TABLE E.2 COMPARISON OF FLOW AT GEREHU OFF-TAKE AND 9 MILE

(m^3/s)

	Gerehu off-take				9 mile			Gerehu off-take				9 mile
	P600	P600	P600	P600	P600	P600		P525	P525	P525	P1000
TIME	09/11/92	10/11/92	11/11/92	Average	12/11/92	12/11/92	TIME	09/11/92	11/11/92	Average	12/11/92
10:45	0.5966	0.5951	0.5598	0.5838		0.5835	12:00	0.5148	0.4594	0.4871	
50						0.5814	15	0.5030	0.4872	0.4951	
55					0.5915	0.5865	30	0.4920	0.4850	0.4885	
1:00	0.5769	0.5835	0.5781	0.5795	0.6101	0.5682	45	0.4991	0.5021	0.5006	
05					0.6020	0.5823	13:00	0.4900	0.4904	0.4902	
10					0.5817	0.5760	15	0.5046	0.4991	0.5019	
15	0.5760	0.5904	0.6011	0.5892	0.5901	0.5613	30	0.4824	0.5224	0.5024	0.518
20					0.5757	0.5847	45	0.4697	0.4799	0.4748	0.483
25					0.5850	0.5697	14:00	0.5105	0.5164	0.5135	0.485
30	0.5787	0.5918	0.5721	0.5809	0.5868	0.5754	15	0.4799	0.5018	0.4909	0.489
35					0.5865	0.5874	30	0.4980	0.5018	0.4999	0.489
40					0.5706	0.5766	45	0.4813	0.4797	0.4805	0.500
45	0.5918	0.5909	0.5889	0.5905	0.5733	0.5769	15:00	0.4802	0.5176	0.4989	0.489
50					0.5930	0.5625	15	0.4770	0.5012	0.4891	0.512
55					0.5850	0.5664	30	0.4777	0.4740	0.4759	0.475
12:00	0.5793	0.5742	0.5805	0.5780	0.5724	0.5610	45	0.5023	0.5119	0.5071	0.492
05					0.5886		16:00	0.4923	0.4866	0.4895	0.500
10					0.5754		15	0.4900	0.5087	0.4994	0.482
15	0.5862	0.5712	0.5760	0.5778		0.5721	30	0.4779	0.4605	0.4692	0.492
30	0.5921	0.5718	0.5871	0.5837		0.5718	45	0.4665	0.4729	0.4697	
45	0.5751	0.5691	0.5700	0.5714		0.5637	17:00	0.4970	0.4594	0.4782	
13:00	0.5802	0.5823	0.5763	0.5796		0.5649	No.	21	21	21	13
15	0.5874	0.5835	0.5924	0.5878		0.5583	Average	0.4898	0.4913	0.4906	0.4928
30	0.5730	0.5904	0.5763	0.5799		0.5613					
45	0.5847	0.5679	0.5790	0.5772		0.5613	Flow at Gerehu off-take is 0.4906 m3/s				
14:00	0.5826	0.5670	0.5904	0.5800		0.5529	while that of Mt.Eriama is 0.4928 m3/s.				
15	0.5918	0.5688	0.5853	0.5820		0.5574					
30	0.5781	0.5568	0.5742	0.5697		0.5428					
45	0.5898	0.5688	0.5649	0.5745		0.5377					
15.00	0.5673	0.5682	0.5739	0.5698		0.5625					
15	0.5814	0.5799	0.5667	0.5760		0.5440					
30	0.5778	0.5658	0.5906	0.5781		0.5392					
45	0.5877	0.5784	0.5625	0.5762		0.5673					
16.00	0.5865	0.5793	0.5763	0.5807		0.5589					
15	0.6002	0.5643	0.5673	0.5773		0.5488					
30	0.5868	0.5883	0.5826	0.5859		0.5733					
45	0.5874	0.5892	0.5598	0.5788		0.5577					
17.00	0.5927	0.5814	0.5625	0.5789		0.5509					
No.	26	26	26	26	16	36					
Average	0.5842	0.5776	0.5767	0.5795	0.5855	0.5652					

Flow at Gerehu off-take is 0.5855 m^3/s while that of Mt. Eriama is 0.5052 m^3/s.

TABLE E.3 FLOW AT 9 MILE (1/2)

(m^3/s)

	P600	P600	P600	P1000	P1000	P1000	P525	P525	P525
DATE	12/11/92	13/11/92	14/11/92	12/11/92	13/11/92	14/11/92	12/11/92	13/11/92	14/11/92
00:00		0.4844	0.0000		0.434				0.2231 *
15		0.4865	0.0000		0.416				0.2240 *
30		0.4934	0.0000		0.429				0.2240 *
45		0.4991	0.0000		0.409				0.2249 *
01:00		0.4907	0.0000		0.422				0.2228 *
15		0.4988	0.0000		0.413				0.1822 *
30		0.5015	0.0000		0.439				0.1752 *
45		0.4916	0.0000		0.420				0.1651 *
02:00		0.4928	0.1158		0.415				0.1692 *
15		0.4769	0.1307		0.416				0.1752 *
30		0.4928	0.0807		0.432				0.1660 *
45		0.4931	0.0427		0.422				0.1692 *
03:00		0.4886	0.0436		0.423				0.1596 *
15		0.4877	0.0457		0.404				0.1622 *
30		0.4620	0.0427		0.428				0.1658 *
45		0.4689	0.0412		0.426				0.1580 *
04:00		0.4632	0.0128		0.417				0.1610 *
15		0.4533	0.0041		0.427				0.1578 *
30		0.4757	0.0089		0.431				0.1599 *
45		0.4542	0.0000		0.422				0.1551 *
05:00		0.4739	0.0065		0.417				0.1631 *
15		0.4683	0.1391		0.428				0.1731 *
30		0.5248	0.1630		0.450				0.1806 *
45		0.5167	0.0580		0.478				0.1916 *
06:00		0.5640	0.0347		0.488				0.2075 *
15		0.5766	0.0227		0.528				0.2073 *
30		0.5673	0.0000		0.499				0.2089 *
45		0.5802	0.1571		0.501				0.2228 *
07:00		0.5793	0.0996		0.509				0.2294 *
15		0.5832	0.1361		0.514				0.2367 *
30		0.5829	0.1253		0.508				0.2468 *
45		0.5826	0.1825		0.505				0.2495 *
08:00		0.5757	0.2118		0.517				0.2454 *
15		0.5850	0.2420		0.527				0.2737 *
30			0.2310		0.516				0.2586 *
45			0.2343		0.530				0.2691 *
09:00			0.2208		0.485				0.2776 *
15			0.2250		0.525				0.2888 *
30		0.5613	0.2133		0.519				0.3036 *
45			0.2247		0.516				0.3045 *
10:00			0.2232		0.531				0.3228 *
15			0.1855		0.538				0.3358 *
30			0.2471		0.522				0.3510 *
45		0.5733	0.2313		0.519				0.4069 *
11:00		0.5631	0.2265		0.525				0.4430
15		0.5793	0.2232		0.498				0.4507
30		0.5739	0.2280		0.534				0.4478
45		0.5757	0.2274		0.512				0.4364

TABLE E.3 FLOW AT 9 MILE (2/2)

(m^3/s)

	P600	P600	P600	P1000	P1000	P1000	P525	P525	P525
DATE	12/11/92	13/11/92	14/11/92	12/11/92	13/11/92	14/11/92	12/11/92	13/11/92	14/11/92
12:00		0.5676	0.2447		0.512				0.4478
15	0.5721	0.5541	0.2591		0.490				0.4409
30	0.5718	0.5685	0.2639		0.510				0.4297
45	0.5637	0.5646	0.2708		0.498				0.4259
13:00	0.5649	0.5709	0.3052		0.484				0.4421
15	0.5583	0.5721	0.3408		0.482				0.4286
30	0.5613	0.5589	0.3779	0.518	0.501				0.4455
45	0.5613	0.5766	0.4380	0.483	0.494				0.4341
14:00	0.5529	0.5751	0.5431	0.485	0.491				0.4398
15	0.5574	0.5685	0.5449	0.489					0.4329
30	0.5428	0.5664	0.5565	0.489					0.4300
45	0.5377	0.5658	0.5514	0.500					0.4416
15:00	0.5625	0.5727	0.5541	0.489					0.4309
15	0.5440	0.5616	0.5544	0.512					0.4332
30	0.5392	0.5335	0.5616	0.475				0.4320	0.4343
45	0.5673	0.5709	0.5583	0.492				0.4384	0.4277
16:00	0.5589	0.5634	0.5598	0.500				0.4297	0.4352
15	0.5488	0.5458	0.5332	0.482				0.4215	0.4222
30	0.5733	0.5491	0.5655	0.492				0.4229	0.4211
45	0.5577	0.5413	0.5329	0.476				0.4407	0.4286
17:00	0.5509	0.5302		0.489				0.4320	
15	0.5464	0.5509		0.498				0.4336	
30	0.5437	0.5598		0.489				0.4336	
45	0.5506	0.5577		0.465				0.4268	
18:00	0.5425	0.5553		0.505				0.4332	
15	0.5437	0.5676		0.502				0.4361	
30	0.5532	0.5760		0.527				0.4359	
45	0.5655	0.5670		0.513				0.4240	
19:00	0.5673	0.5529		0.525				0.4279	
15	0.5547	0.5529		0.492				0.4268	
30	0.5577	0.5622		0.516				0.4099	
45	0.5565	0.5500		0.474				0.4120	
20:00	0.5697	0.5604		0.496				0.4177	
15	0.5562	0.5568		0.485				0.4213	
30	0.5497	0.5556		0.501				0.4083	
45	0.5538	0.5529		0.479				0.4120	
21:00	0.5338	0.5428		0.475				0.4126	
15	0.5356	0.5425		0.471				0.4106	
30	0.5060	0.5503		0.434				0.4024	
45	0.5108	0.5523		0.470				0.4001	
22:00	0.5066	0.5574		0.463				0.3987	
15	0.4934	0.5386		0.439				0.4031	
30	0.5063	0.0939		0.453				0.4542	
45	0.5009	0.0089		0.441				0.3458 *	
23:00	0.4901	0.0000		0.465				0.2876 *	
15	0.5030	0.0000		0.444				0.2792 *	
30	0.5057	0.0000		0.429				0.2411 *	
45	0.4796	0.0000		0.440				0.2251 *	
24:00	0.4844	0.0000		0.434				0.2231 *	
	47	82	12	42	57			29 *	24 *
	0.5432	0.5400	0.5513	0.4824	0.4745			0.4226	0.4354

