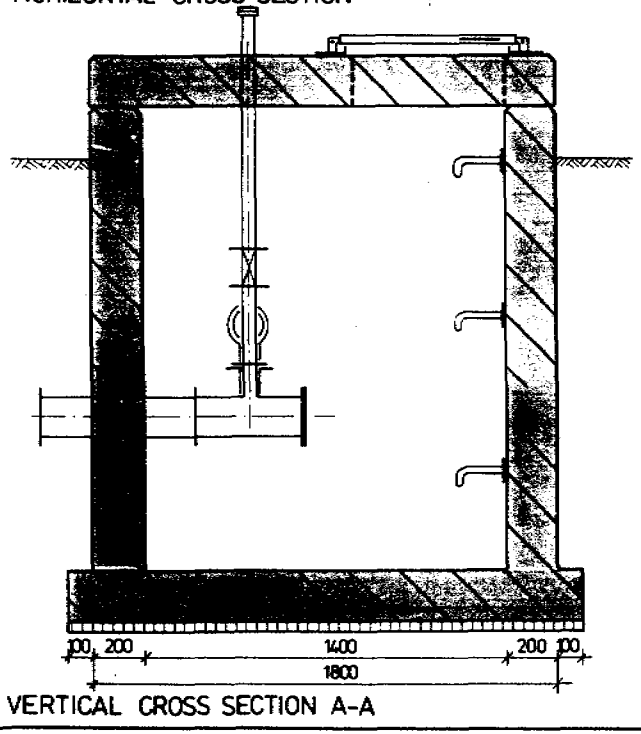


Fig. A.21. Typical district water meter chamber (feeding 1 district)

description of modification	chkd	drwn	date
first issued 25-5-89			A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 12467 Sana'a

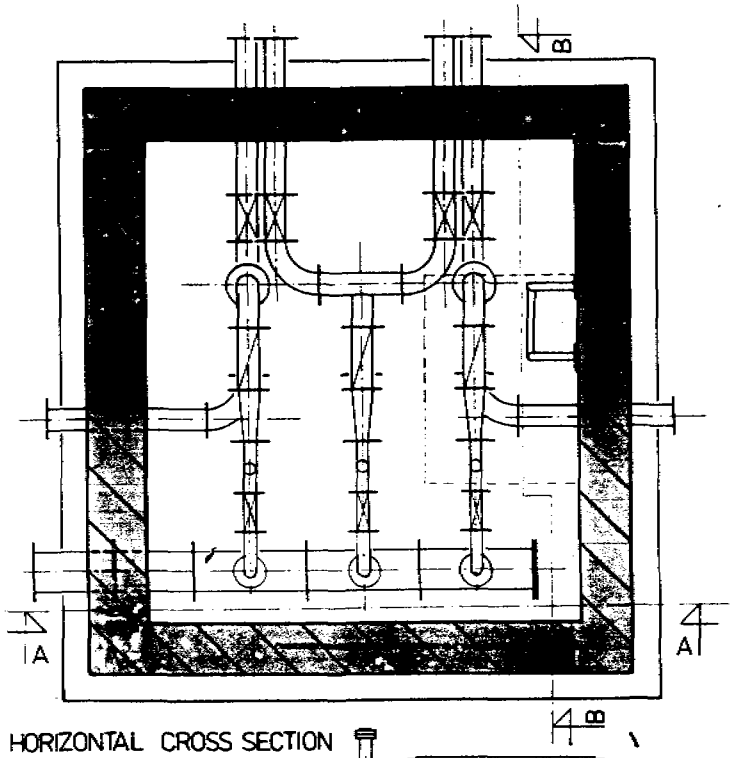
TYPICAL DISTRICT WATER METER CHAMBER, FEEDING 1 DISTRICT

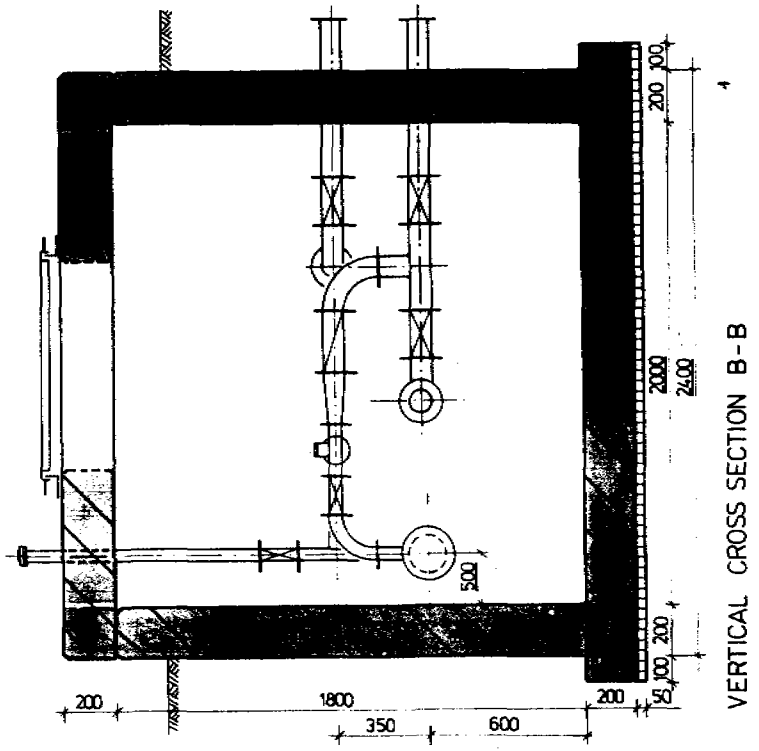
levels in m above 2100m - MSL
dimensions in mm
scale 1:20

format A3

drawing no W-0905

ref no





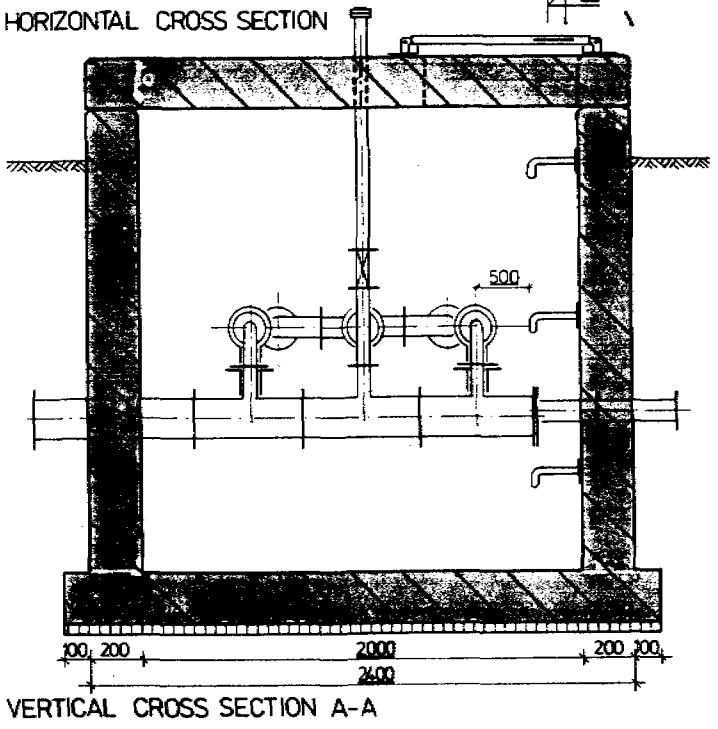


Fig. A.22. Typical district water meter chamber (feeding 3 districts)

description of modification	chkd	drwn	date
first issued 25-5-89			A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

TYPICAL DISTRICT WATER METER CHAMBER, FEEDING 3 DISTRICTS

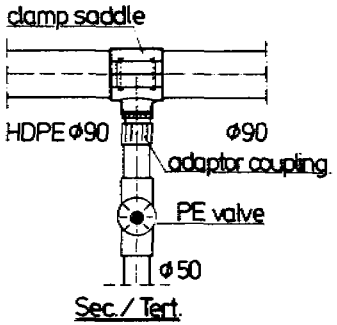
Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 12467 Sana'a

levels in m above 2100m + MSL
dimensions in mm
scale 1: 20

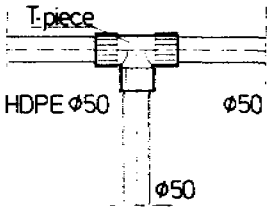
format A3

drawing no W-0907

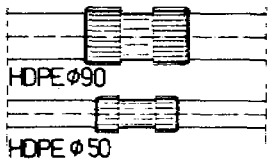
ref no.



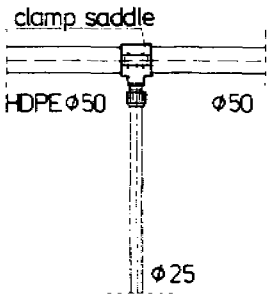
Sec./ Tert.



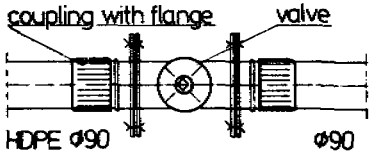
Tert/ Tert



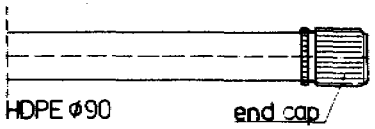
Sec. Tert coupling

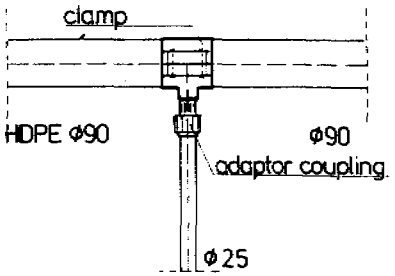


Tert/ House connection

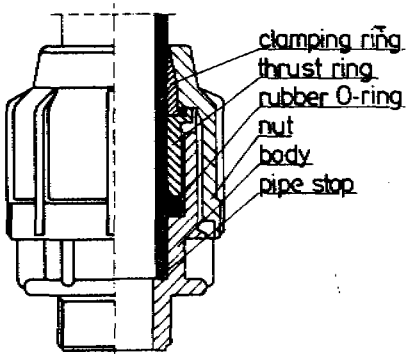


Sec. valve





Sec./ House connection



Fitting

description of modification	checked	date	
first issued	HvO	24-4-89	A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

TYPICALS SECONDARY & TERTIARY WATER DISTRIBUTION SYSTEM

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Agro Vision Holland
P.O. Box 12467 Sana'a

levels in m above 2100m - MSL
dimensions in mm
scale 1:10

format A3

drawing no W-0912

ref. no

Fig. A.23. Typicals, secondary/tertiary water distribution system

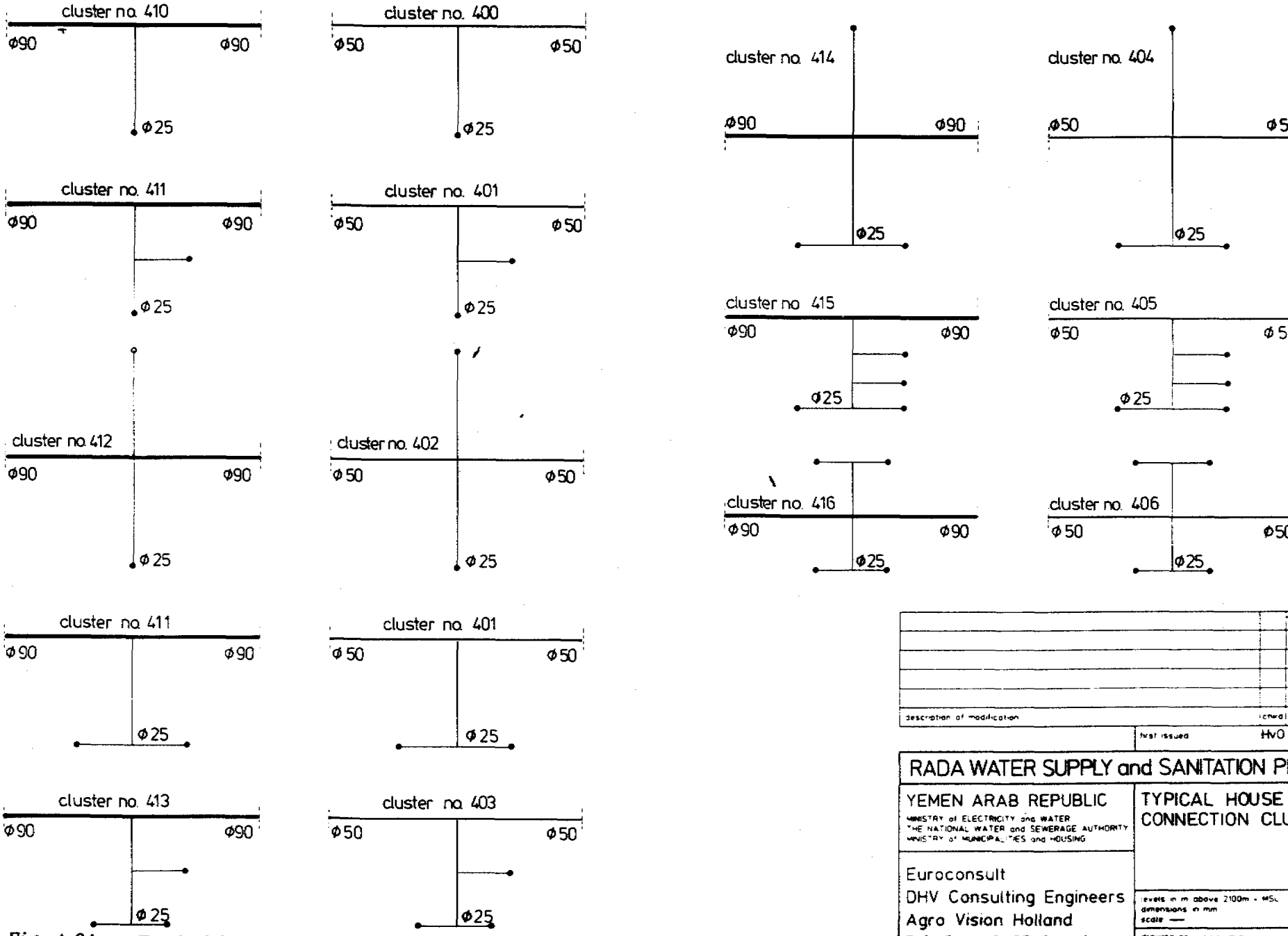

Fig. A.24. Typical house connection clusters

description of modification	ch'ed	dr'wn	date	
first issued		HvO	290489	A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

TYPICAL HOUSE CONNECTION CLUSTERS

Euroconsult
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Agro Vision Holland
P.O. Box 12467 Sana'a