* excluded due to accident in raw water main

TABLE E.4 INFLOW TO MT.ERIAMA TREATMENT PLANT ON 01/10/92

(m^3/s)

TIME	ROUNA 1/3 P 750	BOMANA P 525	TOTAL
10:30	1.2605	0.2200	1.4805
45	1.2845	0.2190	1.5035
11:00	1.2780	0.2231	1.5011
15	1.2775	0.2144	1.4919
30	1.2633	0.2226	1.4859
45	1.2444	0.2249	1.4693
12:00	1.2711	0.2123	1.4834
15	1.2518	0.2267	1.4785
30	1.2393	0.2267	1.4660
45	1.2274	0.2158	1.4432
13:00	1.2113	0.2242	1.4355
15	1.2449	0.2144	1.4593
30	1.2757	0.2171	1.4928
45	1.2545	0.2071	1.4616
14:00	1.2366	0.2082	1.4448
15	1.2785	0.2071	1.4856
30	1.2021	0.2082	1.4103
45	1.2522	0.2023	1.4545
15:00	1.2734	0.2066	1.4800
15	1.2154	0.2123	1.4277
30	1.2053	0.2110	1.4163
45	1.2449	0.2002	1.4451
16:00	1.2720	0.2125	1.4845
Average	1.2506	0.2146	1.4653

TABLE E.5 RAW WATER FROM ROUNA 1/3 HEADPOND

(m^3/s)

TIME	25/09/92	26/09/92	27/09/92	28/09/92	29/09/92	30/09/92	01/10/92
00:00		1.1949	1.2184		1.2082		1.2099
15		1.1925	1.2142		1.2069		1.2370
30		1.2263	1.2212		1.2101		1.2389
45		1.2221	1.1819		1.1902		1.2568
01:00		1.2202	1.2096		1.2193		1.2504
15		1.1944	1.1830		1.1792		1.2996
30		1.2022	1.2124		1.2119		1.2716
45		1.2073	1.2230		1.1935		1.2265
02:00		1.1889	1.2032		1.1805		1.2315
15		1.2276	1.2373		1.2424		1.2504
30		1.1981	1.3032		1.1533		1.2955
45		1.1773	1.2022		1.2161		1.2854
03:00		1.1967	1.2115		1.2161		1.2311
15		1.1249	1.1962		1.2212		1.2596
30		1.2193	1.2346		1.1898		1.2370
45		1.2202	1.2124		1.1981		1.2186
04:00		1.2355	1.2216		1.2161		1.2607
15		1.2221	1.2059		1.1935		1.2762
30		1.2161	1.2156		1.2249		1.2044
45		1.2101	1.2258		1.1805		1.2417
05:00		1.1953	1.2193		1.1976		1.2486
15		1.2004	12221		1.2041		1.2495
30		1.1972	1.2059		1.2198		1.2324
45		1.1944	1.2166		1.2050		1.2458
06:00		1.1976	1.2249		1.2101		1.1832
15		1.2198	1.2406		1.2166		1.2163
30		1.2046	1.2207		1.1967		1.2214
45		1.2309	1.2216		1.2253		1.2232
07:00		1.1838	1.2572		1.2350		1.2177
15		1.2133	1.2156		1.1921		1.2550
30		1.2193	1.2235		1.1902		1.2771
45		1.2009	1.2355		1.1893		1.2550
08:00		1.2216	1.1953		1.2032		1.2444
15		1.2004	1.2396		1.1732		1.2610
30		1.2336	1.2369		1.1902		1.2347
45		1.2161	1.2069		1.1778		1.2591
09:00		1.2124	1.2299		1.2059		.2624
15		1.2036	1.2359		1.2119		1.2812
30		1.2087	1.2046		1.2087		1.2803
45		1.1695	1.2073		1.1833		1.2679
10:00	1.2064	1.2022	1.2281		1.2493		
15	1.1912		1.2059		1.2175		
30	1.2392		1.2170		1.2119		1.2605*
45	1.2304		1.1999		1.2133		1.2845*
11:00	1.2281	1.2018	1.2429		1.2207		1.2780*
15	1.2046	1.1995	1.1912		1.2207	1.2651	1.2775*
30	1.2212	1.2216	1.2401		1.2244	1.2177	1.2633*
45	1.2419	1.1972	1.1949		1.2355	1.2177	1.2444*
12:00	1.2253	1.2175	1.2318	1.2041	1.2022	1.2177	1.2711*
15	1.2456	1.2055	1.2027	1.1935		1.2177	1.2518*
30	1.2387	1.2369	1.1842	1.1842		1.2177	1.2393*
45	1.2369	1.2212	1.2082	1.2221		1.2177	1.2274*
13:00	1.2221	1.1847	1.1861	1.2258		1.2177	1.2113*

15	1.1990	1.2272	1.2184	1.2032		1.2380	1.2449*
30	1.2050	1.1967	1.2022	1.2189		1.1896	1.2757*
45	1.2041	1.2055	1.1639	1.2327		1.2660	1.2545*
14:00	1.2189	1.1815	1.2373	1.2115		1.2389	1.2366*
15	1.2276	1.2050	1.2235	1.2346		1.2407	1.2785*
30	1.2022	1.2147	1.2249	1.2036		1.2145	1.2021*
45	1.2175	1.2096	1.2207	1.2189		1.2090	1.2522*
15:00	1.2101	1.2309	1.1667	1.2129		1.2168	1.2734*
15	1.2055	1.2341	1.2170	1.2166		1.2242	1.2154*
30	1.2073	1.1782	1.1861	1.2069		1.2366	1.2053*
45	1.2038	1.1949	1.2096	1.1990		1.1809	1.2449*
16:00	1.2456	1.2212	1.1861	1.2096		1.1942	1.2720*
15	1.2101	1.2216	1.2036	1.2226		1.1910	
30	1.2092	1.2036	1.2038	1.2124		1.2352	
45	1.2198	1.1995	1.2055	1.2170		1.2338	
17:00	1.2092	1.2022	1.2018	1.2202		1.2347	
15	1.1962	1.2129	1.1796	1.1907		1.2624	
30	1.1912	1.2073	1.2221	1.1912		1.2196	
45	1.2281	1.1842	1.2244	1.1690		1.1887	
18:00	1.2239	1.1810	1.2387	1.1713		1.1915	
15	1.2096	1.2115	1.2419	1.1722		1.1827	
30	1.2193	1.1833	1.2161	1.2064		1.2582	
45	1.2323	1.2443	1.2129	1.1819		1.2357	
19:00	1.2170	1.2378	1.1865	1.2253		1.2757	
15	1.2383	1.2299	1.2475	1.2221		1.2614	
30	1.1759	1.1962	1.2272	1.1644		1.2145	
45	1.2115	1.2221	1.2050	1.1976		1.2513	
20:00	1.2119	1.2059	1.2009	1.1939		1.2610	
15	1.2032	1.1810	1.1962	1.1805		1.2771	
30	1.2313	1.2184	1.1681	1.2373		1.2780	
45	1.2101	1.2110	1.1681	1.1889		1.2458	
21:00	1.2512	1.1773	1.1681	1.2036		1.2582	
15	1.1907	1.2295	1.1681	1.2156		1.2343	
30	1.1898	1.2387		1.1953		1.2012	
45	1.1745	1.2138		1.2244		1.2417	
22:00	1.1829	1.2175		1.1759		1.2486	
15	1.2142	1.2392		1.2263		1.1827	
30	1.2179	1.1829		1.2249		1.2081	
45	1.2369	1.2244		1.2142		1.2504	
23:00	1.2004	1.1972		1.1819		1.2417	
15	1.1972	1.1949		1.2212		1.2817	
30	1.2004	1.2138		1.2096		1.2398	
45	1.2152	1.1958		1.1944		1.2601	
24:00	1.1949	1.2184		1.2082		1.2099	
No.	56	93	86	48	49	51	40*
Average	1.2142	1.2074	1.2124	1.2052	1.2058	1.2311	1.2475*
	Total No. 423 * not included.			Total Average 1.2155 * not included			

TABLE E.6 MAIN FEATURES OF THREE MODEL AREA

* Ratio to the average hourly demand

Name of Model Area	Pressure (m)	Peak * Hourly Demand	Bottom * Hourly Demand
Gordons	65 - 80	1.71	0.55
Boroko	35 - 55	1.53	0.54
Gerehu	23 - 66	1.50	0.73

TABLE E.7 FLOW INTO THE MODEL AREAS (1/2)

(m^3/s)

	Flow to GORDONS Model Area			Flow to GEREHU Model Area			Flow to BOROKO Model Area		
	08/10/92 Thursday	09/10/92 Friday	10/10/92 Saturday	21/10/92 Wednesday	22/10/92 Thursday	23/10/92 Friday	04/11/92 Wednesday	05/11/92 Thursday	06/11/92 Friday
00:00		0.00362	0.00353		0.00242	0.00302		0.00329	0.00346
15		0.00310	0.00303		0.00247	0.00246		0.00316	0.00282
30		0.00276	0.00380		0.00244	0.00252		0.00378	0.00293
45		0.00277	0.00303		0.00234	0.00248		0.00259	0.00301
01:00		0.00285	0.00279		0.00264	0.00272		0.00250	0.00267
15		0.00305	0.00274		0.00275	0.00266		0.00269	0.00275
30		0.00274	0.00237		0.00253	0.00259		0.00261	0.00286
45		0.00297	0.00266		0.00246	0.00268		0.00269	0.00288
02:00		0.00272	0.00274		0.00242	0.00283		0.00265	0.00299
15		0.00276	0.00254		0.00259	0.00267		0.00267	0.00282
30		0.00310	0.00235		0.00257	0.00278		0.00286	0.00261
45		0.00270	0.00233		0.00255	0.00261		0.00248	0.00259
03:00		0.00276	0.00239		0.00250	0.00280		0.00231	0.00235
15		0.00285	0.00245		0.00275	0.00268		0.00295	0.00267
30		0.00301	0.00289		0.00256	0.00272		0.00280	0.00271
45		0.00310	0.00252		0.00247	0.00257		0.00263	0.00267
04:00		0.00337	0.00252		0.00263	0.00276		0.00210	0.00246
15		0.00326	0.00229		0.00281	0.00265		0.00237	0.00297
30		0.00283	0.00241		0.00264	0.00276		0.00231	0.00269
45		0.00316	0.00303		0.00256	0.00312		0.00282	0.00241
05:00		0.00276	0.00293		0.00269	0.00276		0.00235	0.00246
15		0.00293	0.00326		0.00269	0.00336		0.00280	0.00258
30		0.00374	0.00351		0.00240	0.00377		0.00267	.000259
45		0.00312	0.00382		0.00281	0.00299		0.00252	0.00350
06:00		0.00418	0.00538		0.00349	0.00422		0.00246	0.00320
15		0.00513	0.00610		0.00509	0.00366		0.00382	0.00335
30		0.00797	0.00594		0.00508	0.00464		0.00340	0.00380
45		0.00797	0.00472		0.00459	0.00482		0.00491	0.00371
07:00		0.00679	0.00548		0.00497			0.00553	0.00465
15		0.00656	0.00696		0.00366			0.00406	0.00421
30		0.00378	0.00691		0.00444			0.00371	0.00337
45		0.00532	0.00704		0.00378			0.00337	0.00401
08:00		0.00519	0.00565		0.00285			0.00357	0.00388
15		0.00555	0.00610		0.00385			0.00416	0.00459
30		0.00621	0.00706		0.00356			0.00510	0.00374
45		0.00567	0.00708		0.00358	0.00414		0.00455	0.00386
09:00		0.00586	0.00920		0.00355	0.00307		0.00374	0.00525
15		0.00563	0.00893		0.00360	0.00422		0.00455	0.00583
30		0.00623	0.00814		0.00377	0.00585		0.00404	0.00595
45		0.00720	0.00652		0.00374	0.00269		0.00327	0.00612
10:00		0.00567	0.00702		0.00346	0.00322		0.00308	0.00599
15		0.00500	0.00561		0.00397	0.00341		0.00316	
30		0.00500	0.00750		0.00377	0.00305	0.00350	0.00344	
45		0.00500	0.00642		0.00445	0.00332	0.00310	0.00340	
11:00		0.00453	0.00548		0.00363	0.00305	0.00237	0.00519	
15		0.00534	0.00602		0.00325	0.00264	0.00233	0.00533	
30		0.00554	0.00586	0.00332	0.00337	0.00333	0.00335	0.00589	
45		0.00499	0.00554	0.00350	0.00323	0.00337	0.00412	0.00506	

TABLE E.7 FLOW INTO THE MODEL AREAS (2/2)

(m³/s)

	Flow to GORDONS Model Area			Flow to GEREHU Model Area			Flow to BOROKO Model Area		
	08/10/92 Thursday	09/10/92 Friday	10/10/92 Saturday	21/10/92 Wednesday	22/10/92 Thursday	23/10/92 Friday	04/11/92 Wednesday	05/11/92 Thursday	06/11/92 Friday
12:00		0.00602	0.00637	0.00271	0.00356	0.00230	0.00369	0.00518	
15		0.00546	0.00671	0.00246	0.00325	0.00261	0.00340	0.00529	
30		0.00503	0.00621	0.00301	0.00291	0.00294	0.00299	0.00550	
45		0.00542	0.00702	0.00298	0.00307	0.00349	0.00284	0.00574	
13:00		0.00471	0.00509	0.00188	0.00328	0.00404	0.00337	0.00531	
15		0.00407	0.00555	0.00249	0.00321	0.00372	0.00297	0.00510	
30		0.00384	0.00480	0.00221	0.00301	0.00259	0.00248	0.00476	
45	0.00664	0.00540	0.00513	0.00293	0.00266	0.00272	0.00529	0.00568	
14:00	0.00444	0.00492			0.00357	0.00259	0.00585	0.00557	
15	0.00455	0.00461			0.00341	0.00286	0.00602	0.00557	
30	0.00399	0.00519			0.00276	0.00316	0.00372	0.00595	
45	0.00478	0.00666			0.00377	0.00367	0.00557	0.00538	
15:00	0.00642	0.00552			0.00279	0.00386	0.00559	0.00593	
15	0.00542	0.00434			0.00293	0.00368	0.00640	0.00572	
30	0.00362	0.00492			0.00325	0.00435	0.00640	0.00597	
45	0.00546	0.00486			0.00271	0.00383	0.00566	0.00533	
16:00	0.00449	0.00507		0.00256	0.00381	0.00305	0.00619	0.00582	
15	0.00484	0.00586		0.00267	0.00304		0.00619	0.00438	
30	0.00444	0.00530		0.00272	0.00312		0.00437	0.00418	
45	0.00496	0.00519		0.00383	0.00458		0.00474	0.00463	
17:00	0.00471	0.00486		0.00288	0.00436		0.00401	0.00406	
15	0.00596	0.00494		0.00356	0.00423		0.00354	0.00389	
30	0.00664	0.00656		0.00406	0.00418		0.00357	0.00463	
45	0.00664	0.00693		0.00385	0.00461		0.00386	0.00397	
18:00	0.00739	0.00691		0.00460	0.00397		0.00399	0.00361	
15	0.00832	0.00720		0.00377	0.00432		0.00421	0.00357	
30	0.00693	0.00835		0.00450	0.00428		0.00282	0.00416	
45	0.00696	0.00725		0.00495	0.00402		0.00401	0.00320	
19:00	0.00837	0.00776		0.00474	0.00401		0.00489	0.00431	
15	0.00638	0.00820		0.00382	0.00445		0.00365	0.00367	
30	0.00689	0.00720		0.00377	0.00459		0.00301	0.00331	
45	0.00542	0.00694		0.00341	0.00387		0.00356	0.00427	
20:00	0.00747	0.00669		0.00342	0.00377		0.00323	0.00412	
15	0.00747	0.00552		0.00390	0.00452		0.00210	0.00406	
30	0.00681	0.00617		0.00344	0.00345		0.00337	0.00384	
45	0.00598	0.00602		0.00311	0.00291		0.00323	0.00376	
21:00	0.00583	0.00637		0.00322	0.00343		0.00325	0.00406	
15	0.00637	0.00463		0.00326	0.00305		0.00386	0.00450	
30	0.00525	0.00486		0.00276	0.00314		0.00367	0.00354	
45	0.00494	0.00428		0.00328	0.00396		0.00406	0.00448	
22:00	0.00422	0.00370		0.00226	0.00349		0.00395	0.00361	
15	0.00370	0.00274		0.00260	0.00326		0.00365	0.00374	
30	0.00393	0.00391		0.00330	0.00307		0.00357	0.00333	
45	0.00442	0.00409		0.00245	0.00368		0.00286	0.00314	
23:00	0.00455	0.00430		0.00259	0.00315		0.00288	0.00263	
15	0.00469	0.00382		0.00262	0.00231		0.00301	0.00278	
30	0.00411	0.00376		0.00206	0.00254		0.00276	0.00327	
45	0.00386	0.00351		0.00274	0.00265		0.00288	.00284	
No.	41	96	56	42	96	58	54	96	41
Aver	0.00557	0.00488	0.00485	0.00319	0.00336	0.00319	0.00389	0.00390	0.00346