levels in m above 2100m - MSL
dimensions in mm
scale —

format A3

drawing no W-0914

ref no

ANNEX B WASTE WATER DISPOSAL

TABLE OF CONTENTS

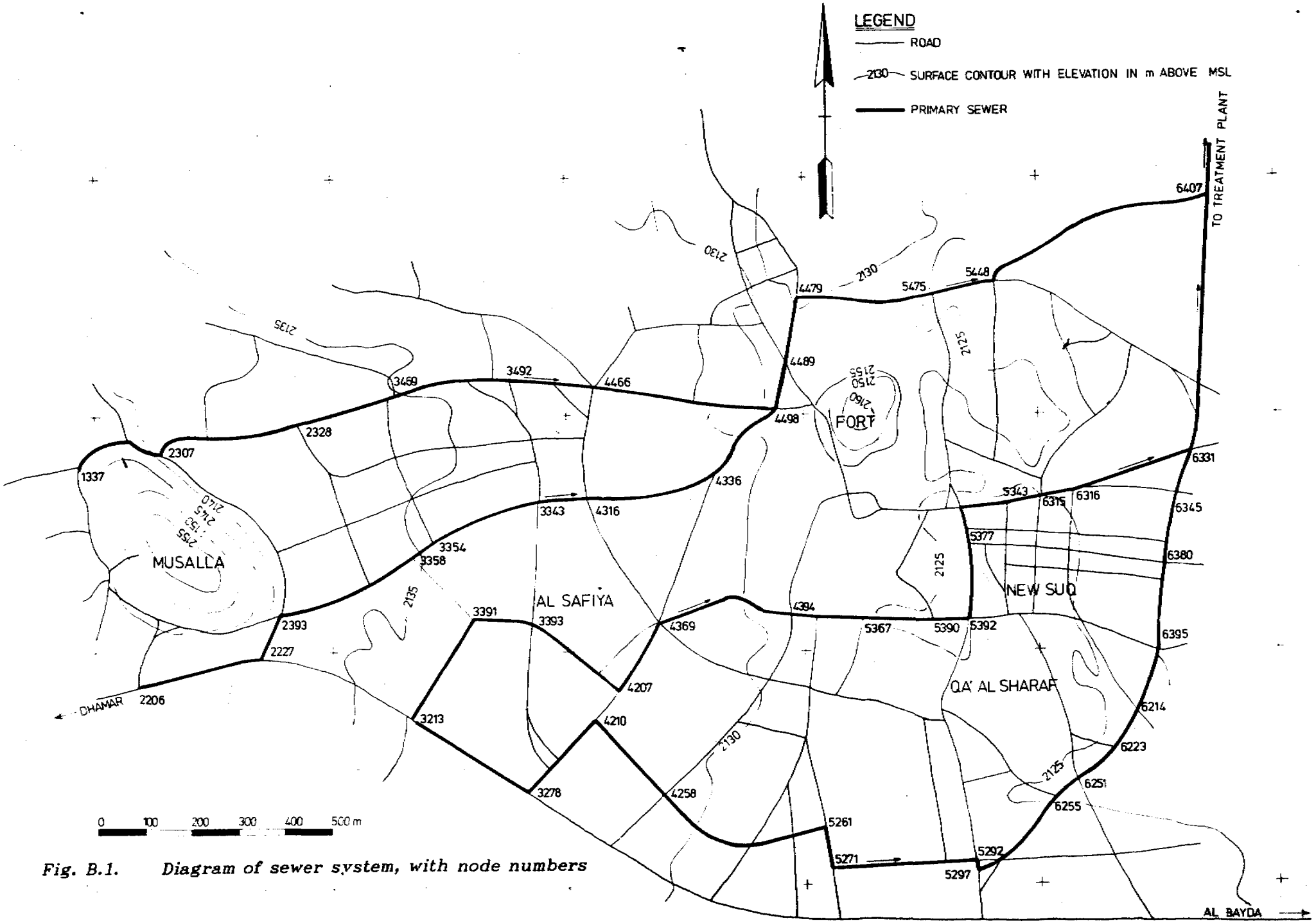


Fig. B.1. Diagram of sewer system, with node numbers

SANITARY SEWER SYSTEM
MAIN SEWER : NORTH
WASTE WATER PRODUCTION 0.8 * 70 * 1.1 L/(C.DAY) YEAR 2010

NODE No.	LEVEL SURF. [m]	LEVEL INVERT [m]	DIAM. [m]	COVER [m]	L [m]	SLOPE SURF. [1:]	SLOPE INVERT [1:]	CAPITA INCR.	CAPITA CUM.	FLOW AVRG. [l/s]	FLOW PEAK [l/s]	Q-PEAK/ Q-FULL [%]	V [m/s]	TAU [N/m²]
1337	41.90	40.75		1.00										
			0.15		310	150	140	1500	1500	1.1	3.2	24%	0.59	1.8
2307	39.89	38.45		1.25										
			0.19		80	30	30	500	2000	1.4	4.3	8%	1.08	7.5
2304	37.13	35.69		1.25										
			0.19		250	200	190	1250	3250	2.3	7.0	34%	0.68	1.9
2328	35.86	34.37		1.30										
			0.19		270	180	180	1000	4250	3.0	8.9	43%	0.75	2.2
3469	34.35	32.91		1.25										
			0.19		150	120	130	1300	5550	4.0	10.9	45%	0.88	3.1
3492	33.15	31.71		1.25										
			0.19		175	440	170	1400	6950	5.0	13.0	61%	0.77	2.9
4466	32.75	30.66		1.90										
			0.19		380	110	140	2000	8950	6.4	15.9	67%	0.85	3.7
4498	29.37	27.93		1.25										
2206	42.00	40.85		1.00										
			0.15		275	100	90	2250	2250	1.6	4.8	29%	0.79	2.9
2227	39.21	37.77		1.25										
			0.19		155	70	70	800	3050	2.2	6.5	20%	0.88	4.0
2393	36.85	35.41		1.25										
			0.19		285	100	100	1900	4950	3.5	10.0	36%	0.96	3.6
3358	34.13	32.65		1.25										
			0.24		40	-30	310	650	5600	4.0	11.0	38%	0.65	1.5
3354	35.05	32.52		2.30										
			0.24		250	200	290	650	6250	4.5	12.0	40%	0.68	1.7
3343	33.80	31.66		1.90										
			0.24		105	140	270	650	6900	4.9	12.9	42%	0.71	1.8
4316	33.06	31.28		1.55										
			0.24		260	370	270	1300	8200	5.8	14.8	48%	0.71	2.0
4336	32.36	30.33		1.80										
			0.24		205	70	80	450	8650	6.2	15.5	27%	1.09	5.0
4498	29.37	27.89		1.25										
4498	29.37	27.82		1.25										
			0.30		105	390	330	1000	18600	13.3	29.0	54%	0.75	2.2
4489	29.10	27.50		1.30										
			0.30		140	280	310	1800	20400	14.5	31.4	57%	0.78	2.4
4479	28.60	27.05		1.25										
			0.30		280	80	110	6500	26900	19.2	39.7	43%	1.31	5.8
5445	25.10	24.40		1.25										
			0.30		120	310	90	2000	28900	20.6	42.3	41%	1.44	6.9
5448	24.71	23.09		1.25										
			0.38		570	330	310	2000	30900	22.0	44.8	45%	0.90	2.6
6407	23.00	21.28		1.35										
TOTAL					4405			30900		22.0	44.8			

DIAMETER [m]	0.188	0.235	0.300	0.375
LENGTH [m]	1745	860	645	570

SANITARY SEWER SYSTEM
MAIN SEWER : MIDDLE
WASTE WATER PRODUCTION 0.8 * 70 * 1.1 L/(C.DAY) YEAR 2010

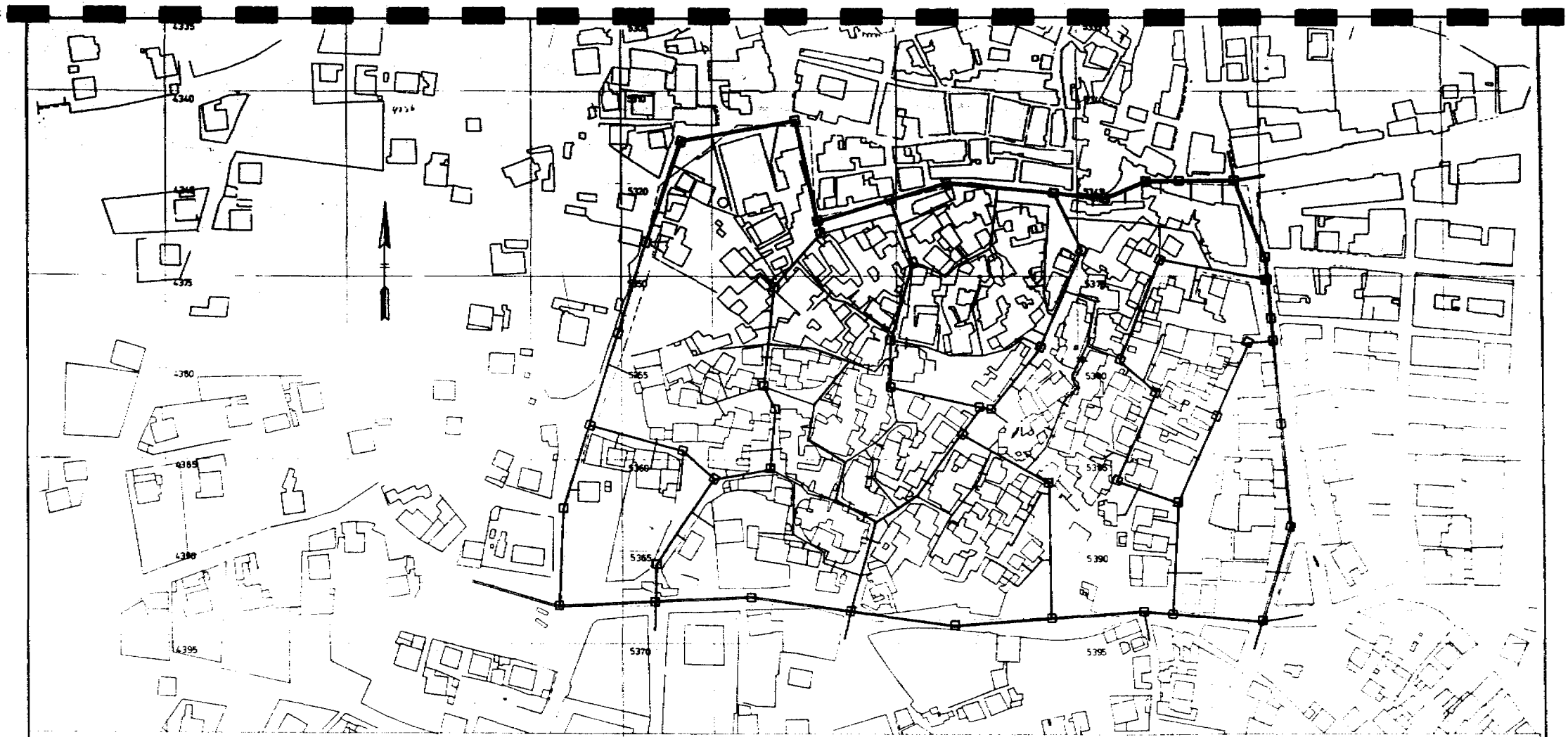
NODE NR.	LEVEL SURF. [m]	LEVEL INVERT [m]	DIAM. [m]	COVER [m]	L [m]	SLOPE SURF. [1:]	SLOPE INVERT [1:]	CAPITA INCR.	CAPITA CUM.	FLOW AVRG. [l/s]	FLOW PEAK [l/s]	Q-PEAK/ Q-FULL [%]	V [m/s]	TAU [N/m²]
3213	35.02	33.62		1.25										
			0.15		130	180	140	750	750	0.5	1.6	12%	0.47	1.4
3204	34.30	32.71		1.40										
			0.19		140	130	150	500	1250	0.9	2.7	12%	0.52	1.6
3391	33.22	31.78		1.25										
			0.19		115	190	190	500	1750	1.2	3.7	19%	0.53	1.5
3393	32.62	31.18		1.25										
			0.19		245	250	200	500	2250	1.6	4.8	24%	0.57	1.5
4207	31.65	29.96		1.50										
			0.19		150	300	200	550	2800	2.0	6.0	30%	0.62	1.7
4369	31.15	29.21		1.75										
			0.19		315	190	200	1300	4100	2.9	8.7	44%	0.71	2.0
4394	29.46	27.62		1.65										
			0.19		155	60	70	1700	5800	4.1	11.3	34%	1.11	5.0
5367	26.80	25.36		1.25										
			0.19		155	100	90	500	6300	4.5	12.0	41%	1.06	4.3
5390	25.20	23.70		1.20										
			0.30		80	1600	320	700	7000	5.0	13.1	24%	0.61	1.5
5392	25.15	23.45		1.40										
			0.30		160	310	310	2100	9100	6.5	16.1	29%	0.67	1.7
5377	24.63	22.93		1.40										
			0.30		75	200	330	500	9600	6.8	16.8	32%	0.67	1.7
5343	24.25	22.70		1.25										
			0.30		285	650	530	3450	13050	9.3	21.6	51%	0.59	1.3
6315	23.81	22.16		1.35										
			0.30		80	1600	530	1200	14250	10.2	23.2	55%	0.59	1.4
6316	23.76	22.01		1.45										
			0.30		280	900	440	250	14500	10.3	23.5	51%	0.65	1.6
6331	23.45	21.38		1.70										
SOUTH								20250						
			0.38		520	1160	420	1600	36350	25.9	51.6	60%	0.77	2.3
6407	23.00	20.13		2.50										
TOTAL					2885				36350	25.9	51.6			
6407	23.00	20.13		2.5										
NORTH								30900						
			0.40		5000		270		67250	47.9	89.2	71%	1.01	4.2
W.T.P	2.60	1.60		1.00										
WASTE WATER TREATMENT PLANT														

DIAMETER [m]	0.188	0.235	0.300	0.375
LENGTH [m]	1275	0	960	520

SANITARY SEWER SYSTEM
MAIN SEWER : SOUTH
WASTE WATER PRODUCTION 0.8 * 70 * 1.1 L/(C.DAY) YEAR 2010

NODE NR.	LEVEL SURF. [m]	LEVEL INVERT [m]	DIAM. [m]	COVER [m]	L [m]	SLOPE SURF. [1:]	SLOPE INVERT [1:]	CAPITA INCR.	CAPITA CUM.	FLOW AVRG. [l/s]	FLOW PEAK [l/s]	Q-ACC/ Q-FULL [%]	V [m/s]	TAU [N/m2]
3213	35.02	33.87		1.00										
			0.15		275	90	90	750	750	0.5	1.6	10%	0.55	2.1
3278	32.10	30.71		1.20										
			0.19		90	900	300	1450	2200	1.6	4.7	29%	0.50	1.1
3249	32.00	30.41		1.40										
			0.19		140	220	290	850	3050	2.2	6.5	40%	0.59	1.3
4210	31.37	29.93		1.25										
			0.19		235	260	200	750	3800	2.7	8.1	41%	0.71	1.9
4258	30.46	28.77		1.50										
			0.19		430	180	210	1500	5300	3.8	10.5	55%	0.69	2.2
5261	28.10	26.72		1.15										
			0.24		110	310	240	2100	7400	5.3	13.7	42%	0.75	2.0
5271	27.75	26.27		1.25										
			0.24		240	340	210	1800	9200	6.6	16.2	47%	0.80	2.5
5292	27.05	25.12		1.70										
			0.24		60	2000	210	700	9900	7.1	17.2	49%	0.80	2.6
5297	27.02	24.84		1.95										
			0.24		240	110	150	2500	12400	8.8	20.7	50%	0.95	3.6
6255	24.83	23.28		1.25										
			0.30		60	350	350	250	12650	9.0	21.0	41%	0.73	1.8
6251	24.66	23.11		1.25										
			0.30		100	320	320	1750	14400	10.3	23.4	43%	0.77	2.0
6223	24.35	22.80		1.25										
			0.30		90	410	530	750	15150	10.8	24.4	58%	0.59	1.4
6214	24.13	22.63		1.20										
			0.30		140	2800	510	2900	18050	12.9	28.3	66%	0.61	1.6
6395	24.08	22.35		1.35										
			0.38		160	410	470	900	18950	13.5	29.5	37%	0.70	1.6
6380	23.69	22.02		1.30										
			0.38		100	910	480	800	19750	14.1	30.5	38%	0.71	1.6
6345	23.58	21.81		1.40										
			0.38		200	1540	470	500	20250	14.4	31.2	39%	0.72	1.6
6331	23.45	21.38		1.70			TO MAIN SEWER : MIDDLE							
TOTAL					2670			20250		14.4	31.2			

DIAMETER [m]	0.188	0.235	0.300	0.375
LENGTH [m]	895	650	390	460



LEGEND

- PRIMARY SEWER
- SECONDARY SEWER
- TERTIARY SEWER
- MANHOLE

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC

DISTRICT V

SEWERAGE

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 12467 Sana'a

A1

Fig. B.2. Network drawing district V

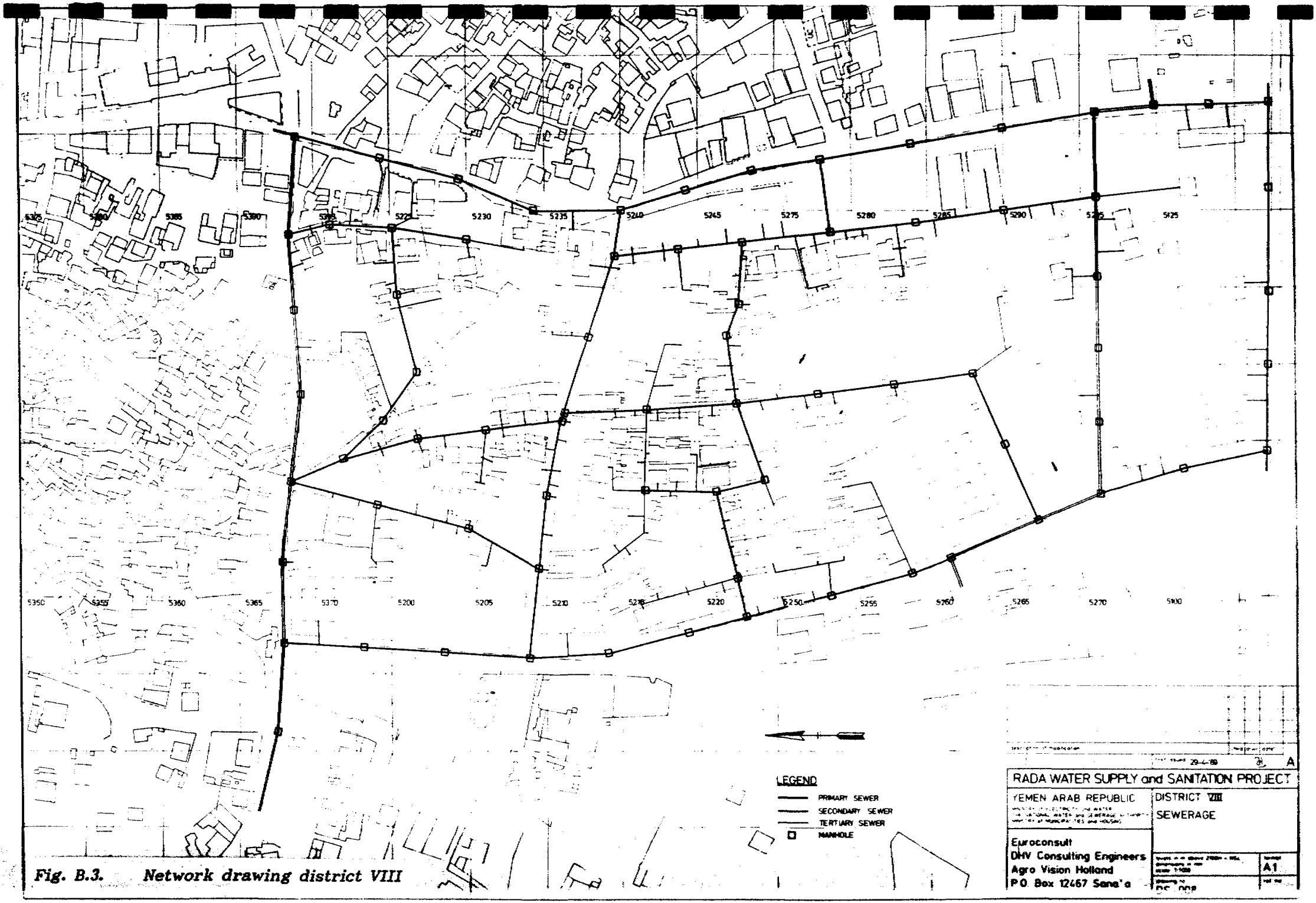


Fig. B.3. Network drawing district VIII

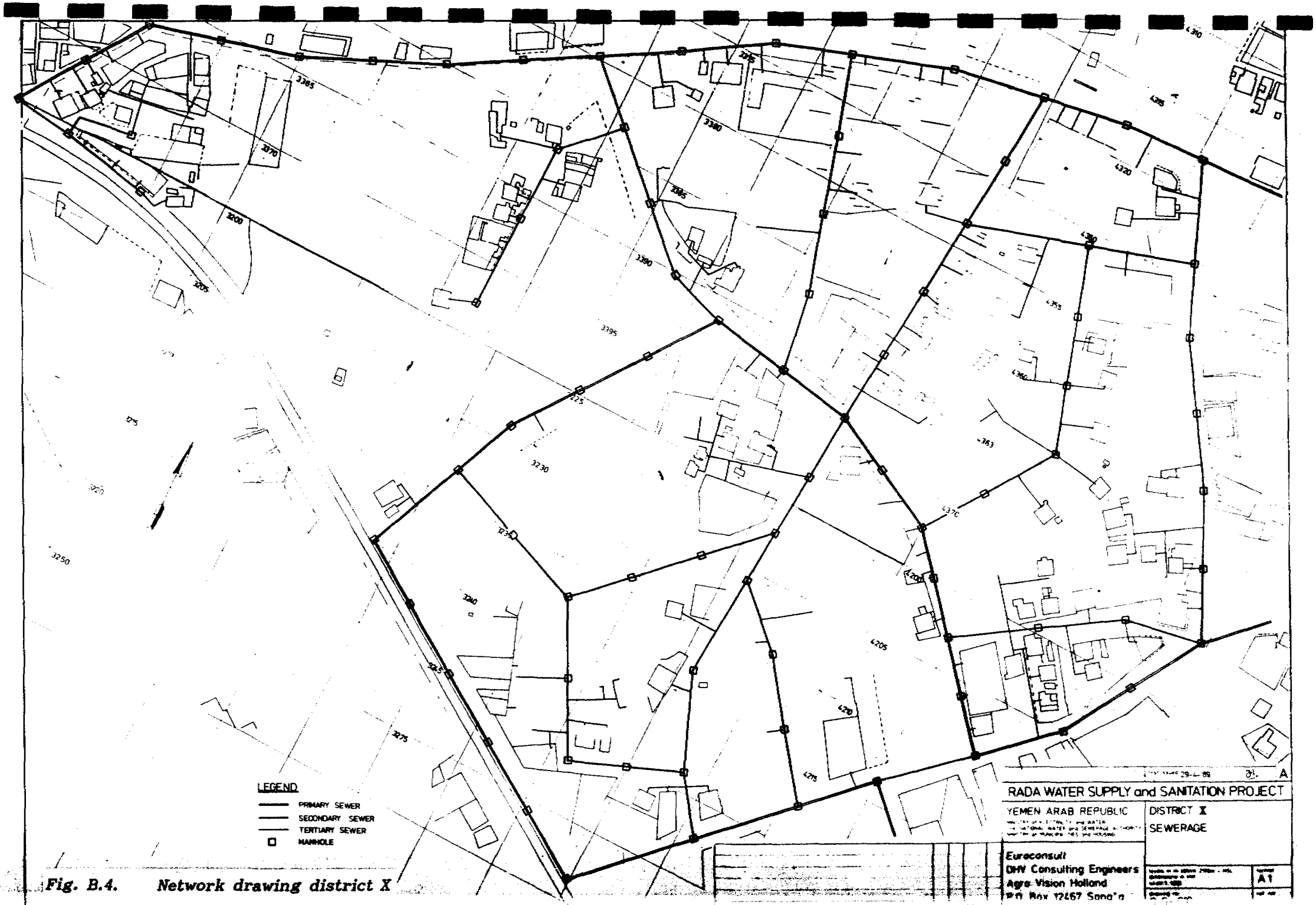


Fig. B.4. Network drawing district X

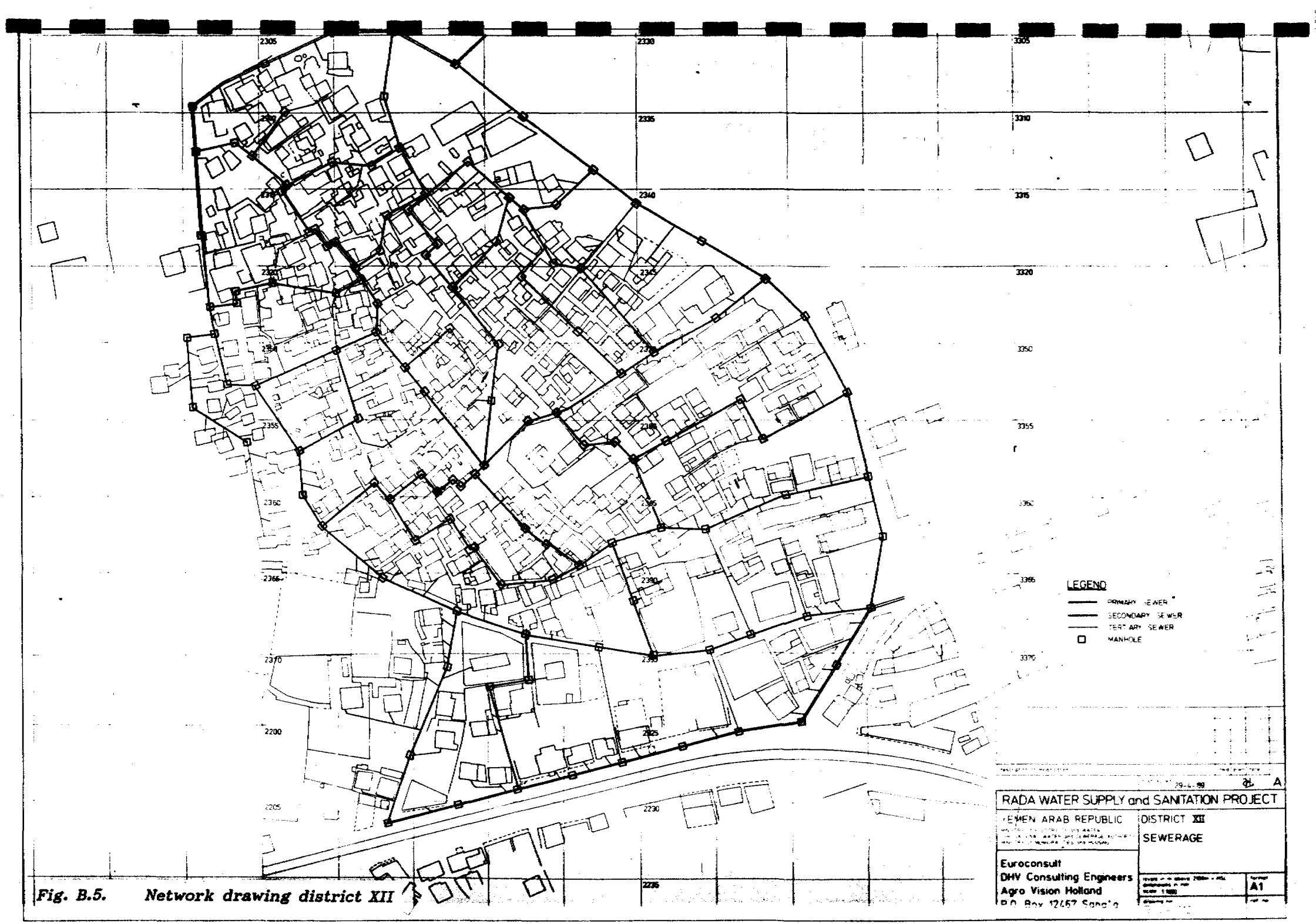
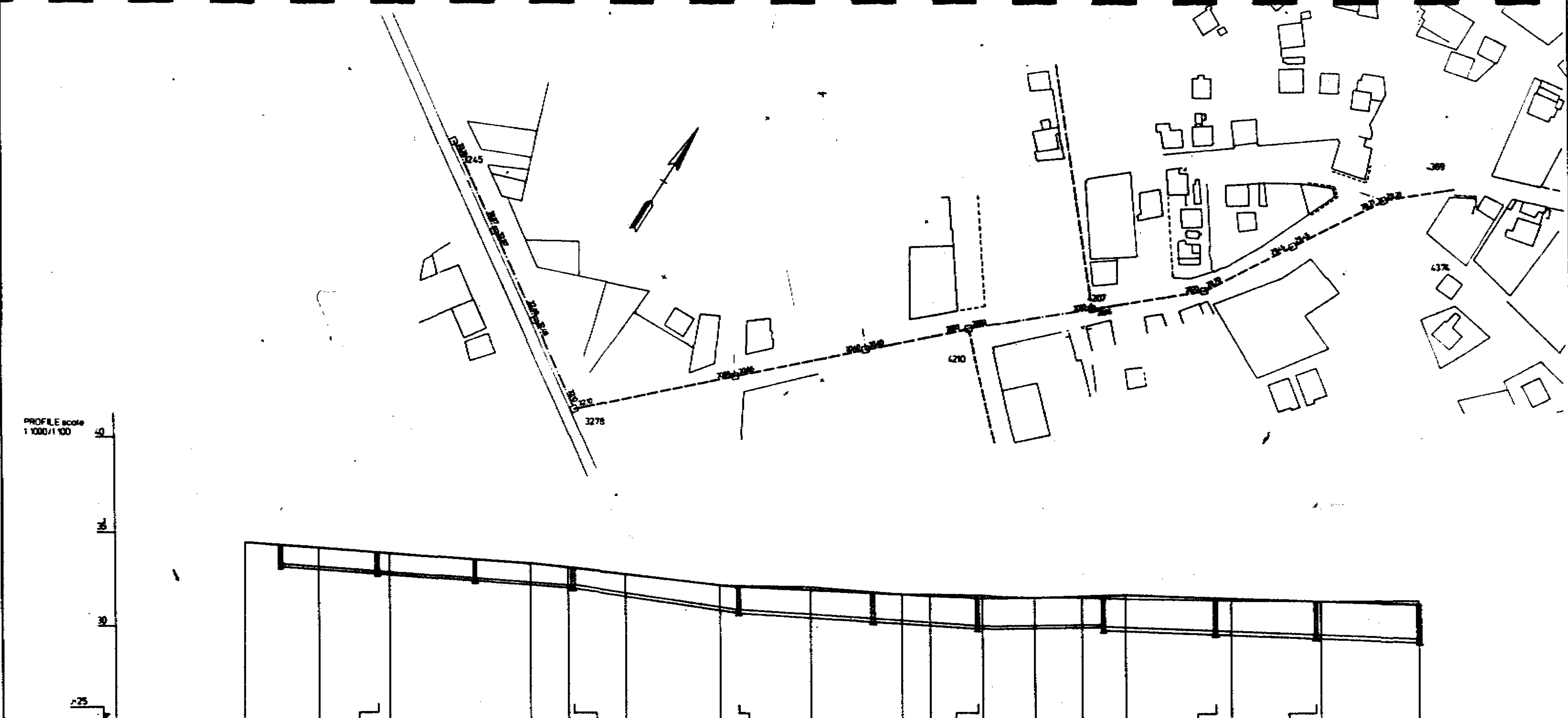


Fig. B.5. Network drawing district XII



CHAINAGE	172	153	133	101	85	49	20	0	3	31	81	91	129	162	177	192	217	220	248	273	284	296	341	352	387	410	451
GROUND LEVEL	34.53		34.23		33.96		33.45	33.25		32.84	32.31		32.18		31.82			31.73	31.62	31.61		31.62		31.50		31.42	31.46
GROUND LEVEL NEW		33.32		34.00		33.65			33.21			32.29	32.06	31.90			31.74			31.71	31.75	31.80	31.66	31.62	31.47	31.46	31.30
NODE NUMBERS	3245							3278										4210				4207					4369
REMARKS																											

description of modification | chkd | drwn | date

first issued 30-5-88 | A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY of ELECTRICITY and WATER
THE NATIONAL WATER and SEWERAGE AUTHORITY
MINISTRY of MUNICIPALITIES and HOUSING

DETAILED LAYOUT OF ALIGNMENT, SEWERAGE
Node number 3245-4369

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 12467 Sana'a

format A1

drawing no AS-007

Fig. B.6. Sewer alignment, node 3245 - 4369

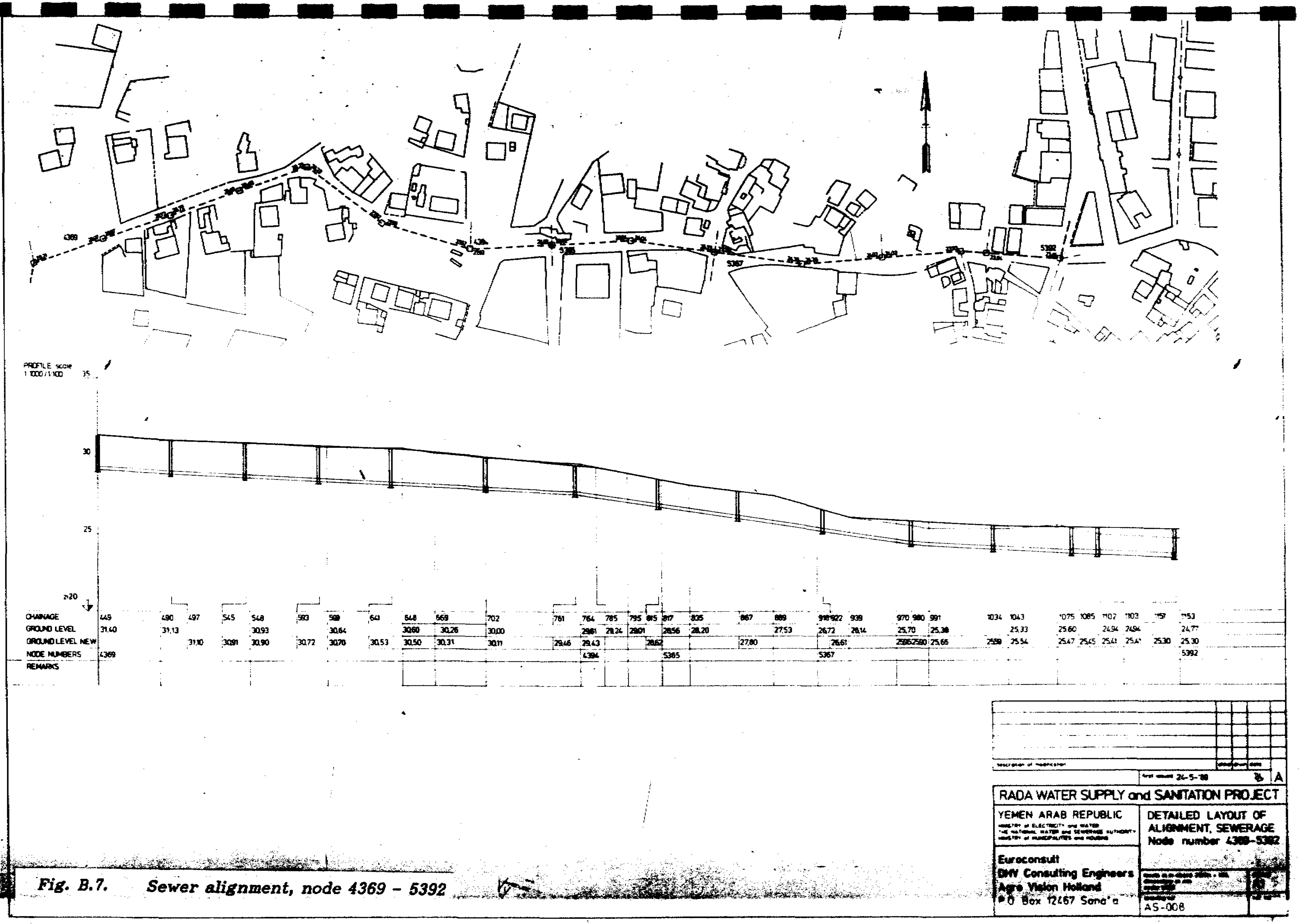
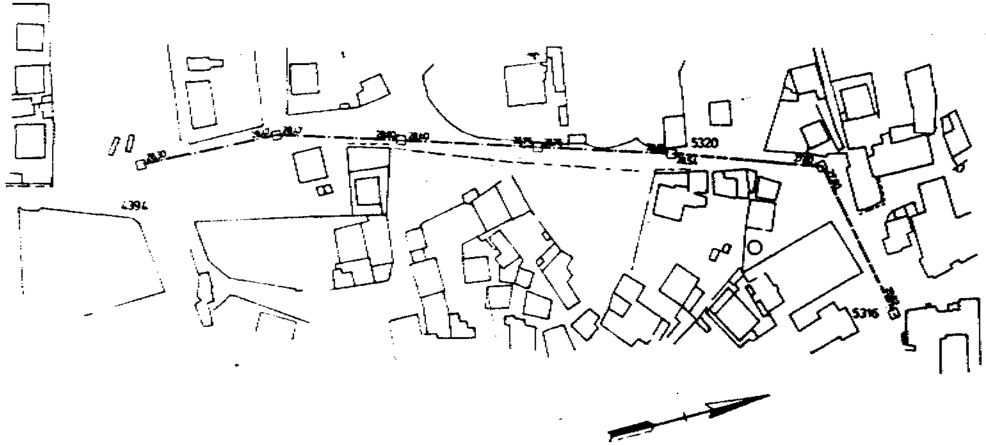
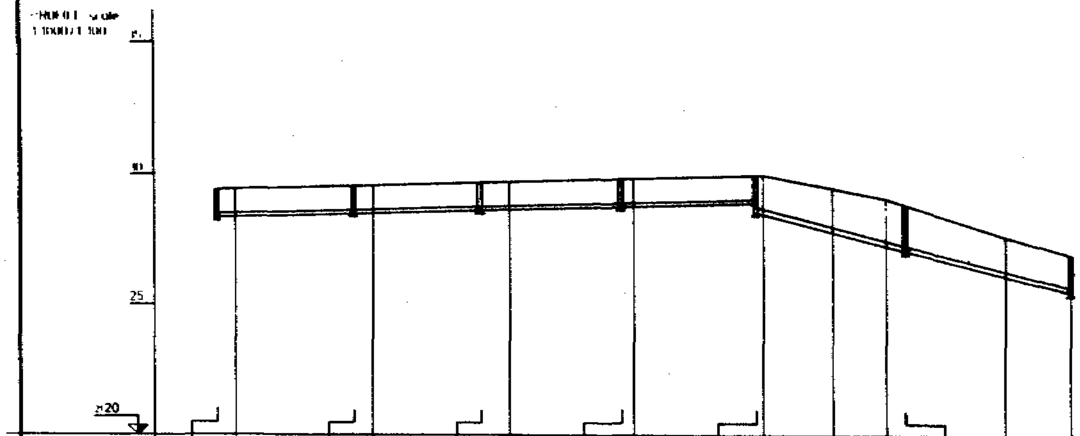