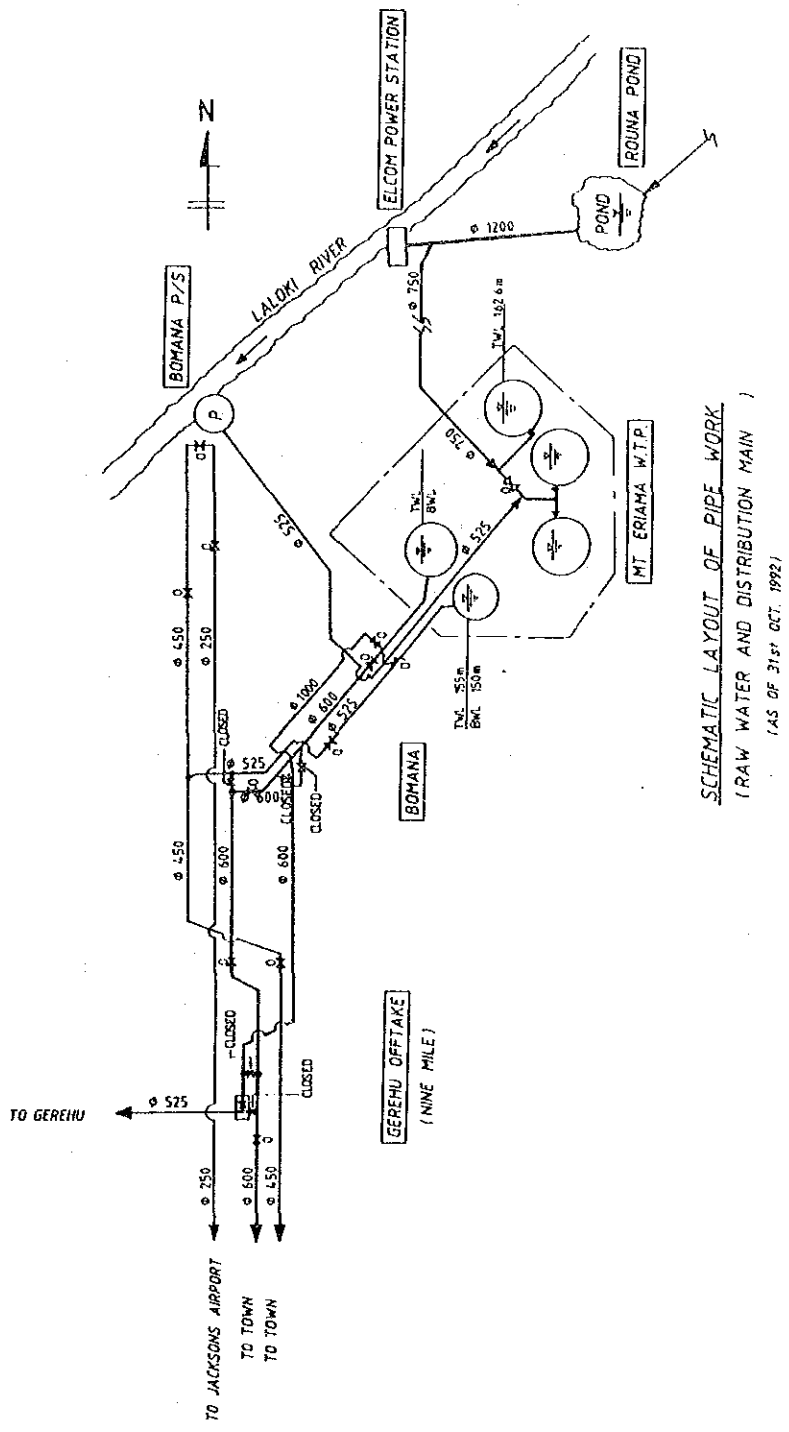
TABLE E.8 CURENT LEAKAGE LEVELS IN 3 MODEL AREAS

		Gordons	Gerehu	Boroko	Remarks
(1)	Minimum night flow: 1/sec	2.3	2.0	2.1	fro measurement
(2)	Legitiate usage: 1/sec	0.2	0.2	0.2	
(3)	Net night flow	2.1	1.8	1.9	(1) - (2)
(4)	Pressure variation: meter	65-80	23-66	35-55	
(5)	Pewaaue viriation: factor	0.816	0.546	0.848	calculated (refer to Table E.9)
(6)	Leakage: m^3/day	148	85	139	(3) x (5) x 86.4
(7)	Deand: m^3/day	420	290	337	from measuremen
(8)	Leakage % of demand	35	29	41	(6) / (7)
(9)	Pipe Material	A	A	CI	
(10	Pipe Intalled Year	1966	1969	1962	
(11)	Predoinant Housing Type	High	Low-Middle	High	

TABLE E.9 CALCULATION OF PRESSURE VARIATION FATOR IN MODLE AREA

Model Area	Gordons		Gerekage		Boroko	
Period (hour)	Average Pressure (meter)	Leakage Index *	Average Pressure (meter)	Leakage Index *	Average Pressure (meter)	Leakage Indix *
00 - 02	50	80	45	67	33	66
02 - 04	50	80	47	67	34	66
04 - 06	36	75	52	60	38	50
06 - 08	15	65	42	50	28	24
08 - 10	15	65	39	50	26	23
10 - 12	15	67	40	51	27	23
12 - 14	15	68	42	52	28	23
14 - 16	16	67	42	51	28	26
16 - 18	18	66	42	50	28	30
18 - 20	19	65	39	50	26	31
20 - 22	28	68	36	52	23	42
22 - 24	46	70	40	56	27	60
∑(Leakage indices)		656		328		346
Leakage index for night period		67		50		34
Therefore,		T=(656/67) *2		T=(329/50)*2		T=(346/34) *2
		=19.6 hours		=13.1 hours		=20.4 hours
namely		=19.6/24		=13.1/24		=20.4/24
		=0.816		=0.546		=0.848

(* calculated from Fig.D.8 taken from "Leakage control policy and practice", Water Authority Association, UK, 1985)



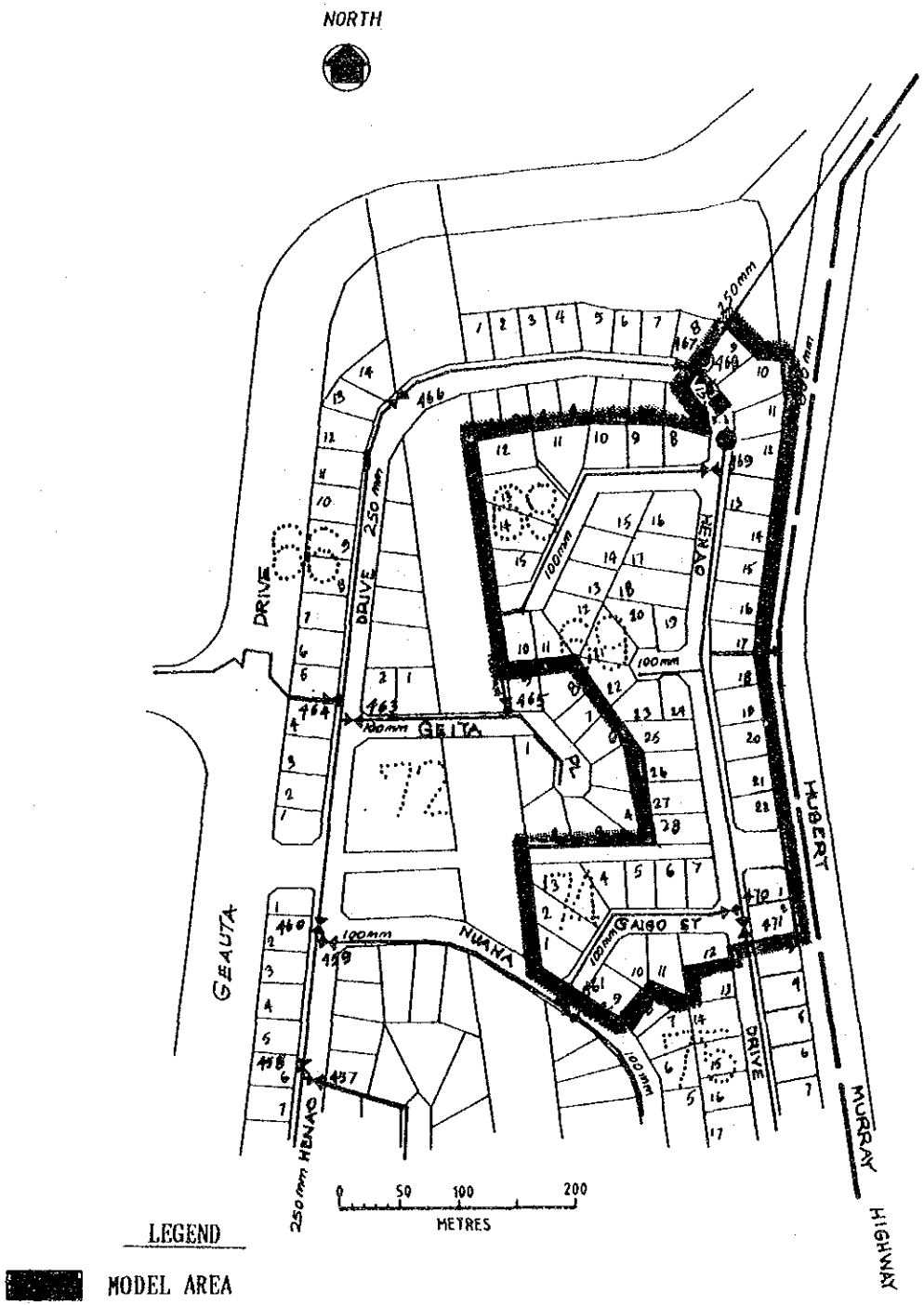
TITLE

SCHEMATIC TRUNK MAINS LAYOUT
(TREATMENT PLANT TO GEREHU OFF-TAKE)