Fig. B.7. *Sewer alignment, node 4369 - 5392*





CHAINAGE	8	0	46	53	95	106	149	154	201	204	231	252	259	297	322
GROUND LEVEL		29.61		29.62		29.72		29.74		29.91	29.51	29.12		27.68	26.97
GROUND LEVEL NEW		29.43	29.57	29.59	29.70	29.73	29.85	29.86	29.88	30.00			28.89		
NODE NUMBER		4394								5320					5316
REMARKS															

first issued 30-5-88 A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC

DETAILED LAYOUT OF ALIGNMENT, SEWERAGE NODE NUMBERS 4394-5316

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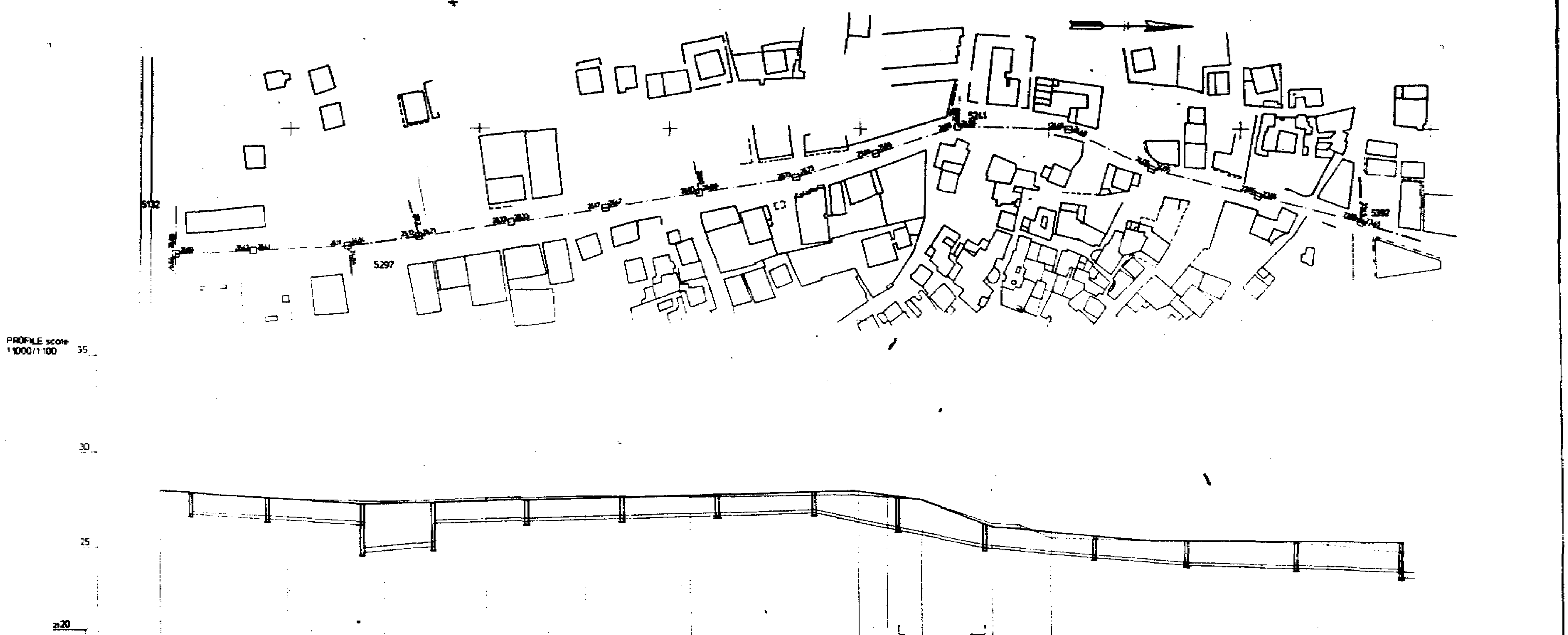
A1

Fig. B.8. Sewer alignment, node 4394 - 5316



CHAINAGE	0	16	57	67	107	119	145	173	193	224	244	280	294	345
GROUND LEVEL	28.00			27.57		27.45		27.66		27.76		27.74		
GROUND LEVEL NEW		27.90	27.64		27.32	27.35	27.42	27.49	27.54	27.63	27.68	27.77	27.81	27.94
NODE NUMBERS	5132					5297								
REMARKS	CENTER OF MAIN ROAD													

CHAINAGE	368	383	389	401	435	439	454	470	493	520	541	580	598	615	654
GROUND LEVEL	27.81	27.72		27.57		26.32	26.24	25.58		25.43		25.37		25.22	24.77
GROUND LEVEL NEW	28.00		27.73		26.28	26.13	26.02	25.88	25.67		25.41		25.35	25.34	25.30
NODE NUMBERS															5392
REMARKS															

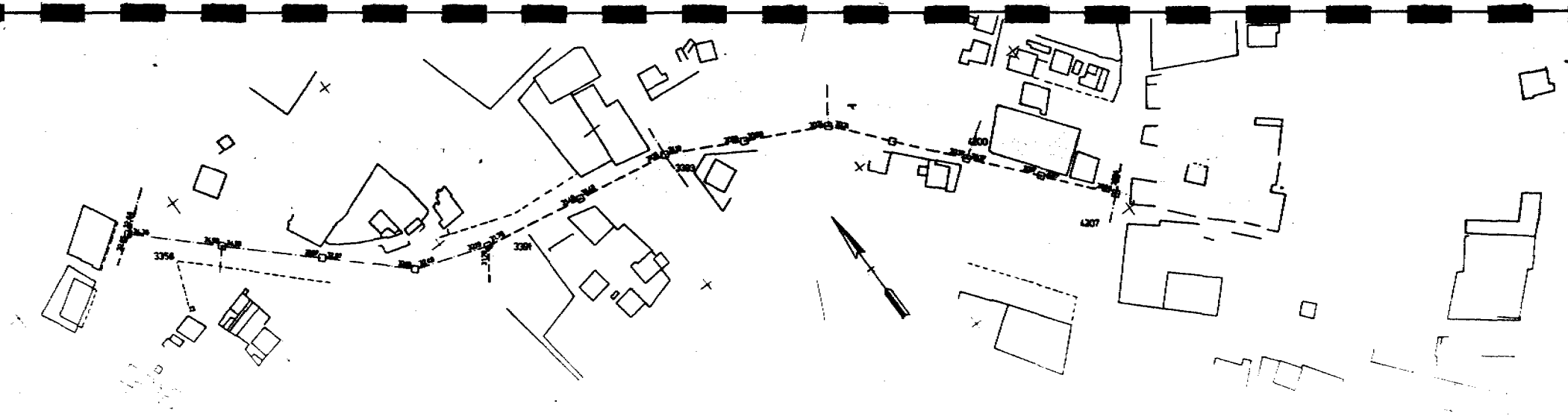
RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC

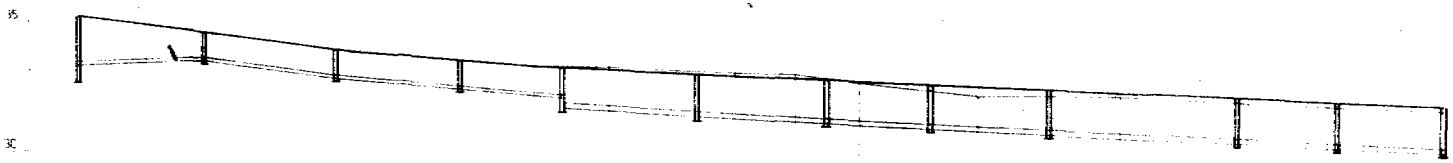
DETAILED LAYOUT OF ALIGNMENT, SEWERAGE
Node number 5132-5392

AS-031

Fig. B.9. *Sewer alignment, node 5132 - 5392*



PROFILE scale
1:1000/1:100



CHAINAGE	0		49	52		100	106		149		178	189	207		241	256	280	292	305		332	351		378	406		450	455	486	490	531
GROUND LEVEL	35.30			34.63			33.92				33.37		33.34			33.13	33.05		32.74			32.21			32.20			31.88	31.80		31.61
GROUND LEVEL NEW			34.67			34.00			33.59			33.31	33.20		33.10	33.02	33.92	33.39	32.81		32.69	32.60		32.48	32.36		32.16	32.14	32.00	31.98	31.80
NODE NUMBERS	3358										3391								3393									4200			4207
REMARKS																															

Fig. B.10. Sewer alignment, node 3358 – 4207

description of modification — date

A

RADA WATER SUPPLY and SANITATION PROJECT

YEMEN ARAB REPUBLIC
MINISTRY OF ELECTRICITY AND WATER
THE NATIONAL WATER AND SEWERAGE AUTHORITY
MINISTRY OF MUNICIPALITIES AND HOUSING

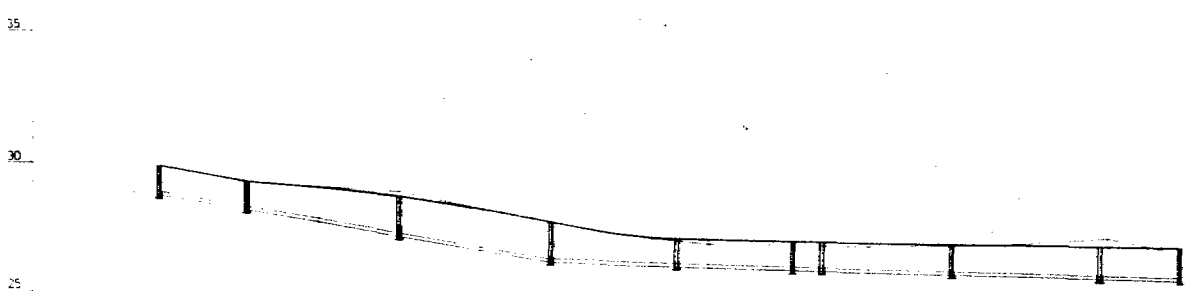
DETAILED LAYOUT OF ALIGNMENT, SEWERAGE
Node number 3358–4207

Euroconsult
DHV Consulting Engineers
Agro Vision Holland
P.O. Box 17467 Sana'a

format A1

AS-036

PROFILE scale
1:1000 / 1:100



CHAINAGE	0	34	62	94	126	153	173	192	202	214	247	258	275	308	329	364	368	396
GROUND LEVEL	29.95	29.36	29.11	28.96	28.29		27.40	27.20		26.97			26.84		26.90		27.17	27.60
GROUND LEVEL NEW				28.70		27.78			27.18	27.16		27.09	27.07	27.04	26.97	26.93		26.85	26.80
NODE NUMBERS	4233			5205			5206											5240
REMARKS																		

Fig. B.11. Sewer alignment, node 4233 - 5240

	last issued 23-5-89 rev. A
RADA WATER SUPPLY and SANITATION PROJECT	
YEMEN ARAB REPUBLIC MINISTRY OF ELECTRICITY and WATER THE NATIONAL WATER and SEWERAGE AUTHORITY MINISTRY OF MUNICIPALITIES and HOUSING	DETAILED LAYOUT OF ALIGNMENT, SEWERAGE Node number 4233-5240
Euroconsult DHV Consulting Engineers Agro Vision Holland P.O. Box 12467 Sana'a	format A1 AS-037

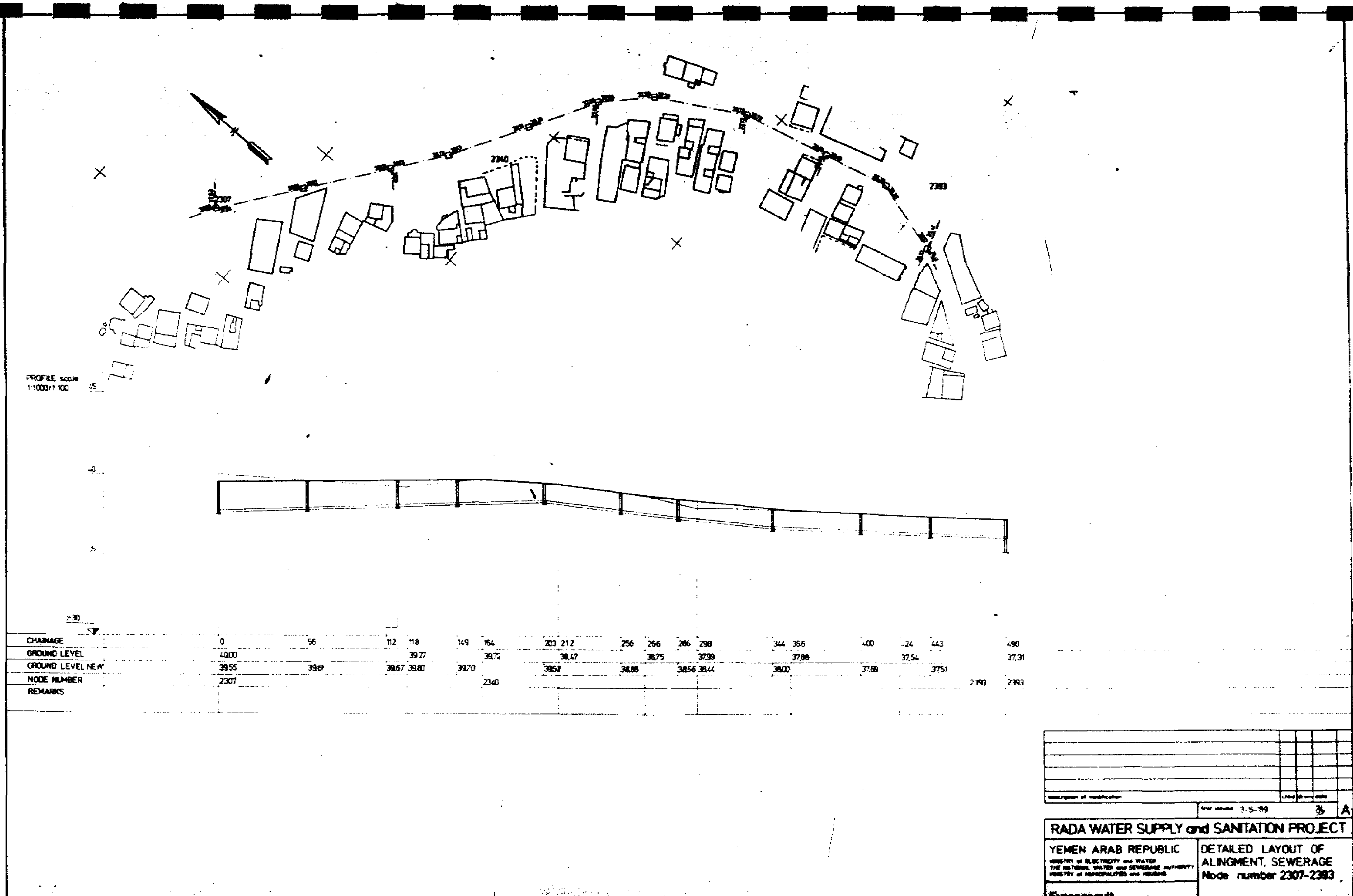


Fig. B.12. *Sewer alignment, node 2307 - 2393*

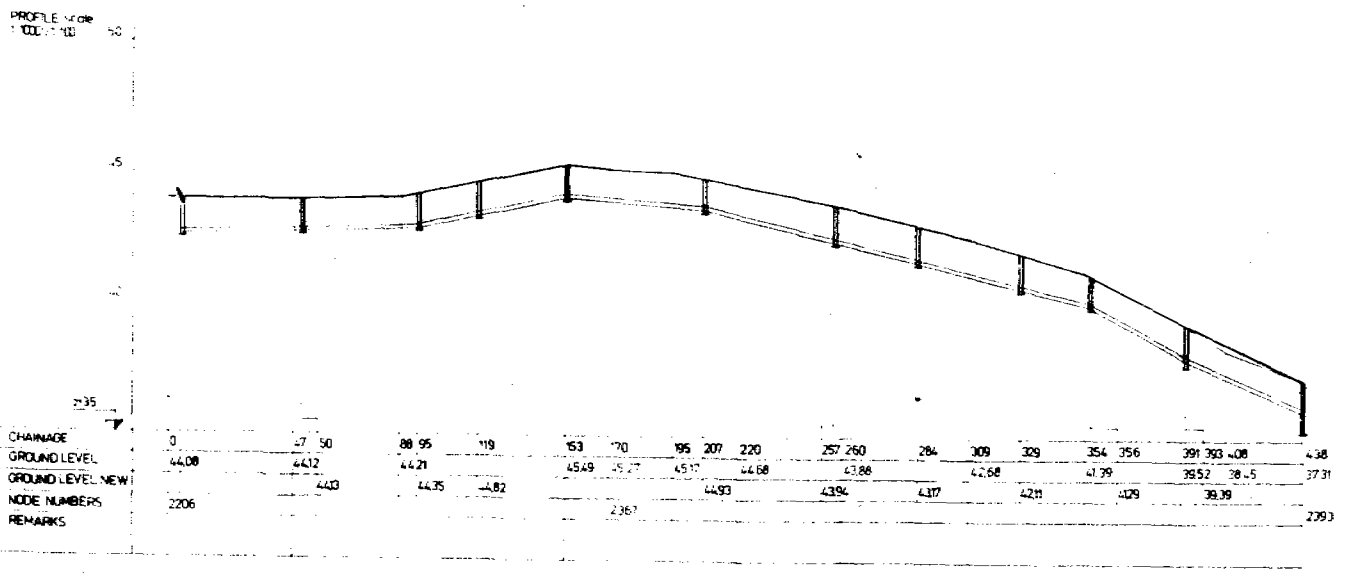


Fig. B.13. Sewer alignment, node 2206 – 2393

	A
RADA WATER SUPPLY and SANITATION PROJECT	
YEMEN ARAB REPUBLIC	DETAILED LAYOUT OF ALIGNMENT, SEWERAGE Node number 2206-2393
Euroconsult DHV Consulting Engineers Agro, Vision Holland P.O. Box 2467 Sana'a	A1 AS-04