Fig. No.
E.1

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

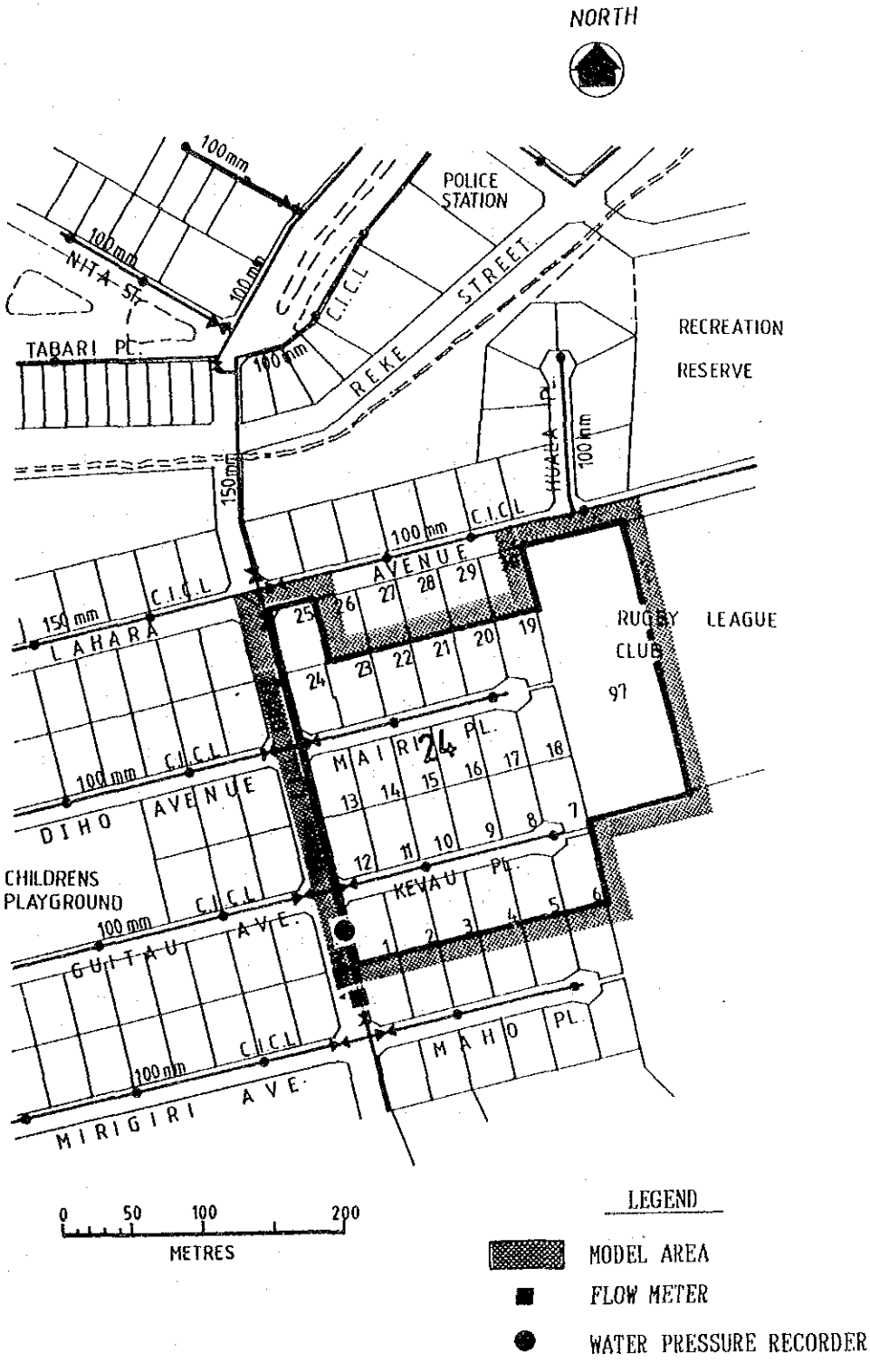
GORDONS MODEL AREA

Fig. No.

E.2

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

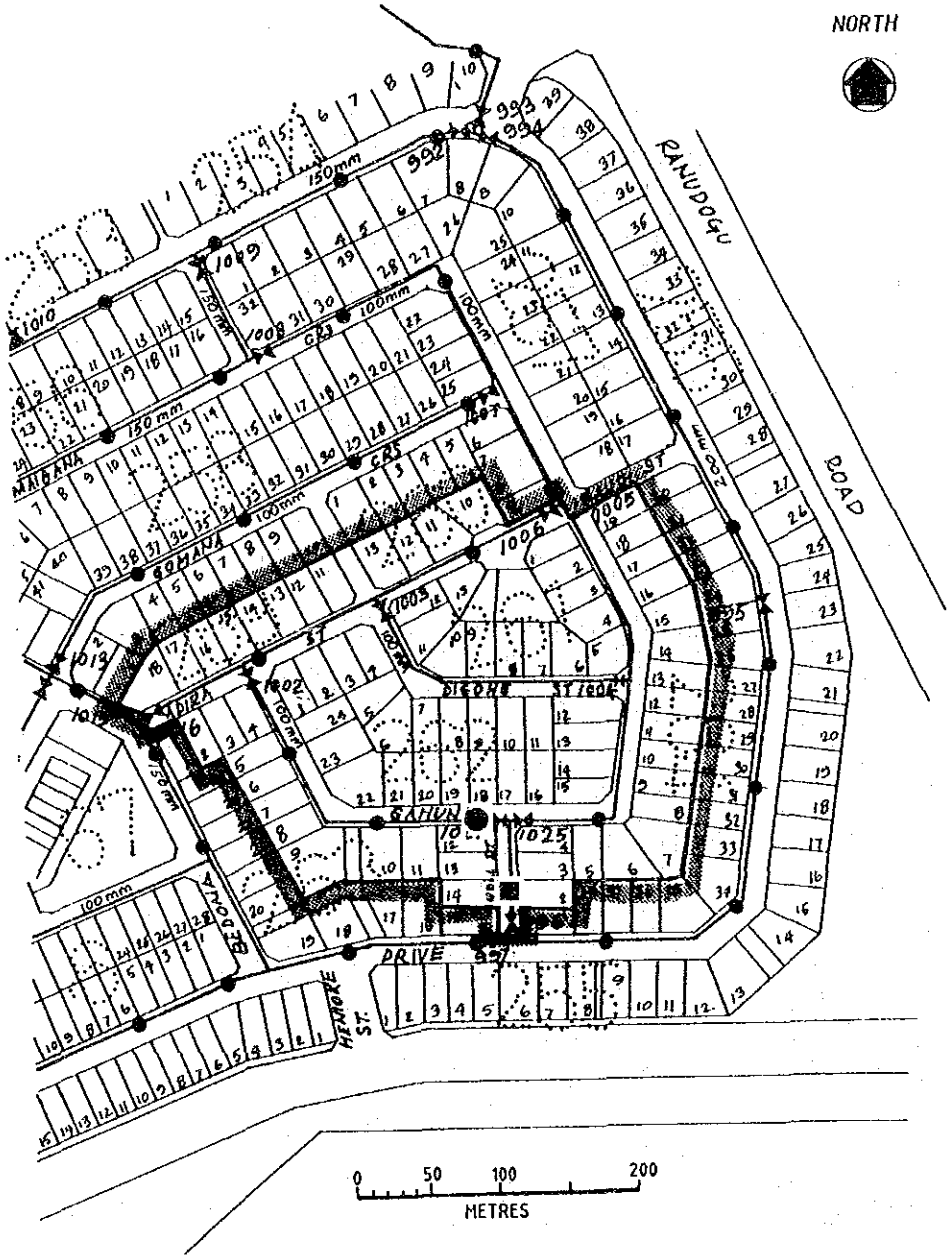
BOROKO MODEL AREA

Fig. No.