Annex B2

Peakfactor calculation for waste water discharge

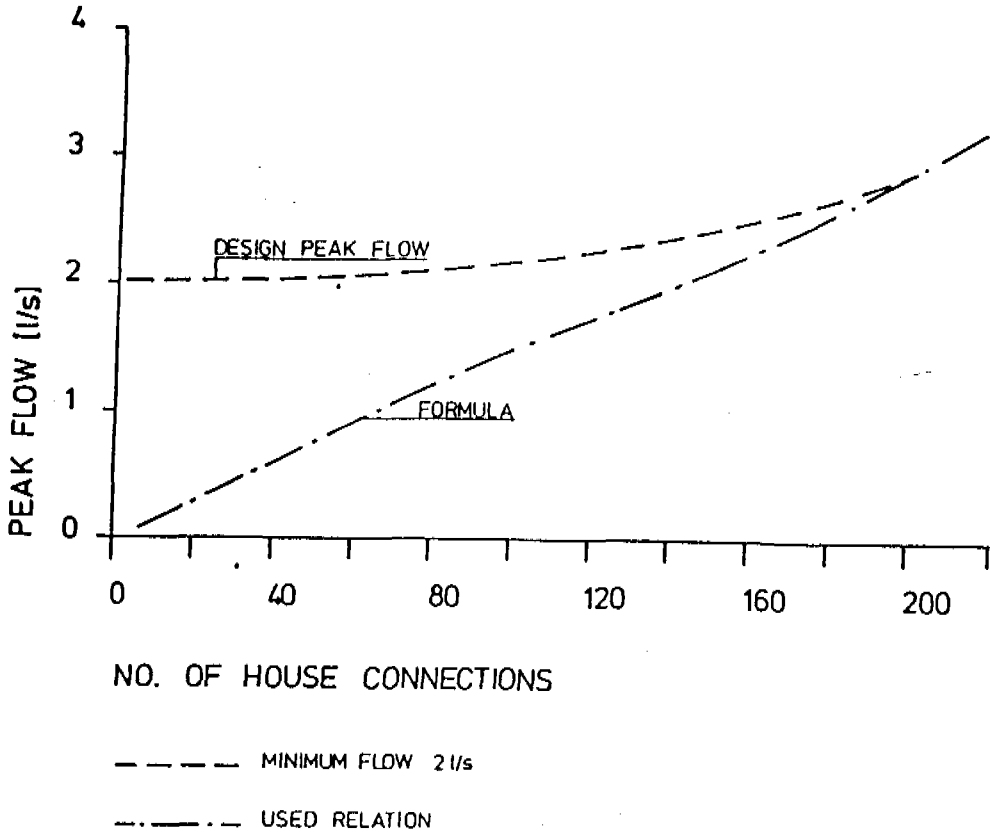
The formula used for calculation of the peakfactor for waste water discharge is:

$P = 1.5 + 2.5\ q$
P = peakfactor
q = average hourly flow of waste water, expressed in l/s.
This formula is one of the many mentioned in the literature, and commonly used.
The following table gives the calculation of the peakfactor for the Rada situation as function from the inhabitants/ house figure.

Houses	Persons	Flow (l/...) daily	hour	sec	Factor	Peakflow l/s
1	7	392	16	0.00	38.62	0.18
2	14	784	33	0.01	27.74	0.25
4	28	1568	65	0.02	20.06	0.36
8	56	3136	131	0.04	14.62	0.53
16	112	6272	261	0.07	10.78	0.78
32	224	12544	523	0.15	8.06	1.17
100	700	39200	1633	0.45	5.21	2.36
250	1750	98000	4084	1.14	3.85	4.30
1000	7000	392000	16333	4.54	2.67	12.13
1500	10500	588000	24500	6.81	2.46	16.73

The figures from the last colum are presented in graphical form in the figure presented underneath, corresponding to figure 3.3 on page 3.5 of the draft final design report, vol. 1.
The other line in this graph is drawn on basis of the definited minimum peakflow of 2 l/s.

From the above presented table it can be concluded that very small peakflows occur.



Sewerage peak flow vs. number of house connections

The actual peakload from a house to the sewer varies considerably in time. Calculations were made assuming stationary conditions.

ANNEX C RAINWATER DRAINAGE

TABLE OF CONTENTS PAGE

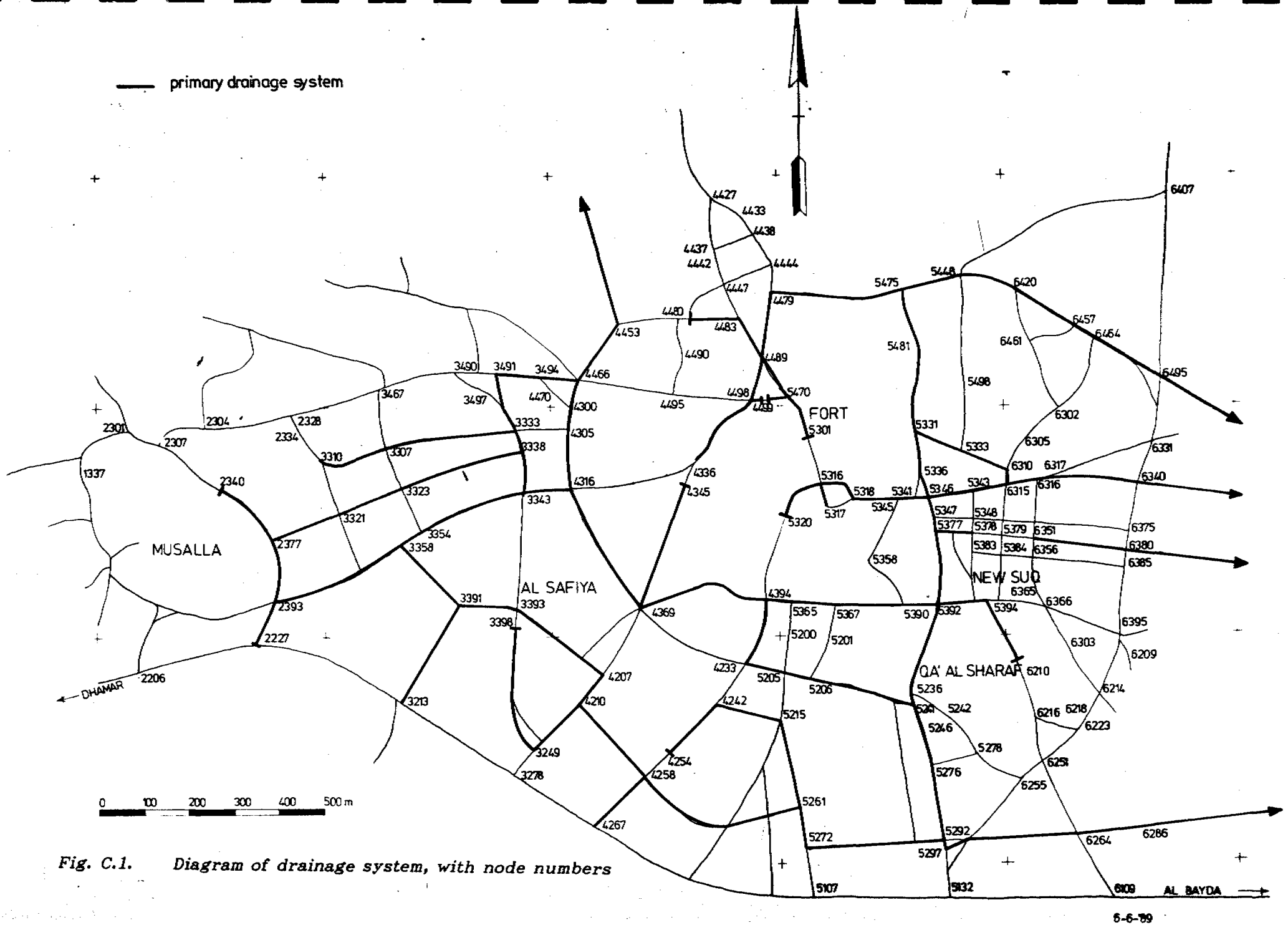


Fig. C.1. Diagram of drainage system, with node numbers

```
**********************************************************************
*                                                                    *
*     RADA WATER SUPPLY AND SANITATION PROJECT                       *
*     CALCULATION OF THE DRAINAGE SYSTEM                             *
*     RECURRENCY PERIOD     2 YEARS                                  *
*         NORTH - EASTERN  PART                                      *
*            VERSION  16 APRIL  1989                                 *
*                                                                    *
**********************************************************************
```

***** INPUT *****
****

G E N E R A L D A T A
****

DIFFUSIVE WAVE EQUATIONS
IMPLICIT METHOD

LENGTH OF A COORDINATE-UNIT (M)	:	1.000
ROUGHNESS ACCORDING TO NIKURADSE (M)		
FOR OPEN CONDUITS	:	.0050
FOR CLOSED CONDUITS	:	.0050
EFFECTIVE CROSS-SECTIONAL AREA	:	1.000
RUN-OFF COEFFICIENT (DEFAULT)	:	.250
TOTAL CALCULATION TIME (HOUR)	:	2
TIME STEP (CALCULATION) (MIN)	:	1
TIME STEP (OUTPUT) (MIN)	:	15
NUMBER OF TRAPEZIUM PROFILES	:	15
NUMBER OF VARIABLE PROFILES	:	0
NUMBER OF CLOSED CONDUITS	:	0
NUMBER OF WEIRS	:	0
NUMBER OF NODES	:	14
NUMBER OF SPILLWAYS	:	1
NUMBER OF PUMPS	:	0
NUMBER OF INFLOW HYDROGRAPHS	:	0
NUMBER OF RAIN CURVES	:	1
NUMBER OF EVAPORATION CURVES	:	0
NUMBER OF STORAGE CURVES	:	0
NUMBER OF PROFILE CURVES	:	0
NUMBER OF WATER LEVEL CURVES	:	0
NUMBER OF MOVABLE WEIR CURVES	:	0

***** INPUT *****
****

N O D E D A T A
****

CATCHMENT AREA (CODE 1) 0^ = HA PUMP CAP. (CODE 2) 0^ = M3/S
1^ = M2 1^ = L/S

NODE NUMBER	GROUND LEVEL (M)	WATER LEVEL (M)	X-COORD	Y-COORD	CATCHMENT AREA (CODE 1)	RUN OFF COEFF	C U R V E N U M B E R S INFL	STORGE	EVAP	RAIN	WATLEV	PUMP CAP (CODE 2)	PUMP START (M)	PUMP STOP (M)	SPILLWAY WIDTH (M)	SPILLWAY LEVEL (M)	SPILLWAY COEFF
4336	31.51	.00	0.	0.	6.2 0^	.60				1							
4479	29.25	.00	0.	0.	3.3 0^	.70				1							
4483	30.35	.00	0.	0.	2.6 0^	.60				1							
4489	29.43	.00	0.	0.	2.4 0^	.60				1							
4495	30.50	.00	0.	0.	.1 0^	.60				1							
4498	29.57	.00	0.	0.	3.3 0^	.70				1							
4499	29.70	.00	0.	0.	.1 0^	.70				1							
5301	29.82	.00	0.	0.	1.6 0^	.60				1							
5445	25.45	.00	0.	0.	5.5 0^	.60				1							
5448	25.04	.00	0.	0.	3.0 0^	.40				1							
5470	29.66	.00	0.	0.	1.8 0^	.60				1							
5498	26.16	.00	0.	0.	1.1 0^	.40				1							
6420	25.08	.00	0.	0.	5.3 0^	.40				1							
6464	24.19	.00	0.	0.	5.1 0^	.40				1							
6495	23.60	.00	0.	0.											100.00	23.41	1.85

***** INPUT *****
****

C O N D U I T D A T A
****

CONDT NUMBER	NODE NUMBER BEGIN	END	INVERT LEVEL BEGIN (M)	END (M)	LENGTH (M)	ROUGH NESS (*)	EFF. CROSS COEFF	BOTTOM WIDTH (M)	CATCHM. WIDTH (M)	SIDE SLOPES COTGA	COTGB	PROFILE CURVE NUMBER	CLOSED CONDUIT - CHARACTERISTICS SHAPE	HEIGHT (M)	WIDTH (M)	LOSSES BEGIN	END	SILT (%)
10	4336	4498	31.36	29.37	205	.0050	1.00	6.00	0	.01	.01							
20	4479	4489	28.60	29.10	140	.0050	1.00	6.00	0	.01	.01							
30	4479	5445	28.60	25.10	280	.0050	1.00	6.00	0	.01	.01							
35	4483	4489	30.20	29.10	110	.0050	1.00	6.00	0	.01	.01							
40	4489	4498	29.10	29.37	150	.0050	1.00	6.00	0	.01	.01							
50	4489	5470	29.10	29.51	80	.0050	1.00	6.00	0	.01	.01							
55	4495	4498	30.35	29.37	170	.0050	1.00	6.00	0	.01	.01							
60	4498	4499	29.37	29.55	40	.0050	1.00	6.00	0	.01	.01							
70	4499	5470	29.55	29.51	40	.0050	1.00	6.00	0	.01	.01							
80	5301	5470	29.65	29.51	65	.0050	1.00	6.00	0	.01	.01							
90	5445	5448	25.10	24.71	120	.0050	1.00	6.00	0	.01	.01							
100	5448	5498	24.71	26.01	260	.0050	1.00	5.00	0	.01	.01							
110	5448	6420	24.71	24.63	90	.0050	1.00	8.00	0	.01	.01							
120	6420	6464	24.63	23.79	245	.0050	1.00	8.00	0	.01	.01							
130	6464	6495	23.79	23.40	160	.0050	1.00	8.00	0	.01	.01							

* ROUGHNESS ACCORDING TO NIKURADSE (M)

R A I N C U R V E S
****

RAIN CURVE													
1	TIME (MIN)	0	30	31	60	61	75	76	90	91	105	106	120
	INTENS. (MM/H)	2.6	2.6	5.4	5.4	12.0	12.0	46.4	46.4	20.0	20.0	8.0	8.0
	TIME (MIN)	121	150	151	180	181	480						
	INTENS. (MM/H)	3.6	3.6	2.0	2.0	.0	.0						

***** RESULTS *****
****

M A X I M U M W A T E R L E V E L S A N D D I S C H A R G E S

CONDT NUMBR	NODE NMBR	SURFACE LEVEL (M)	WATER LEVEL (M)	INVERT LEVEL (M)	CONDT DEPTH (M)	FILLING (%)	*\#	TIME (MIN)	TIME (MIN)	DISCHARGE (M3/S)	VELOCITY (M/S)	GRADIENTS WATER (1:X)	GRADIENTS INVERT (1:X)	BOTTOM WIDTH (M)	REMARKS
OPEN CONDUITS WITH TRAPEZIUM PROFILES :															
10	4334	31.51	31.41	31.36	.15	30		91	92	.368	.78	106	103	6.00	
	4493	29.57	29.49	29.37	.20	59		95							
20	4479	29.25	28.69	28.60	.65	13		97	97	-.947	1.11	228	280	6.00	
	4489	29.43	29.30	29.10	.33	60		97							
30	4479	29.25	28.69	28.60	.65	13		97	97	1.131	1.41	82	80	6.00	
	5445	25.45	25.28	25.10	.35	52		98							
35	4483	30.35	30.22	30.20	.15	12		101	91	.156	.27	119	99	6.00	
	4489	29.43	29.30	29.10	.33	60		97							
40	4489	29.43	29.30	29.10	.33	60		97	95	-.537	.57	796	555	6.00	
	4498	29.57	29.49	29.37	.20	59		95							
50	4489	29.43	29.30	29.10	.33	60		97	92	-.198	.30	323	195	6.00	
	5470	29.66	29.55	29.51	.15	24		92							
55	4495	30.50	30.35	30.35	.15	2		93	93	.005	.02	196	173	6.00	
	4498	29.57	29.49	29.37	.20	59		95							
60	4498	29.57	29.49	29.37	.20	59		95	92	-.005	.01	598	222	6.00	
	4499	29.70	29.55	29.55	.15	3		93							
70	4499	29.70	29.55	29.55	.15	3		93	96	.002	.01	4962	1000	6.00	
	5470	29.66	29.55	29.51	.15	24		92							
80	5301	29.82	29.70	29.65	.17	29		92	92	.094	.36	423	464	6.00	
	5470	29.66	29.55	29.51	.15	24		92							
90	5445	25.45	25.28	25.10	.35	52		98	98	1.389	1.07	376	307	6.00	
	5448	25.04	24.96	24.71	.33	76		100							
100	5448	25.04	24.96	24.71	.33	76		100	92	-.041	.07	244	199	5.00	
	5498	26.16	26.02	26.01	.15	9		92							
110	5448	25.04	24.96	24.71	.33	76		100	100	1.498	.95	473	1125	8.00	
	6420	25.08	24.77	24.63	.45	32		100							
120	6420	25.08	24.77	24.63	.45	32		100	101	1.656	.94	361	291	8.00	
	6464	24.19	24.09	23.79	.40	76		104							
130	6464	24.19	24.09	23.79	.40	76		104	104	1.764	1.23	250	410	8.00	
	6495	23.60	23.45	23.40	.20	27		104							