E.3

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL



LEGEND

- MODEL AREA
- FLOW METER
- WATER PRESSURE RECORDER

TITLE

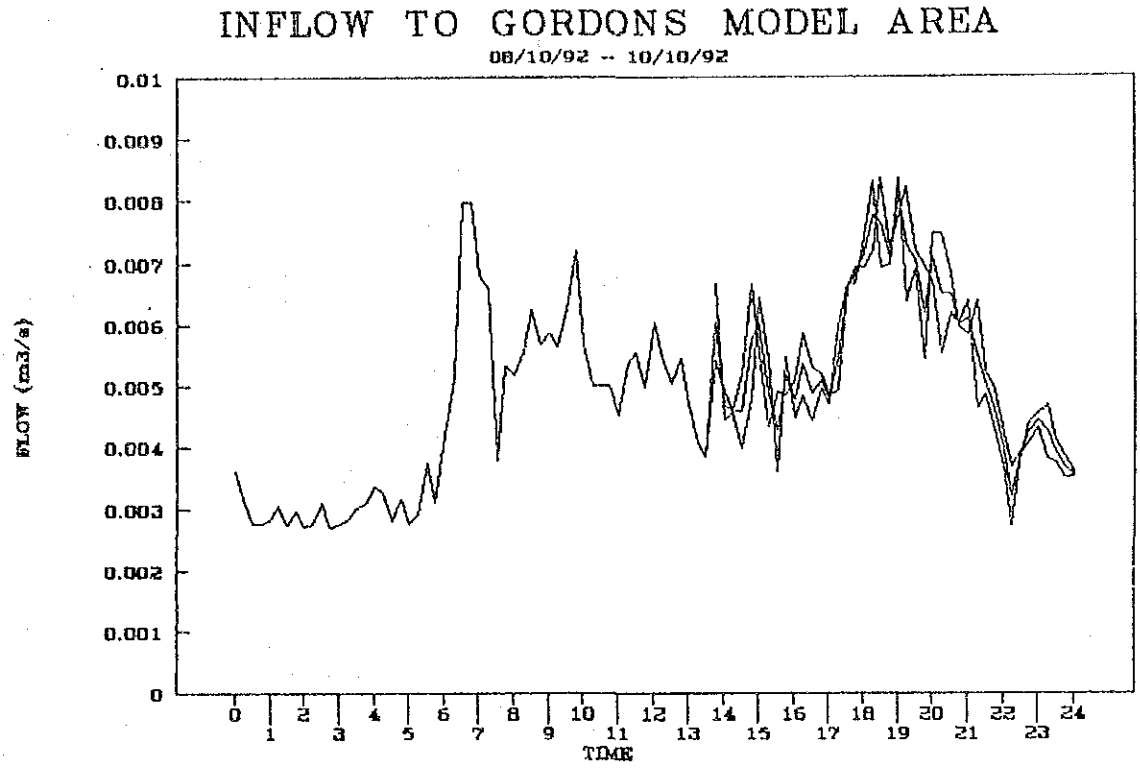
GEREHU MODEL AREA

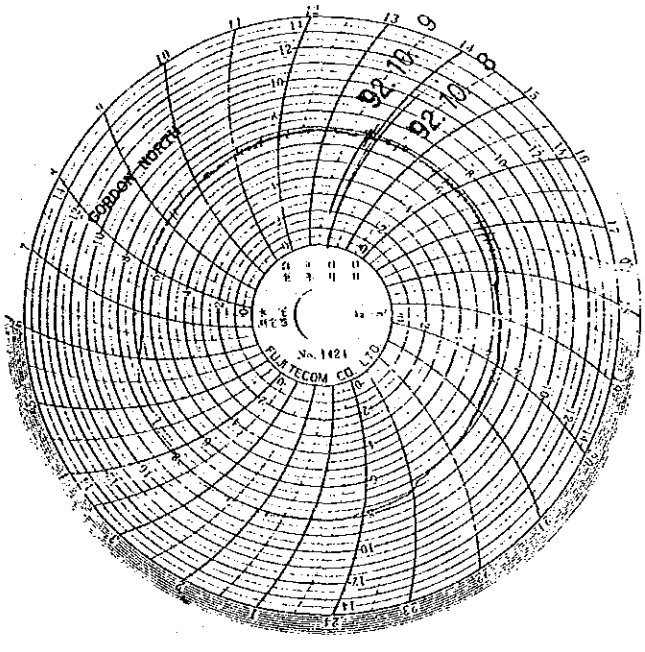
Fig. No.

E.4

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL





TITLE

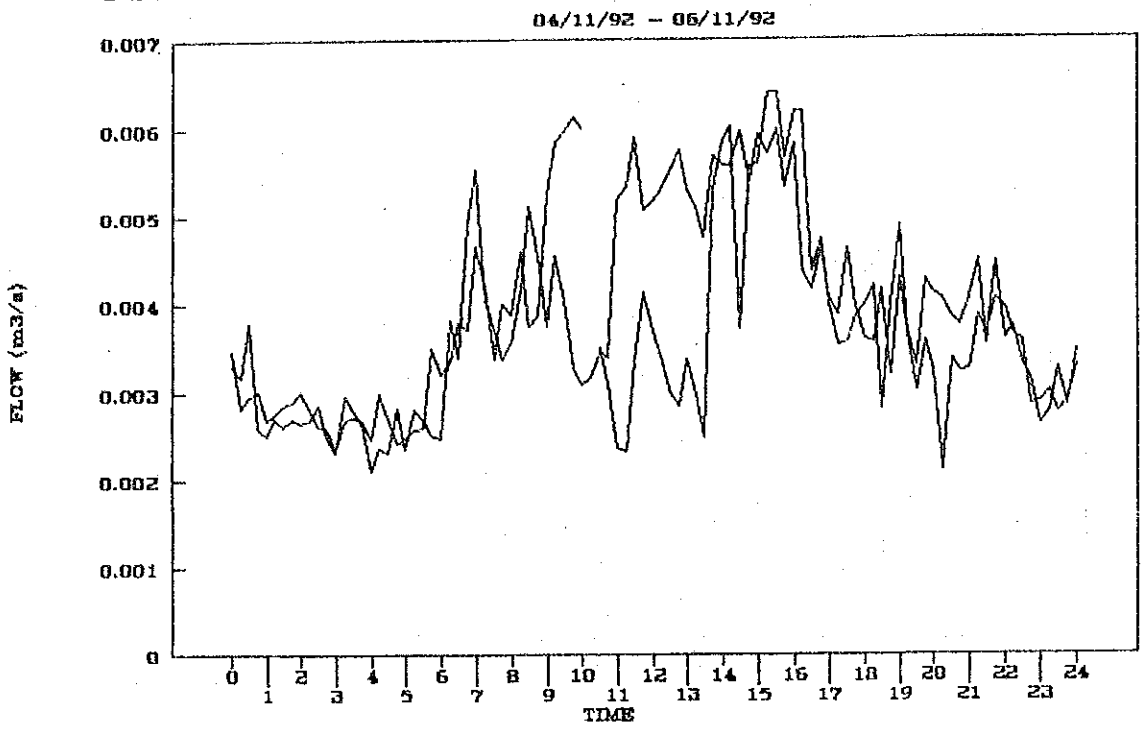
FLOW AND PRESSURE IN GORDONS MODEL AREA

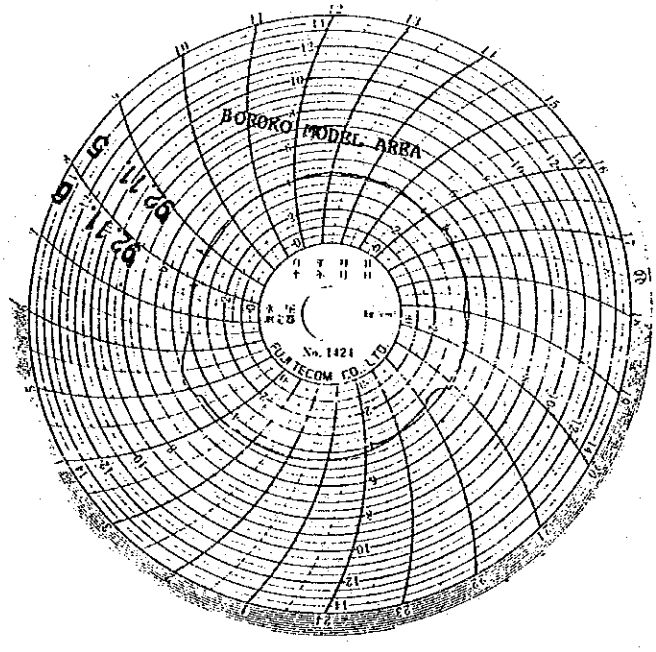
Fig. No. E.5

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL

FIG. INFLOW TO BOROKO MODEL AREA





TITLE

BOROKO MODEL AREA

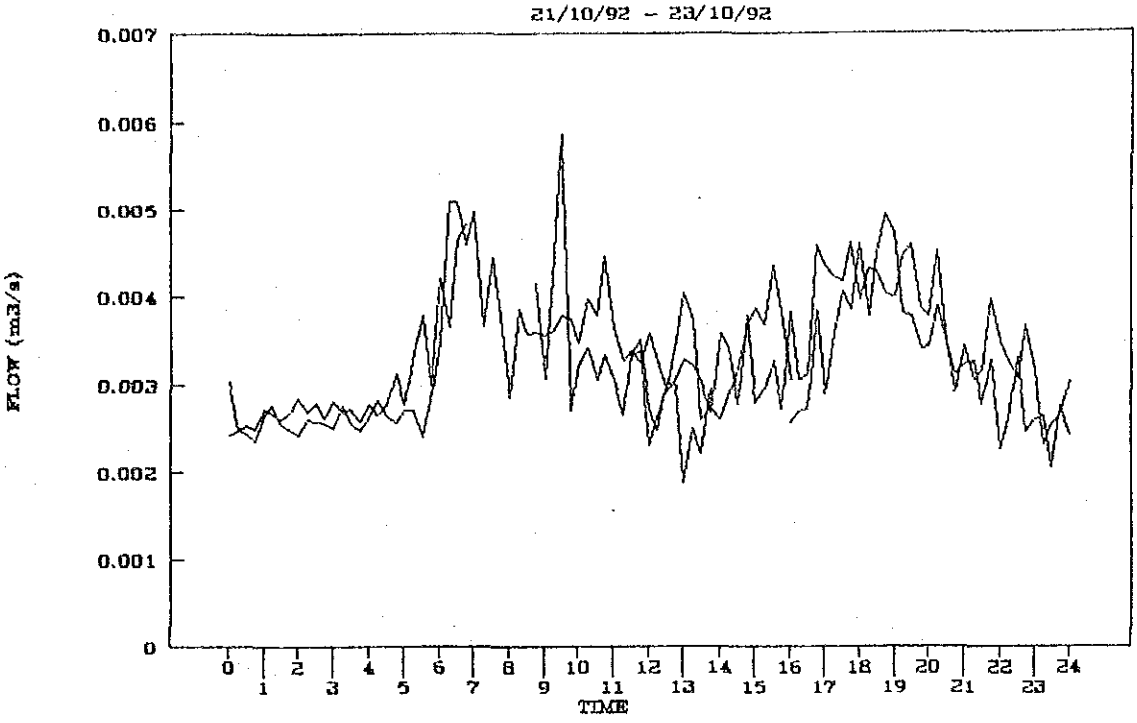
Fig. No.

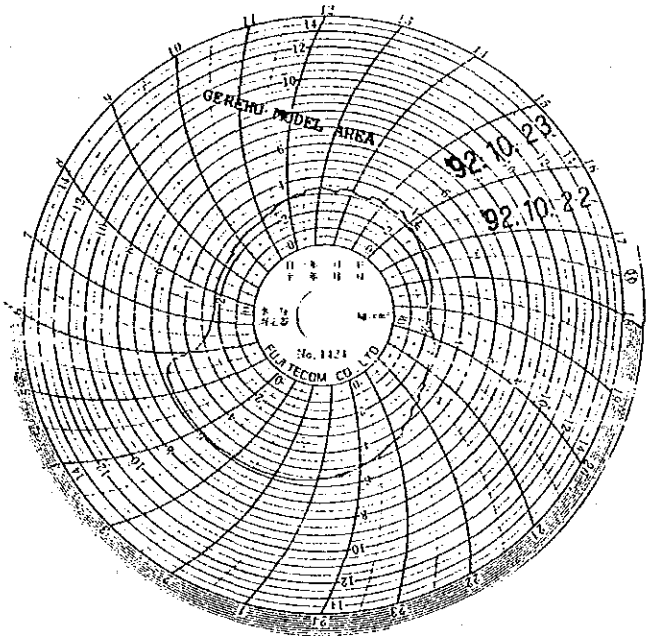
E.6

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL

FIG. INFLOW TO GEREHU MODEL AREA





TITLE

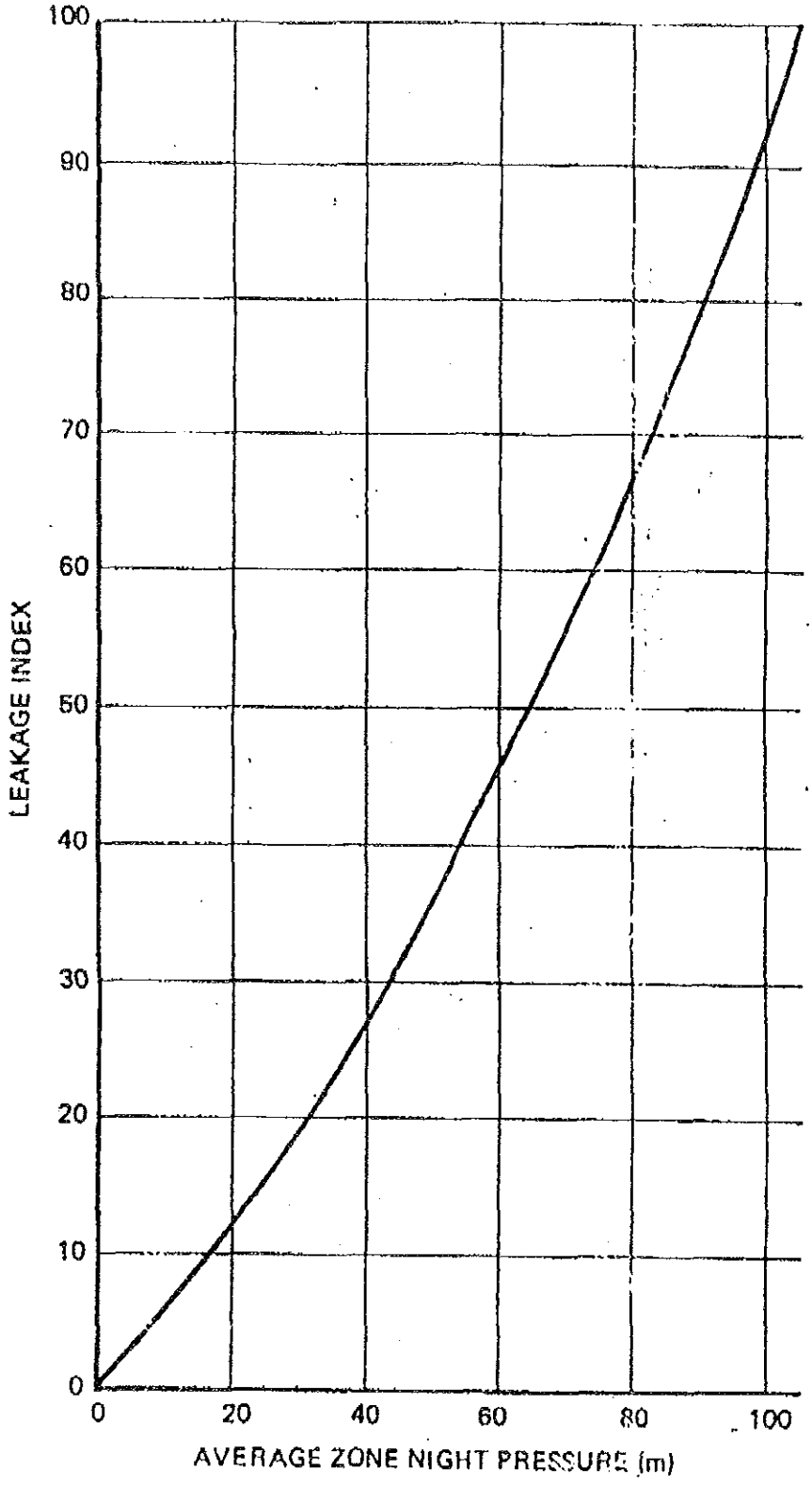
FLOW AND PRESSURE IN GEREHU MODEL AREA

Fig. No.

E.7

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

LEAKAGE INDEX

Fig. No.

E.8

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANS in association with PACIFIC CONSULTANTS INTERNATIONAL

APPENDIX F

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

NETWORK ANALYSIS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX F NETWORK ANALYSIS

1. INTRODUCTION

To formulate an effective rehabilitation program and for better understanding of the city's potable water infrastructure, hydraulic analysis of the existing distribution system was carried out during the first on-site job. After construction and calibration of the hydraulic model for the NCD water supply system, hydraulic analysis for the Master Plan and the Feasibility Study was carried out during the second on-site job. Hydraulic analysis suggests the time in the master plan period and location in the distribution system that should be improved by installing new pipes for future systems. The network analysis was carried out in the following four key stages;

(1) Data collection
(2) Model construction and calibration
(3) Hydraulic analysis of existing system
(4) Hydraulic analysis of future system

2. PRESENTATION OF MS-NET SOFTWARE

The method of the existing NCD water supply network was established using the computer program "MS-NET," written and developed by TEC. MS-NET is a multipurpose software used to solve pressure flow problems in meshed pipe networks. Using network data, MS-NET calculates velocity, flow rates, pressure, etc.

A network may be described as a series of points, called nodes, connected by pipes. Water flows through the pipes and consumptions are allocated only to the nodes. Many types of reservoirs and hydraulic equipment can be modeled within the network.

It should be emphasized that MS-NET is only a model and consequently does not reflect small details of the operation of the network. For example, it is clear that the distribution of consumptions over the network changes slightly all the time, whereas the input to the computer model are daily maximum , hourly maximum or yearly averages only for node consumption.

3. DATA COLLECTION

In addition to the existing NCDC records and drawings at the Technical Unit of NCDC, basic data was obtained from previous study reports ("Port Moresby Water Supply Study 1980", Camp Scott Furphy Pty. Ltd). Information regarding the distribution system and the current operating conditions, especially valve status, was obtained from counterparts, technicians and valve operators.

All the major components of the primary distribution system, given in Fig. F.1, were verified by NCDC during October and November 1992. The status of key valves at the major pipe junctions were also verified during the first on-site job (October to December 1992).

Fig. F.2 represents the network model formulated from the general data.

3.1 MAP AND SYSTEM IN MS-NET

In MS-NET, NCD water supply area is divided into two areas; map "No. 1" and "map. No. 2", prepared by JICA study team since its area is vast and its network is complicated. Map No.1 covers the southern part which includes Town, Boroko, Gordons and Hohola, and Map No.2 covers the northern part which includes Tokalala, Waigani, Morata, and Gerehu.

The master plan proposes that NCD water supply system should be managed and operated by each reservoir block. There are 11 reservoir blocks, and transmission pipes are necessary, separate from distribution pipes. Network analysis of the master plan, therefore, was separately conducted, for the transmission system and the distribution system in each reservoir block. In MS-NET the "system No.", shown in Table F.1, is given to the distribution reservoir blocks for the systematic and easy analysis. The map and system number are used in all data; node, pipe consumption, etc.

3.2 NODE DATA

In MS-NET, a node can only exist if linked to a network through a pipe. A node is defined by the following features:

- Map number
- System number

- Node number
- Planimetric coordinates (x , y) and
- Altimetric coordinate - ground level (z):

TABLE F.1 SYSTEM NUMBER

System Description	System No.
Reservoir	1
Transmission	2
Immediate Remedial Measure	9
Reservoir Block	
Boroko	11
Korobosea	12
3 Mile	13
Koki	14
Town	15
Waigani	23
Hohola	24
Gerehu	25
Erima	26
9 Mile	27
Laloki	28

All the nodes corresponding to pipe connections and changes in pipe diameter have been included in the NCD model. Nodes corresponding to treatment plants, reservoir, and major valves have also been considered. Additional nodes have been defined in some areas to allow for more accurate allocation of water consumptions.

The planimetric coordinates have been digitized for the pipe length. The topography data was taken from the1972 topographical map, with scale 1/2000 and 1978 aerial hotographs.

Original node numbers in NCD water supply maps for 20 series maps are rearranged and revised to new numbers for systematic and orderly network analysis.

Summary of node data is given below.