FREEBOARD CODE (% OF DEPTH): *** 0% - 5%; ** 5% - 10%; * 10% - 20%

FILLING OF CLOSED CONDUITS (% OF DEPTH\DIAM.): ### 95% - 100%; ## 90% - 95%; # 80% - 90%

POSITIVE DISCHARGE FROM LOW TO HIGH NODE NUMBER

***** RESULTS *****
****

TOTAL CATCHMENT AREA 41.4000 HA

S P I L L E D V O L U M E S
****

NODE NUMBER	VOLUME (M3)	SPILLING TIME (MIN)
6495	2840	49

W A T E R B A L A N C E I N [M3]
****

INFLOW (HYDROGRAPHS)	:	0
INFLOW (FIXED WATER LEVELS)	:	0
RAINFALL	:	5768
TOTAL IN	:	5768
OUTFLOW (SPILLWAYS)	:	2841
OUTFLOW (PUMPS)	:	0
OUTFLOW (FIXED WATER LEVELS)	:	0
EVAPORATION	:	0
TOTAL OUT	:	2841
STORAGE CHANGE	:	2962
TOTAL OUT + STORAGE CHANGE	:	5803
BALANCE ERROR	:	.60 %

****** E N D O F C Y C L O N E ******

```
**********************************************************************
*                                                                    *
*     RADA WATER SUPPLY AND SANITATION PROJECT                       *
*     CALCULATION OF THE DRAINAGE SYSTEM                             *
*        NORTH - WESTERN SECTION                                     *
*     RECURRENCY PERIOD     2 YEARS                                  *
*               VERSION 16 APRIL 1989                                *
*                                                                    *
**********************************************************************
```

***** INPUT *****
****

G E N E R A L D A T A
****

DIFFUSIVE WAVE EQUATIONS
IMPLICIT METHOD

LENGTH OF A COORDINATE-UNIT (M)	:	1.000
ROUGHNESS ACCORDING TO NIKURADSE (M)		
FOR OPEN CONDUITS	:	.0050
FOR CLOSED CONDUITS	:	.0050
EFFECTIVE CROSS-SECTIONAL AREA	:	1.000
RUN-OFF COEFFICIENT (DEFAULT)	:	.250
TOTAL CALCULATION TIME (HOUR)	:	2
TIME STEP (CALCULATION) (MIN)	:	1
TIME STEP (OUTPUT) (MIN)	:	15
NUMBER OF TRAPEZIUM PROFILES	:	18
NUMBER OF VARIABLE PROFILES	:	0
NUMBER OF CLOSED CONDUITS	:	0
NUMBER OF WEIRS	:	0
NUMBER OF NODES	:	16
NUMBER OF SPILLWAYS	:	1
NUMBER OF PUMPS	:	0
NUMBER OF INFLOW HYDROGRAPHS	:	0
NUMBER OF RAIN CURVES	:	1
NUMBER OF EVAPORATION CURVES	:	0
NUMBER OF STORAGE CURVES	:	0
NUMBER OF PROFILE CURVES	:	0
NUMBER OF WATER LEVEL CURVES	:	0
NUMBER OF MOVABLE WEIR CURVES	:	0

***** INPUT *****
****

N O D E D A T A
****

CATCHMENT AREA (CODE 1) 0* = HA 1* = M2 PUMP CAP. (CODE 2) 0* = M3/S 1* = L/S

NODE NUMBER	GROUND LEVEL (M)	WATER LEVEL (M)	X-COORD	Y-COORD	CATCHMENT AREA (CODE 1)	RUN OFF COEF	CURVE NUMBERS INFL	STORGE	EVAP	RAIN	WATLEV	PUMP CAP (CODE 2)	PUMP START (M)	PUMP STOP (M)	SPILLWAY WIDTH (M)	SPILLWAY LEVEL (M)	SPILLWAY COEFF
2227	39.36	.00	0.	0.	4.2 0*	.30				1							
2340	39.72	.00	0.	0.	3.2 0*	.40				1							
2377	37.86	.00	0.	0.	3.0 0*	.30				1							
2393	37.00	.00	0.	0.	1.7 0*	.60				1							
3307	35.24	.00	0.	0.	3.3 0*	.30				1							
3310	36.20	.00	0.	0.	2.4 0*	.30				1							
3321	35.43	.00	0.	0.	2.0 0*	.30				1							
3323	35.99	.00	0.	0.	2.2 0*	.30				1							
3338	34.31	.00	0.	0.	1.6 0*	.30				1							
3343	34.60	.00	0.	0.	2.4 0*	.30				1							
3354	34.05	.00	0.	0.	.1 0*	.40				1							
3492	35.20	.00	0.	0.	1.7 0*	.30				1							
4305	33.30	.00	0.	0.	5.7 0*	.30				1							
4316	33.14	.00	0.	0.	1.1 0*	.50				1							
4466	33.31	.00	0.	0.	1.7 0*	.50				1							
4453	32.90	.00	0.	0.	2.5 0*	.60				1							
	32.26	.00	0.	0.						1					10.00	32.67	1.85

***** INPUT *****
****

C O N D U I T D A T A
****

CONDT NUMBER	NODE NUMBER BEGIN	END	INVERT LEVEL BEGIN (M)	END (M)	LENGTH (M)	ROUGHNESS (*)	EFF. CROSS COEFF	BOTTOM WIDTH (M)	CATCHM. WIDTH (M)	SIDE SLOPES COTGA	COTGB	PROFILE CURVE NUMBER	CLOSED CONDUIT - CHARACTERISTICS SHAPE	HEIGHT (M)	WIDTH (M)	LOSSES BEGIN	LOSSES END	SILT (%)
10	2227	2393	39.21	36.85	155	.0050	1.00	6.00	0	.01	.01							
20	2340	2377	39.57	37.73	200	.0050	1.00	6.00	0	.01	.01							
30	2377	2393	37.73	36.85	100	.0050	1.00	6.00	0	.01	.01							
40	2377	3321	37.73	35.28	185	.0050	1.00	6.00	0	.01	.01							
50	2393	3354	36.85	35.05	225	.0050	1.00	6.00	0	.01	.01							
60	3307	3310	35.09	36.05	130	.0050	1.00	6.00	0	.01	.01							
70	3323	3338	34.75	34.13	280	.0050	1.00	6.00	0	.01	.01							
80	3307	3333	35.09	34.45	295	.0050	1.00	6.00	0	.01	.01							
90	3321	3323	35.28	34.75	115	.0050	1.00	6.00	0	.01	.01							
95	3333	3338	34.45	34.13	100	.0050	1.00	6.00	0	.01	.01							
100	3333	3492	34.45	33.15	160	.0050	1.00	6.00	0	.01	.01							
110	3338	3343	34.13	33.80	105	.0050	1.00	6.00	0	.01	.01							
120	3343	3354	33.80	35.05	250	.0050	1.00	6.00	0	.01	.01							
130	3343	4316	33.80	33.06	105	.0050	1.00	6.00	0	.01	.01							
150	3492	4466	33.15	32.60	175	.0050	1.00	6.00	0	.01	.01							
160	4305	4316	32.90	33.06	125	.0050	1.00	6.00	0	.01	.01							
170	4305	4466	32.90	32.60	135	.0050	1.00	6.00	0	.01	.01							
180	4453	4466	32.06	32.60	165	.0050	1.00	6.00	0	.01	.01							

* ROUGHNESS ACCORDING TO NIKURADSE (M)

R A I N C U R V E S
****

RAIN CURVE 1	TIME (MIN)	0	30	31	60	61	75	76	90	91	105	106	120
	INTENS. (MM/H)	2.6	2.6	5.4	5.4	12.0	12.0	46.4	46.4	20.0	20.0	8.0	8.0
	TIME (MIN)	121	150	151	180								
	INTENS. (MM/H)	3.6	3.6	2.0	2.0								

***** RESULTS *****
****

M A X I M U M W A T E R L E V E L S A N D D I S C H A R G E S

CONDT NUMBR	NODE NMBR	SURFACE LEVEL (M)	WATER LEVEL (M)	INVERT LEVEL (M)	CONDT DEPTH (M)	FILLING (%) *\#	TIME (MIN)	TIME (MIN)	DISCHARGE (M3/S)	VELOCITY (M/S)	GRADIENTS WATER (1:X)	GRADIENTS INVERT (1:X)	BOTTOM WIDTH (M)	REMARKS
OPEN CONDUITS WITH TRAPEZIUM PROFILES :														
10	2227	39.36	39.23	39.21	.15	14	92	92	.123	.58	66	65	6.00	
	2293	37.00	36.90	36.85	.15	33	92							
20	2340	39.72	39.62	39.57	.15	30	92	93	.121	.60	107	108	6.00	
	2377	37.88	37.75	37.73	.15	15	93							
30	2377	37.88	37.75	37.73	.15	15	93	93	-.097	.45	117	113	6.00	
	2393	37.00	36.90	36.85	.15	33	92							
40	2377	37.88	37.75	37.73	.15	15	93	94	.105	.58	76	75	6.00	
	3321	35.43	35.32	35.28	.15	26	94							
50	2393	37.00	36.90	36.85	.15	33	92	94	.318	.77	133	130	6.00	
	3354	35.20	35.14	35.05	.15	60	95							
60	3307	35.24	35.17	35.09	.15	53	100	92	-.071	.28	144	135	6.00	
	3310	36.20	36.07	36.06	.15	11	91							
70	3323	35.00	34.82	34.75	.25	27	97	99	.218	.49	465	451	6.00	
	3338	34.31	34.22	34.13	.18	48	106							
80	3307	35.24	35.17	35.09	.15	53	100	101	.127	.41	423	460	6.00	
	3333	34.60	34.47	34.45	.15	16	103							
90	3321	35.43	35.32	35.28	.15	26	94	95	.159	.50	229	216	6.00	
	3323	35.00	34.82	34.75	.25	27	97							
95	3333	34.60	34.47	34.45	.15	16	103	104	.076	.23	387	312	6.00	
	3338	34.31	34.22	34.13	.18	48	106							
100	3333	34.60	34.47	34.45	.15	16	103	98	.103	.46	126	123	6.00	
	3492	33.30	33.20	33.15	.15	36	93							
110	3338	34.31	34.22	34.13	.18	48	106	104	-.304	.65	305	318	6.00	
	3343	34.05	33.87	33.80	.25	29	102							
120	3343	34.05	33.87	33.80	.25	29	102	98	-.372	.80	197	200	6.00	
	3354	35.20	35.14	35.05	.15	60	95							
130	3343	34.05	33.87	33.80	.25	29	102	102	.652	.85	167	141	6.00	
	4316	33.31	33.24	33.06	.25	74	103							
150	3492	33.30	33.20	33.15	.15	36	93	95	.258	.48	405	318	6.00	
	4466	32.90	32.77	32.60	.30	58	107							
160	4305	33.14	33.04	32.90	.24	60	105	104	-.712	.73	621	781	6.00	
	4316	33.31	33.24	33.06	.25	74	103							
170	4305	33.14	33.04	32.90	.24	60	105	106	.743	.78	499	449	6.00	
	4466	32.90	32.77	32.60	.30	58	107							
180	4453	32.26	32.22	32.06	.20	79	108	107	-1.055	1.06	297	305	6.00	
	4466	32.90	32.77	32.60	.30	58	107							

FREEBOARD CODE *** 0% - 5% FILLING OF CLOSED ### 95% - 100% POSITIVE DISCHARGE FROM LOW TO HIGH NODE NUMBER
OPEN CONDUITS ** 5% - 10% CONDUITS ## 90% - 95%
(% OF DEPTH) * 10% - 20% (% OF DEPTH\DIAM.) # 80% - 90%

***** RESULTS *****
****

TOTAL CATCHMENT AREA 38.8000 HA

S P I L L E D V O L U M E S
****

NODE NUMBER	VOLUME (M3)	SPILLING TIME (MIN)
4453	1592	49

W A T E R B A L A N C E I N [M3]
****

INFLOW (HYDROGRAPHS)	:	0
INFLOW (FIXED WATER LEVELS)	:	0
RAINFALL	:	3518
TOTAL IN	:	3516
OUTFLOW (SPILLWAYS)	:	1592
OUTFLOW (PUMPS)	:	0
OUTFLOW (FIXED WATER LEVELS)	:	0
EVAPORATION	:	0
TOTAL OUT	:	1592
STORAGE CHANGE	:	1948
TOTAL OUT + STORAGE CHANGE	:	3540
BALANCE ERROR	:	.62 %

****** E N D O F C Y C L O N E ******

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**********************************************************************
*                                                                    *
*     RADA WATER SUPPLY AND SANITATION PROJECT                       *
*     CALCULATION OF THE DRAINAGE SYSTEM                             *
*     RECURRENCY PERIOD     2 YEARS                                  *
*          MIDDLE SECTION                                            *
*          VERSION 16 APRIL 1989                                     *
*                                                                    *
**********************************************************************


***** INPUT *****
*****************

G E N E R A L   D A T A
************************

DIFFUSIVE WAVE EQUATIONS
IMPLICIT METHOD

LENGTH OF A COORDINATE-UNIT    (M) :        1.000

ROUGHNESS ACCORDING TO
NIKURADSE (M)
FOR OPEN CONDUITS                  :         .0050
FOR CLOSED CONDUITS                :         .0050
EFFECTIVE CROSS-SECTIONAL AREA     :        1.000
RUN-OFF COEFFICIENT (DEFAULT)      :         .250

TOTAL CALCULATION TIME      (HOUR) :        2
TIME STEP (CALCULATION)      (MIN) :        1
TIME STEP (OUTPUT)           (MIN) :        5

NUMBER OF TRAPEZIUM PROFILES       :       31
NUMBER OF VARIABLE PROFILES        :        0
NUMBER OF CLOSED CONDUITS          :        0
NUMBER OF WEIRS                    :        0
NUMBER OF NODES                    :       30
NUMBER OF SPILLWAYS                :        2
NUMBER OF PUMPS                    :        0
NUMBER OF INFLOW HYDROGRAPHS       :        0
NUMBER OF RAIN CURVES              :        1
NUMBER OF EVAPORATION CURVES       :        0
NUMBER OF STORAGE CURVES           :        0
NUMBER OF PROFILE CURVES           :        0
NUMBER OF WATER LEVEL CURVES       :        0
NUMBER OF MOVABLE WEIR CURVES      :        0
```

***** INPUT *****
****

N O D E D A T A
****

CATCHMENT AREA (CODE 1) 0~ = HA PUMP CAP. (CODE 2) 0~ = M3/S
1~ = M2 1~ = L/S

NODE NUMBER	GROUND LEVEL (M)	WATER LEVEL (M)	X-COORD	Y-COORD	CATCHMENT AREA (CODE 1)	RUN OFF COEFF	CURVE NUMBERS INFL STORGE EVAP RAIN WATLEV	PUMP CAP (CODE 2)	PUMP START (M)	PUMP STOP (M)	SPILLWAY WIDTH (M)	SPILLWAY LEVEL (M)	SPILLWAY COEFF
4207	31.80	.00	0.	0.	.6 0~	.30	1						
4333	30.13	.00	0.	0.	2.2 0~	.40	1						
4316	33.31	.00	0.	0.	2.1 0~	.40	1						
4345	31.60	.00	0.	0.	1.8 0~	.40	1						
4369	31.30	.00	0.	0.	8.3 0~	.40	1						
4394	29.61	.00	0.	0.	5.7 0~	.50	1						
5205	28.80	.00	0.	0.	1.8 0~	.40	1						
5206	27.40	.00	0.	0.	.1 0~	.40	1						
5236	26.13	.00	0.	0.	2.5 0~	.50	1						
5241	26.80	.00	0.	0.	2.6 0~	.40	1						
5316	26.97	.00	0.	0.	4.0 0~	.60	1						
5317	27.85	.00	0.	0.	.1 0~	.60	1						
5318	26.51	.00	0.	0.	3.0 0~	.60	1						
5320	30.00	.00	0.	0.	5.6 0~	.60	1						
5331	24.61	.00	0.	0.	.1 0~	.60	1						
5333	24.44	.00	0.	0.	.1 0~	.60	1						
5343	24.50	.00	0.	0.	.1 0~	.50	1						
5345	25.60	.00	0.	0.	.1 0~	.60	1						
5346	24.91	.00	0.	0.	2.1 0~	.50	1						
5367	26.75	.00	0.	0.	.1 0~	.40	1						
5377	25.00	.00	0.	0.	2.8 0~	.50	1						
5378	26.50	.00	0.	0.	.1 0~	.60	1						
5390	25.47	.00	0.	0.	.1 0~	.70	1						
5392	25.30	.00	0.	0.	5.4 0~	.60	1						
5394	25.68	.00	0.	0.	1.9 0~	.60	1						
6210	27.96	.00	0.	0.	1.7 0~	.60	1						
6310	24.31	.00	0.	0.	.1 0~	.60	1						
6315	24.31	.00	0.	0.	3.2 0~	.60	1						
6316	24.28	.00	0.	0.	.1 0~	.60	1						
6351	25.22	.00	0.	0.	2.1 0~	.60	1						
6340	23.73	.00	0.	0.			1				20.00	23.49	1.85
6380	23.94	.00	0.	0.			1				20.00	23.70	1.85

***** INPUT *****
****

C O N D U I T D A T A
****

CONDT NUMBER	NODE NUMBER BEGIN	END	INVERT LEVEL BEGIN (M)	END (M)	LENGTH (M)	ROUGHNESS (*)	EFF. CROSS COEFF	BOTTOM WIDTH (M)	CATCHM. WIDTH (M)	SIDE SLOPES COTGA	COTGB	PROFILE CURVE NUMBER	CLOSED CONDUIT - CHARACTERISTICS SHAPE	HEIGHT (M)	WIDTH (M)	LOSSES BEGIN	END	SILT (%)
21	4316	4369	33.16	31.15	280	.0050	1.00	6.00	0	.01	.01							
40	4207	4369	31.65	31.15	150	.0050	1.00	6.00	0	.01	.01							
44	4233	5205	29.98	28.65	95	.0050	1.00	6.00	0	.01	.01							
53	4345	4369	31.45	31.15	270	.0050	1.00	6.00	0	.01	.01							
55	4369	4394	31.15	29.46	315	.0050	1.00	6.00	0	.01	.01							
57	4394	5367	29.46	26.60	155	.0050	1.00	6.00	0	.01	.01							
78	5205	5206	28.65	27.25	80	.0050	1.00	6.00	0	.01	.01							
80	5206	5241	27.25	26.45	220	.0050	1.00	6.00	0	.01	.01							
83	5236	5241	25.98	26.65	20	.0050	1.00	6.00	0	.01	.01							
85	5236	5392	25.98	25.05	210	.0050	1.00	6.00	0	.01	.01							
98	5320	5316	29.85	26.82	105	.0050	1.00	6.00	0	.01	.01							
99	5316	5317	26.82	27.70	80	.0050	1.00	6.00	0	.01	.01							
100	5316	5318	26.82	26.31	80	.0050	1.00	6.00	0	.01	.01							
101	5318	5345	26.31	25.47	120	.0050	1.00	6.00	0	.01	.01							
102	5331	5333	24.46	24.29	125	.0050	1.00	6.00	0	.01	.01							
106	5333	6310	24.29	24.16	100	.0050	1.00	6.00	0	.01	.01							
108	5343	5346	24.25	24.50	110	.0050	1.00	6.00	0	.01	.01							
110	5343	6315	24.25	23.81	50	.0050	1.00	6.00	0	.01	.01							
111	5345	5346	25.47	24.50	80	.0050	1.00	6.00	0	.01	.01							
112	5346	5377	24.50	24.63	100	.0050	1.00	6.00	0	.01	.01							
115	5367	5390	26.60	25.32	155	.0050	1.00	5.00	0	.01	.01							
116	5377	5378	24.63	26.35	90	.0050	1.00	5.00	0	.01	.01							
117	5377	5392	24.63	25.05	160	.0050	1.00	6.00	0	.01	.01							
119	5390	5392	25.32	25.05	80	.0050	1.00	6.00	0	.01	.01							
120	5392	5394	25.05	25.53	110	.0050	1.00	6.00	0	.01	.01							
121	5394	6210	25.53	27.81	290	.0050	1.00	6.00	0	.01	.01							
145	6310	6315	24.16	23.81	40	.0050	1.00	6.00	0	.01	.01							
146	6315	6316	23.81	23.76	75	.0050	1.00	6.00	0	.01	.01							
147	6316	6340	23.76	23.48	220	.0050	1.00	8.00	0	.01	.01							
152	6340	6380	23.48	23.69	130	.0050	1.00	6.00	0	.01	.01							
154	6351	6380	25.07	23.69	205	.0050	1.00	6.00	0	.01	.01							

* ROUGHNESS ACCORDING TO NIKURADSE (M)

R A I N C U R V E S
****

RAIN CURVE 1	TIME	(MIN)	0	30	31	60	61	75	76	90	91	105	106	120
	INTENS.	(MM/H)	2.6	2.6	5.4	5.4	12.0	12.0	46.4	46.4	20.0	20.0	8.0	8.0
	TIME	(MIN)	121	150	151	180								
	INTENS.	(MM/H)	3.6	3.6	2.0	2.0								

***** RESULTS *****
****

MAXIMUM WATER LEVELS AND DISCHARGES

CONDT NUMBR	NODE NMBR	SURFACE LEVEL (M)	WATER LEVEL (M)	INVERT LEVEL (M)	CONDT DEPTH (M)	FILLING (%) *\#	TIME (MIN)	TIME (MIN)	DISCHARGE (M3/S)	VELO-CITY (M/S)	GRADIENTS WATER (1:X)	GRADIENTS INVERT (1:X)	BOTTOM WIDTH (M)	REMARKS
OPEN CONDUITS WITH TRAPEZIUM PROFILES :														
21	4316	33.31	33.18	33.16	.15	12	92	92	.082	.28	144	139	6.00	
	4369	31.30	31.25	31.15	.15	64	103							
40	4207	31.80	31.66	31.65	.15	6	92	93	.017	.06	363	300	6.00	
	4369	31.30	31.25	31.15	.15	64	103							
44	4233	30.13	30.01	29.98	.15	18	92	92	.085	.58	71	71	6.00	
	5205	28.80	28.67	28.65	.15	14	91							
53	4345	31.60	31.48	31.45	.15	21	94	95	.065	.18	1145	999	6.00	
	4369	31.30	31.25	31.15	.15	64	103							
55	4369	31.30	31.25	31.15	.15	64	103	103	.357	.80	131	126	6.00	
	4394	29.61	29.51	29.46	.15	35	101							
57	4394	29.61	29.51	29.46	.15	35	101	100	.562	1.24	55	54	6.00	
	5367	26.75	26.70	26.60	.15	66	95							
78	5205	28.80	28.67	28.65	.15	14	91	92	.157	.58	89	57	6.00	
	5206	27.40	27.33	27.25	.15	50	98							
80	5206	27.40	27.33	27.25	.15	50	98	97	.134	.45	338	366	6.00	
	5241	26.80	26.67	26.65	.15	16	97							
83	5236	26.13	26.03	25.98	.15	34	94	95	-.219	.97	31	29	6.00	
	5241	26.80	26.67	26.65	.15	16	97							
85	5236	26.13	26.03	25.98	.15	34	94	94	.331	.49	263	225	6.00	
	5392	25.30	25.23	25.05	.25	73	99							
98	5320	30.00	29.88	29.85	.15	22	91	92	-.352	1.13	35	34	6.00	
	3316	26.97	26.90	26.82	.15	50	93							
99	5316	26.97	26.90	26.82	.15	50	93	92	-.006	.03	99	90	6.00	
	5317	27.85	27.70	27.70	.15	2	92							
100	5316	26.97	26.90	26.82	.15	50	93	92	.563	.85	182	156	6.00	
	5318	26.51	26.46	26.31	.20	73	93							
101	5318	26.51	26.46	26.31	.20	73	93	93	.729	1.18	129	142	6.00	
	5345	25.60	25.53	25.47	.13	45	93							
102	5331	24.61	24.47	24.46	.15	6	95	97	.005	.09	743	735	6.00	
	5333	24.44	24.30	24.29	.15	7	98							
106	5333	24.44	24.30	24.29	.15	7	98	100	.011	.09	928	769	6.00	
	6310	24.31	24.19	24.16	.15	22	103							
108	5343	24.50	24.42	24.25	.25	66	101	100	-2.112	1.43	268	440	6.00	
	5346	24.91	24.83	24.50	.41	79	99							
110	5343	24.50	24.42	24.25	.25	66	101	100	2.112	1.29	223	113	6.00	
	6315	24.31	24.19	23.81	.50	77	102							
111	5345	25.60	25.53	25.47	.13	45	93	93	.733	.68	113	82	6.00	
	5346	24.91	24.83	24.50	.41	79	99							
112	5346	24.91	24.83	24.50	.41	79	99	101	-1.419	.78	1157	769	6.00	
	5377	25.00	24.91	24.63	.37	76	101							
115	5367	26.75	26.70	26.60	.15	66	95	98	.572	1.13	121	121	5.00	
	5390	25.47	25.42	25.32	.15	66	100							

FREEBOARD CODE *** 0% - 5% FILLING OF CLOSED ### 95% - 100% POSITIVE DISCHARGE FROM LOW TO HIGH NODE NUMBER
OPEN CONDUITS ** 5% - 10% CONDUITS ## 90% - 95%
(% OF DEPTH) * 10% - 20% (% OF DEPTH\DIAM.) # 80% - 90%

***** RESULTS *****
****

M A X I M U M W A T E R L E V E L S A N D D I S C H A R G E S

CONDT NUMBR	NODE NMBR	SURFACE LEVEL (M)	WATER LEVEL (M)	INVERT LEVEL (M)	CONDT DEPTH (M)	FILLING (%) *\#	TIME (MIN)	TIME (MIN)	DISCHARGE (M3/S)	VELOCITY (M/S)	GRADIENTS WATER (1:X)	GRADIENTS INVERT (1:X)	BOTTOM WIDTH (M)	REMARKS
OPEN CONDUITS WITH TRAPEZIUM PROFILES :														
116	5377	25.00	24.91	24.63	.37	76	101	92	-.006	.01	62	52	5.00	
	5378	26.50	26.35	26.35	.15	2	92							
117	5377	25.00	24.91	24.63	.37	76	101	99	1.319	.95	497	380	6.00	
	5392	25.30	25.23	25.05	.25	73	99							
119	5390	25.47	25.42	25.32	.15	66	100	100	.575	.68	432	296	6.00	
	5392	25.30	25.23	25.05	.25	73	99							
120	5392	25.30	25.23	25.05	.25	73	99	94	-.197	.31	329	229	6.00	
	5394	25.68	25.57	25.53	.15	25	94							
121	5394	25.68	25.57	25.53	.15	25	94	93	-.098	.51	127	127	6.00	
	6210	27.96	27.84	27.81	.15	18	92							
145	6310	24.31	24.19	24.16	.15	22	103	97	.040	.03	88115	114	6.00	
	6315	24.31	24.19	23.81	.50	77	102							
146	6315	24.31	24.19	23.81	.50	77	102	102	2.246	1.03	823	1500	6.00	
	6316	24.28	24.10	23.76	.52	66	103							
147	6316	24.28	24.10	23.76	.52	66	103	103	2.243	1.10	482	785	8.00	
	6340	23.73	23.65	23.48	.25	66	104							
152	6340	23.73	23.65	23.48	.25	66	104	94	-.050	.11	1897	619	6.00	
	6380	23.94	23.71	23.69	.25	10	97							
154	6351	25.22	25.12	25.07	.15	32	93	94	-.117	.54	146	148	6.00	
	6380	23.94	23.71	23.69	.25	10	97							

FREEBOARD CODE *** 0% - 5% FILLING OF CLOSED ### 95% - 100% POSITIVE DISCHARGE FROM LOW TO HIGH NODE NUMBER
OPEN CONDUITS ** 5% - 10% CONDUITS ## 90% - 95%
(% OF DEPTH) * 10% - 20% (% OF DEPTH\DIAM.) # 80% - 90%

***** RESULTS *****
****

TOTAL CATCHMENT AREA 60.5000 HA

THE BANDWIDTH OF THE SYMMETRICAL MATRIX IS 6 POSITIONS

S P I L L E D V O L U M E S
****

NODE NUMBER	VOLUME (M3)	SPILLING TIME (MIN)
6340	3643	41
6380	112	46

W A T E R B A L A N C E I N [M3]
****

INFLOW (HYDROGRAPHS)	:	0
INFLOW (FIXED WATER LEVELS)	:	0
RAINFALL	:	7911
TOTAL IN	:	7911
OUTFLOW (SPILLWAYS)	:	3756
OUTFLOW (PUMPS)	:	0
OUTFLOW (FIXED WATER LEVELS)	:	0
EVAPORATION	:	0
TOTAL OUT	:	3756
STORAGE CHANGE	:	4202
TOTAL OUT + STORAGE CHANGE	:	7958
BALANCE ERROR	:	.60 %

****** E N D O F C Y C L O N E ******

```
**********************************************************************
*                                                                    *
*     RADA WATER SUPPLY AND SANITATION PROJECT                       *
*     CALCULATION OF THE DRAINAGE SYSTEM                             *
*     RECURRENCY PERIOD     2 YEARS                                  *
*          SOUTHERN SECTION                                          *
*          VERSION 16 APRIL 1989                                     *
*                                                                    *
**********************************************************************


***** INPUT *****
*****************


G E N E R A L   D A T A
***********************


DIFFUSIVE WAVE EQUATIONS
IMPLICIT METHOD

LENGTH OF A COORDINATE-UNIT     (M) :        1.000

ROUGHNESS ACCORDING TO
NIKURADSE (M)
FOR OPEN CONDUITS                   :         .0050
FOR CLOSED CONDUITS                 :         .0050
EFFECTIVE CROSS-SECTIONAL AREA      :        1.000
RUN-OFF COEFFICIENT (DEFAULT)       :         .250

TOTAL CALCULATION TIME       (HOUR) :           2
TIME STEP (CALCULATION)       (MIN) :           1
TIME STEP (OUTPUT)            (MIN) :           5

NUMBER OF TRAPEZIUM PROFILES        :          21
NUMBER OF VARIABLE PROFILES         :           0
NUMBER OF CLOSED CONDUITS           :           0
NUMBER OF WEIRS                     :           0
NUMBER OF NODES                     :          21
NUMBER OF SPILLWAYS                 :           1
NUMBER OF PUMPS                     :           0
NUMBER OF INFLOW HYDROGRAPHS        :           0
NUMBER OF RAIN CURVES               :           1
NUMBER OF EVAPORATION CURVES        :           0
NUMBER OF STORAGE CURVES            :           0
NUMBER OF PROFILE CURVES            :           0
NUMBER OF WATER LEVEL CURVES        :           0
NUMBER OF MOVABLE WEIR CURVES       :           0
```

***** INPUT *****
****

N O D E D A T A
****

CATCHMENT AREA (CODE 1) 0~ = HA 1~ = M2 PUMP CAP. (CODE 2) 0~ = M3/S 1~ = L/S

NODE NUMBER	GROUND LEVEL (M)	WATER LEVEL (M)	X-COORD	Y-COORD	CATCHMENT AREA (CODE 1)	RUN OFF COEFF	CURVE INFL	CURVE STORGE	CURVE EVAP	CURVE RAIN	CURVE WATLEV	PUMP CAP (CODE 2)	PUMP START (M)	PUMP STOP (M)	SPILLWAY WIDTH (M)	SPILLWAY LEVEL (M)	SPILLWAY COEFF
3213	35.17	.00	0.	0.	4.6 0~	.30				1							
3249	32.31	.00	0.	0.	3.6 0~	.30				1							
3291	33.37	.00	0.	0.	5.7 0~	.30				1							
3342	32.37	.00	0.	0.	3.6 0~	.30				1							
3378	32.99	.00	0.	0.	2.4 0~	.30				1							
4207	31.80	.00	0.	0.	.5 0~	.30				1							
4210	31.60	.00	0.	0.	2.5 0~	.30				1							
4242	30.37	.00	0.	0.	3.5 0~	.30				1							
4254	30.71	.00	0.	0.	2.0 0~	.30				1							
4258	30.66	.00	0.	0.	2.7 0~	.30				1							
4267	32.01	.00	0.	0.	3.5 0~	.30				1							
5107	29.09	.00	0.	0.	2.0 0~	.40				1							
5132	28.00	.00	0.	0.	2.0 0~	.30				1							
5215	28.60	.00	0.	0.	4.0 0~	.40				1							
5261	28.30	.00	0.	0.	5.8 0~	.40				1							
5272	28.00	.00	0.	0.	4.0 0~	.40				1							
5276	27.74	.00	0.	0.	2.0 0~	.50				1							
5292	27.35	.00	0.	0.	.1 0~	.50				1							
5297	27.22	.00	0.	0.	2.8 0~	.40				1							
6109	25.70	.00	0.	0.	2.0 0~	.30				1							
6264	25.60	.00	0.	0.	3.7 0~	.50				1							
6286	25.20	.00	0.	0.						1					20.00	24.31	1.86

***** INPUT *****
****

C O N D U I T D A T A
****

CONDT NUMBER	NODE NUMBER BEGIN	END	INVERT LEVEL BEGIN (M)	END (M)	LENGTH (M)	ROUGHNESS (*)	EFF. CROSS COEFF	BOTTOM WIDTH (M)	CATCHM. WIDTH (M)	SIDE SLOPES COTGA	COTGB	PROFILE CURVE NUMBER	CLOSED CONDUIT - CHARACTERISTICS SHAPE	HEIGHT (M)	WIDTH (M)	LOSSES BEGIN	LOSSES END	SILT (%)
10	3213	3391	35.02	33.22	290	.0050	1.00	6.00	0	.01	.01							
15	3249	4210	32.16	31.37	250	.0050	1.00	6.00	0	.01	.01							
20	3398	3249	32.84	32.16	100	.0050	1.00	6.00	0	.01	.01							
30	3391	3393	33.22	32.62	220	.0050	1.00	6.00	0	.01	.01							
40	3393	4207	32.62	31.65	230	.0050	1.00	6.00	0	.01	.01							
50	4207	4210	31.65	31.37	80	.0050	1.00	6.00	0	.01	.01							
60	4210	4258	31.37	30.46	230	.0050	1.00	6.00	0	.01	.01							
65	4242	4254	30.22	30.56	175	.0050	1.00	6.00	0	.01	.01							
70	4242	5215	30.22	28.45	150	.0050	1.00	6.00	0	.01	.01							
80	4258	4267	30.46	31.86	130	.0050	1.00	6.00	0	.01	.01							
90	4258	5261	30.46	28.10	420	.0050	1.00	6.00	0	.01	.01							
100	5107	5272	28.94	27.75	100	.0050	1.00	6.00	0	.01	.01							
110	5132	5297	27.85	27.02	90	.0050	1.00	6.00	0	.01	.01							
140	5215	5261	28.45	28.10	190	.0050	1.00	6.00	0	.01	.01							
150	5261	5272	28.10	27.75	100	.0050	1.00	6.00	0	.01	.01							
160	5272	5292	27.75	27.05	280	.0050	1.00	6.00	0	.01	.01							
165	5276	5292	27.59	27.05	150	.0050	1.00	6.00	0	.01	.01							
170	5292	5297	27.05	27.02	40	.0050	1.00	6.00	0	.01	.01							
180	6109	6264	25.55	25.30	240	.0050	1.00	6.00	0	.01	.01							
185	5297	6264	27.02	25.30	150	.0050	1.00	6.00	0	.01	.01							
190	6264	6266	25.30	24.80	125	.0050	1.00	6.00	0	.01	.01							

* ROUGHNESS ACCORDING TO NIKURADSE (M)

R A I N C U R V E S
****

RAIN CURVE													
1	TIME (MIN)	0	30	31	60	61	75	76	90	91	105	106	120
	INTENS. (MM/H)	2.6	2.6	5.4	5.4	12.0	12.0	46.4	46.4	20.0	20.0	8.0	8.0
	TIME (MIN)	121	150	151	180								
	INTENS. (MM/H)	3.6	3.6	2.0	2.0								

***** RESULTS *****
****

M A X I M U M W A T E R L E V E L S A N D D I S C H A R G E S

CONDT NUMBR	NODE NMBR	SURFACE LEVEL (M)	WATER LEVEL (M)	INVERT LEVEL (M)	CONDT DEPTH (M)	FILLING (%) *\#	TIME (MIN)	TIME (MIN)	DISCHARGE (M3/S)	VELOCITY (M/S)	GRADIENTS WATER (1:X)	GRADIENTS INVERT (1:X)	BOTTOM WIDTH (M)	REMARKS
OPEN CONDUITS WITH TRAPEZIUM PROFILES :														
10	3213	35.17	35.05	35.02	.15	20	92	93	.136	.47	164	161	6.00	
	3391	33.37	33.29	33.22	.15	47	97							
15	3249	32.31	32.20	32.16	.15	27	92	93	.173	.39	354	316	6.00	
	4210	31.60	31.49	31.37	.23	54	100							
20	3398	32.99	32.86	32.84	.15	14	92	92	-.071	.39	151	147	6.00	
	3249	32.31	32.20	32.16	.15	27	92							
30	3391	33.37	33.29	33.22	.15	47	97	97	.254	.56	375	366	6.00	
	3393	32.87	32.70	32.62	.25	33	91							
40	3393	32.87	32.70	32.62	.25	33	91	94	.317	.71	233	237	6.00	
	4207	31.80	31.72	31.65	.15	45	95							
50	4207	31.80	31.72	31.65	.15	45	95	97	.331	.58	358	285	6.00	
	4210	31.60	31.49	31.37	.23	54	100							
60	4210	31.60	31.49	31.37	.23	54	100	101	.533	.87	241	252	6.00	
	4258	30.66	30.54	30.46	.20	41	103							
65	4242	30.37	30.24	30.22	.15	15	93	94	-.051	.27	489	514	6.00	
	4254	30.71	30.60	30.56	.15	27	95							
70	4242	30.37	30.24	30.22	.15	15	93	93	.147	.48	87	84	6.00	
	5215	28.60	28.53	28.45	.15	53	93							
80	4258	30.66	30.54	30.46	.20	41	103	91	-.105	.44	97	92	6.00	
	4267	32.01	31.88	31.86	.15	13	91							
90	4258	30.66	30.54	30.46	.20	41	103	103	.661	.92	183	177	6.00	
	5261	28.30	28.26	28.10	.20	79	104							
100	5107	29.09	28.95	28.94	.15	8	93	91	.080	.19	97	84	6.00	
	5272	28.00	27.93	27.75	.25	70	106							
110	5132	28.00	27.86	27.85	.15	10	88	91	.060	.30	120	108	6.00	
	5297	27.22	27.12	27.02	.20	48	107							
140	5215	28.60	28.53	28.45	.15	53	93	95	.303	.48	702	542	6.00	
	5261	28.30	28.26	28.10	.20	79	104							
150	5261	28.30	28.26	28.10	.20	79	104	105	1.063	1.06	300	285	6.00	
	5272	28.00	27.93	27.75	.25	70	106							
160	5272	28.00	27.93	27.75	.25	70	106	106	1.221	.97	443	399	6.00	
	5292	27.35	27.29	27.05	.30	81 *	108							
165	5276	27.74	27.61	27.59	.15	16	92	92	.098	.18	468	277	6.00	
	5292	27.35	27.29	27.05	.30	81 *	108							
170	5292	27.35	27.29	27.05	.30	81 *	108	108	1.279	1.25	225	1333	6.00	
	5297	27.22	27.12	27.02	.20	48	107							
180	6109	25.70	25.58	25.55	.15	20	107	93	.050	.10	5935	960	6.00	
	6264	25.60	25.54	25.30	.30	80	109							
185	5297	27.22	27.12	27.02	.20	48	107	108	1.384	1.37	95	87	6.00	
	6264	25.60	25.54	25.30	.30	80	109							
190	6264	25.60	25.54	25.30	.30	80	109	109	1.516	1.37	204	250	6.00	
	6286	25.20	24.93	24.80	.40	32	110							

FREEBOARD CODE *** 0% - 5% FILLING OF CLOSED ### 95% - 100% POSITIVE DISCHARGE FROM LOW TO HIGH NODE NUMBER
OPEN CONDUITS ** 5% - 10% CONDUITS ## 90% - 95%
(% OF DEPTH) * 10% - 20% (% OF DEPTH\DIAM.) # 80% - 90%

***** RESULTS *****
****

TOTAL CATCHMENT AREA 63.0000 HA

S P I L L E D V O L U M E S
****

NODE NUMBER	VOLUME (M3)	SPILLING TIME (MIN)
6286	2321	52

W A T E R B A L A N C E I N [M3]
****

INFLOW (HYDROGRAPHS)	:	0
INFLOW (FIXED WATER LEVELS)	:	0
RAINFALL	:	5592
TOTAL IN	:	5592
OUTFLOW (SPILLWAYS)	:	2321
OUTFLOW (PUMPS)	:	0
OUTFLOW (FIXED WATER LEVELS)	:	0
EVAPORATION	:	0
TOTAL OUT	:	2321
STORAGE CHANGE	:	3306
TOTAL OUT + STORAGE CHANGE	:	5627
BALANCE ERROR	:	.63 %

****** E N D O F C Y C L O N E ******

C.2. PRESENT AND FUTURE ELEVATIONS

NODE DATA DRAINAGE SYSTEM

NODE	SURFACE LEVEL [cm]			PROPOSED INVERT LEVEL	DEPTH	TRIB. AREA [0.1*Ha]	REMARKS
	PRESENT	PROPOSED	DIFF.				
2227 *	3936	3936	0	3921	15	42	
2340 *	3972	3972	0	3957	15	32	
2377 *	3788	3788	0	3773	15	30	
2393 *	3700	3700	0	3685	15	17	
3213 *	3517	3517	0	3502	15	46	
3249 *		3231		3216	15		
3249 *	3231	3231	0	3216	15	39	
3307 *	3524	3524	0	3509	15	33	
3310 *	3620	3620	0	3605	15	24	
3321 *	3543	3543	0	3528	15	20	
3323 *	3500	3500	0	3475	25	22	
3333 *		3460		3445	15	24	
3338 *	3431	3431	0	3413	18	16	
3343 *	3405	3405	0	3380	25		
3354 *	3520	3520	0	3505	15	17	
3391 *	3337	3337	0	3322	15	57	
3393 *	3289	3287	2	3262	25	36	
3398 *	3299	3299	0	3284	15	24	
3492 *	3330	3330	0	3315	15		
4207 *	3161	3180	-19	3165	15	5	SOUTH
4207 *	3161	3180	-19	3165	15	6	MIDDLE
4210 *	3170	3160	10	3137	23	25	
4233 *	2994	3013	-19	2998	15	28	
4242 *	3045	3037	8	3022	15	35	
4254 *	3071	3071	0	3056	15	20	
4258 *	3066	3066	0	3046	20	27	
4267 *	3201	3201	0	3186	15	35	
4305 *	3314	3314	0	3290	24	11	
4316 *	3331	3331	0	3306	25	17	NW
4316 *	3331	3331	0	3316	15	21	MIDDLE
4336 *	3151	3151	0	3136	15	62	
4345 *	3160	3160	0	3145	15	18	
4369 *	3138	3130	8	3115	15	83	
4394 *	2961	2961	0	2946	15	57	
4442 *	3075	3075	0	3060	15		
4453 *	3226	3226	0	3206	20	34	
4466 *	3290	3290	0	3275	15	15	
4479 *	2953	2925	28	2860	65	33	
4483 *	3035	3035	0	3020	15	26	
4489 *	2935	2943	-8	2910	33	24	
4495 *		3050		3035	15		
4498 *	2945	2957	-12	2937	20	33	
4499 *	2947	2970	-23	2955	15		
5205 *	2896	2880	16	2865	15	18	
5206 *	2740	2740	0	2725	15		
5215 *	2857	2860	-3	2845	15	40	

C.2. PRESENT AND FUTURE ELEVATIONS (CONTINUED)

NODE	SURFACE LEVEL [cm] PRESENT	PROPOSED	DIFF.	PROPOSED INVERT LEVEL	DEPTH	TRIB. AREA [0.1*Ha]	REMARKS
5236 *	2632	2613	19	2598	15	25	
5241 *	2690	2680	10	2665	15	26	
5261 *	2844	2830	14	2810	20	58	
5272 *	2801	2800	1	2775	25	40	
5276 *	2774	2774	0	2759	15	20	
5292 *	2745	2735	10	2705	30		
5297 *	2757	2722	35	2702	20	28	
5301 *	2982	2982	0	2965	17	16	
5316 *	2700	2697	3	2682	15	40	
5317 *	2785	2785	0	2770	15		
5318 *	2646	2651	-5	2636	15		
5320 *	2991	3000	-9	2985	15	30	
5331 *	2459	2461	-2	2446	15	56	
5333 *	2407	2444	-37	2429	15		
5343 *		2450		2425	25		
5345 *	2571	2560	11	2545	15		
5346 *	2508	2483	25	2450	33	21	
5367 *	2675	2675	0	2660	15		
5377 *	2499	2500	-1	2463	37	28	
5378 *	2639	2650	-11	2635	15		
5390 *	2560	2547	13	2532	15		
5392 *	2477	2530	-53	2515	15	54	
5394 *	2563	2568	-5	2553	15	19	
5445 *	2545	2524	21	2510	14	55	
5448 *	2431	2504	-73	2471	33	30	
5470 *	2932	2966	-34	2951	15	18	
5498 *	2616	2616	0	2601	15	11	
6109 *	2570	2570	0	2555	15	20	
6210 *	2796	2796	0	2781	15	17	
6264 *	2560	2560	0	2530	30	37	
6286 *		2500		2480	20		
6310 *	2445	2431	14	2416	15		
6315 *	2490	2431	59	2381	50	32	
6316 *	2428	2428	0	2376	52		
6340 *	2373	2373	0	2358	15	31	
6351 *	2540	2522	18	2507	15	21	
6380 *	2400	2394	6	2369	25		
6420 *	2508	2508	0	2463	45	53	
6464 *	2414	2419	-5	2379	40	51	
6495 *	2360	2360	0	2340	20	40	
1337		4205		4190	15		
2304	3728	3728	0	3713	15		
2307	4004	4004	0	3989	15		
2328	3601	3601	0	3586	15		
2334	3633	3633	0	3618	15		
2413	3450	3450	0	3435	15		
3278	3225	3225	0	3210	15		

C.2. PRESENT AND FUTURE ELEVATIONS (CONTINUED)

NODE	SURFACE LEVEL [cm]			PROPOSED INVERT LEVEL	DEPTH	TRIB. AREA [0.1*Ha]	REMARKS
	PRESENT	PROPOSED	DIFF.				
3358	3530	3529	1	3514	15		
3390	3282	3299	-17	3284	15		
3418	3220	3220	0	3205	15		
3469	3450	3450	0	3435	15		
3490	3434	3434	0	3419	15		
3496	3460	3460	0	3445	15		
4427	2900	2900	0	2885	15		
4437	3047	3047	0	3032	15		
4438	3106	3106	0	3091	15		
4444	3035	3020	15	3005	15		
4490	3230	3230	0	3215	15		
4575	2825	2825	0	2810	15		
5107	2909	2909	0	2894	15	20	
5132	2800	2800	0	2785	15	20	
5200	2920	2920	0	2905	15		
5201	2757	2757	0	2742	15		
5242	2749	2749	0	2734	15		
5246	2781	2790	-9	2775	15		
5278	2583	2583	0	2568	15		
5298	2610	2610	0	2595	15		
5341	2492	2492	0	2477	15		
5347	2483	2486	-3	2471	15		
5348	2656	2656	0	2641	15		
5358	2520	2520	0	2505	15		
5379	2591	2591	0	2576	15		
5383	2657	2641	16	2626	15		
5384	2612	2612	0	2597	15		
5481	2668	2668	0	2653	15		
6209	2429	2429	0	2414	15		
6214	2440	2428	12	2413	15		
6216	2538	2538	0	2523	15		
6223	2450	2450	0	2435	15		
6251	2481	2481	0	2466	15		
6255	2498	2498	0	2483	15		
6302	2453	2453	0	2438	15		
6305	2480	2480	0	2465	15		
6331	2360	2360	0	2345	15		
6356		2555		2540	15		
6365	2580	2580	0	2565	15		
6366	2504	2504	0	2489	15		
6395	2423	2423	0	2408	15		
6457	2456	2456	0	2441	15		
6461	2424	2482	-58	2467	15		

* PRIMARY SYSTEM

C.3. ROADS TO BE PAVED

PART	PIPE	FLOW (m3/s)	LENGTH (m)	NODE NO. FROM	NODE NO. TO	CUMUL. LENGTH
M	147	2.24	220	6316	6340	220
M	110	2.11	50	5343	6315	270
M	108	2.11	110	5343	5346	380
NE	130	1.76	160	6464	6495	540
NE	120	1.66	245	6420	6464	785
S	190	1.52	125	6264	6286	910
NE	110	1.50	90	5448	6420	1,000
M	112	1.42	100	5346	5377	1,100
NE	90	1.39	120	5445	5448	1,220
S	185	1.38	150	5297	6264	1,370
M	117	1.32	160	5377	5392	1,530
S	170	1.28	40	5292	5297	1,570
M	146	1.25	75	6315	6316	1,645
S	160	1.22	280	5272	5292	1,925
NE	30	1.13	280	4479	5445	2,205
S	150	1.06	100	5261	5272	2,305
NW	180	1.06	165	4453	4466	2,470
NE	20	0.95	140	4479	4489	2,610
NW	170	0.74	135	4305	4466	2,745
M	111	0.73	80	5345	5346	2,825
M	101	0.73	120	5318	5345	2,945
NW	160	0.71	125	4305	4316	3,070
S	90	0.66	420	4258	5261	3,490
NW	130	0.65	105	3343	4316	3,595
M	119	0.58	80	5390	5392	3,675
M	115	0.57	155	5367	5390	3,830
M	100	0.56	80	5316	5318	3,910
NE	40	0.54	150	4489	4498	4,060
S	60	0.53	230	4210	4258	4,290
NE	10	0.39	205	4336	4498	4,495
NW	120	0.37	250	3343	3354	4,745
M	55	0.36	315	4369	4394	5,060
M	98	0.35	105	5320	5316	5,165
M	85	0.33	210	5236	5392	5,375
S	50	0.33	80	4207	4210	5,455
NW	50	0.32	235	2393	3354	5,690
S	40	0.32	230	3393	4207	5,920
S	140	0.30	190	5215	5261	6,110
NW	110	0.30	105	3338	3343	6,215
NW	150	0.26	175	3492	4466	6,390
S	30	0.25	220	3391	3393	6,610
M	83	0.22	20	5236	5241	6,630
NW	70	0.22	280	3323	3338	6,910
M	120	0.20	110	5392	5394	7,020
S	15	0.17	250	3249	4210	7,270
M	78	0.16	80	5205	5206	7,350
NW	90	0.16	115	3321	3323	7,465
NE	35	0.16	110	4483	4489	7,575
S	70	0.15	150	4242	5215	7,725
S	10	0.14	290	3213	3391	8,015
M	80	0.13	220	5206	5241	8,235
NW	80	0.13	295	3307	3333	8,530
NW	10	0.12	155	2227	2393	8,685
NW	20	0.12	200	2340	2377	8,885