1. Node numbers of Mt.Eriama and New (9 Mile) water treatment plants are number "1" and "40", respectively.

2. Series numbers of nodes on transmission pipe are summarized in Table F.2, and Fig. F.3 shows major node locations from Mt.Eriama treatment plant to Town reservoir.

3. Node numbers of each reservoir and series numbers of nodes in each reservoir block are summarized in Table F.3. Fig.4 shows node locations of distribution.

4. The node data is shown in Table F.4.

TABLE F.2 SERIES NUMBER OF NODES ON TRANSMISSION

Route		Pipe Description (diameter in mm)	Node series	
From	To	or (zone)	From	To
Existing pipe				
Mt. Eriama	Town	600,525,600,450,375	110	129
Mt.Eriama	3 Mile	525,450	130	149
Foot of Mt. Eriama	Waigani	600,525	150	159
Mt.Eriama	9 mile	1000,1200	160	169
Foot of Mt.Eriama	Air Port	250	170	180
New pipe				
		Low Zone	2100	2149
		High Zone	2150	2199

TABLE F.3 NODE NO. OF RESERVOIR AND SERIES NO. OF NODES WITHIN RESERVOIR BLOCKS

Reservoir	Node No.	Series No.of nodes within reservoir blocks			
		Existing pipe		New pipe	
		From	To	From	To
Existing reservoir					
Boroko	21	9200	9200	-	-
Korobosea	22	9250	9250	-	-
Three Mile	23	8200	8200	-	-
Koki	24	8250	8250	-	-
Town	25	7200	7200	-	-
Waigani	31	300	300	2300	2399
Hohola	32	400	400	2400	2499
New reservoir					
Gerehu	41	500	500	2500	2599
Erima	42	600	600	2600	2699
Laloki	43	700	700	2799	2799
9 Mile	(40)	800	800	2899	2899

3.3 PIPE DATA

In MS-NET, a standard pipe is defined by the following features:

- Map number
- System number
- Initial node;
- Final node;
- Length;
- Diameter;
- Coefficient of velocity in Hazen William's formula.
- Date of laid pipes
- Material

Almost all pipes with diameter over 150 mm have been included in the NCD model. Some pipes of smaller diameter have also been considered when necessary for hydraulic

systems (completion of loops, areas with only tertiary networks, etc.).

The length and diameter of each pipe has been digitized or taken from network maps of 1974 with scale 1/4,000, and the 1972 topographical map, with scale 1/2,000.

The pipe data which represents the water supply system for the year 2015 are given in Table F.5 as an example. In this table, valve status is represented by using numbers 93, 95, 97, 99 whose meanings are shown as below;

	Valve Status
93	replaced pipe
95	reservoir block
97	low and high zone and transmission
99	others

Generally, pipe materials are DICL, CICL, MSCL, and AC. Approximation of these pipes for the network analysis is summarized in Table F.4

TABLE F.4 MAIN CONDUIT BY MATERIAL

Type	Approximate Length (m)	Year
AC	67,325	1965 - 1975
CICL	79,485	1959 - 1967
MSCL	50,127	1966 - 1971
DICL	2,370	1965
GWI	1,250	1964 - 1970
DCIP	2,010	1990
Total	202,567	1959 - 1990

Cement lining pipes are commonly used in NCD. AC was mainly installed from 1965 to 1975. It is recommended that AC pipes be removed in future because of health issues. The locations of AC pipes are shown in Fig. F.5, which are in the Gerehu, Tokalala, Waigani, and Gordon areas. Fig. F.6 shows the locations of pipes laid before 1965. From Fig. F.6, relatively aged pipes exist mainly in the areas of Town, Korobosea and Boroko.

The above information should be carefully considered for the long term program.

NEW INSTALLATION PIPES

The pipes, installed after 1979, are shown in the Table F.5. These pipes are only distribution pipes and do not include trunk mains. This table also shows that there have been no major capital works since 1979.

TABLE F.5 INSTALLATION RECORD (1979 - 1992)

Draw. No.	Place Name	D (mm)	L(m) Approx.	Material	Inst. Year
4	Kaugere Housing	100	120	PVC	1987
	3 mile Subdivision	100	120	PVC	1988
		100	540	PVC	1992
	Army Murray Barracks	100	200	PVC	1992
	Gorobe	250	240	CICL	1988
5	East Boroko	100	440	PVC	1987
	Gavamani	250	820	DICL	1988
7	Rifle Range Settlement	100	660	PVC	1989
		150	630	PVC	1980
10	Gordons	100	2200	PVC	1992
	Lamana Subdivision	100	1400	PVC	1989
	Islander Subdivision	100	880	PVC	1992
	Hohola Subdivision	100	800	PVC	1991
11	Air Niugini Subdiv.	100	640	PVC	1988
		150	240	PVC	1988
13	Games Village Subdiv.	100	800	PVC	1991
		150	1480	PVC	1991
	Begabari Estate	100	800	PVC	1990
15	North Waigani Subdiv.	100	780	PVC	1990
	Post Telecom. (PTC)	100	1500	PVC	1991
	Ensisi	100	520	PVC	1988
		150	1660	PVC	1988
16	Morata Subdivision	150	680	PVC	1989
17	Rainbow Village	100	1650	PVC	1992
		150	800	PVC	1991
20	Gerefu 3 B/2	150	1680	PVC	1979
		200	660	PVC	1979
		TOTAL	22940		

Source: NCDC Technical Unit

VALVE STATUS

The status of valves was confirmed with counterparts during the first on-site job and summarized in Table F.6, which shows closing valves for network analysis.

TABLE F.6 CLOSING VALVES FOR THE ANALYSIS

No.	DRG. No.	Valve No. in DRG	No.	DRG. No.	Valve No. in DRG
1	2	New	21	8	88
2	3	2078	22		8
3		2079	23		153
4		2650	24	10	669
5		932	25		675
6		2017	26		New
7	4	1131	27		598
8		655	28		597
9		New	29		610
10		656	30	11	579
11		841	31		950
12		831	32	13	684
113		823	33		678
14	5	New	34	14	554
15		76	35	19	1010
16	6	2034	36		993
17	7	383	37		2087
18		New	38		
19		332	39		
20		74	40		

Source : Technical Unit in NCDC

Valve Status is as of Nov. 16, 1992.

DRG. stands for 20 series map of distribution facilities in NCD.

4. MODEL CALIBRATION

The facts about the existing water supply system, which were studied by the team, are summarized below.

- the daily maximum demand is 160 mld in 1992, exceeding the produced amount of water at Mt. Eriama (125 mld). Consequently,

- there are chronic low pressure areas shown in Fig. 3.2 in the master plan main report. These areas are mostly in the coastal strips and high elevation areas remote from Mt. Eriama water treatment plant.

- No water filling at reservoirs durings day time.

- The study team measured the water pressure at Boroko, Gordon, and Gerehu areas in October, 1992.

Accordingly, the newly created model should display the system trends menioned above, namely low pressure areas, correct water pressure near measured points, and no water filling at reservoirs. The total demand in the model is 125 mld, corresponding to the current water producing capacity of Mt. Eriama treatment plant.

110 was selected as the C valve (Hazen William's pipe roughness coefficient) based on pipe age and material and also considering of water head loss in various parts of the pipe which indicate change in pipe bend diameter .

The hydraulic results of the calibrated model are given in Table F.11.

A comparison between the measured and modeled residual head is given in Table F.7.

TABLE F.7 MEASURED AND CALCULATED HEAD (m)

Gordon Area			Boroko Area		
Measured Head (m)	Near Node	Modeled Head (m)	Measured Head (m)	Near Node	Modeled Head (m)
65	617	42.4	31	9208	51.2
60	625	40.0	31	513	19.0
20	621	10.0	43	9210	38.0
46	622	34.6	36	9211	30.5
26	620	24.8	32	9215	33.5
60	9201	53.1	7	627	13.8
48	9203	47.1	35	9223	34.0
18	9207	28.1	33	9221	30.1
10	9205	17.2	37	9213	36.2
33	9204	27.6			

The measured head of 31 meters for node 513 cannot be included, because the actual measured point is between node 9210 and 513. Since the calculated head for 9210 is 38 m, the result is reasonable.

From Table F.11, the modeled residual heads at each reservoir (see Table F.8) are negative, which means no water filling reservoirs under the current system and model assumptions.

The results of calibration carried out generally reflect the existing water supply system. Accordingly, the constructed model may be considered saitisfactory.

TABLE F.11 RESIDUAL HEAD OF RESERVOIR

Reservoir	Node No.	Residual Head (m)	Reservoir	Node No.	Residual Head (m)
Boroko	11	-41	Town	15	-24
Korobosea	12	-32	Waigani	23	-30
3 mile	13	-28	Hohola	24	-25
Koki	14	-33			

5. HYDRAULIC ANALYSIS OF THE PRESENT SYSTEM

In general, most of the primary distribution, except Gerehu area, is adequately sized for the current supply. However, a major rehabilitation program is required to improve the entire system to an acceptable level, providing purified water consistently at a reasonable working pressure to each consumer accunted for.

The hydraulic analysis of the present system confirms that severe problems associated with the distribution system exist in the areas mentioned below. The iso-residual head lines are illustrated in Fig. 6.2 in the master plan main report.

- No water filling at each reservoir
- Inadequate pressure at nodes 7206, 7205, 7204, and 7203 near the Town reservoir.
- Inadequate pressure at nodes 8259, 126, and 8260 in Elamakana.
- Inadequate pressure at nodes 123, 24, and 8266 near Koki reservoir.

- Inadequate pressure at nodes 8202, 8201, and 40 in Gorobe area.
- Inadequate pressure at nodes 401, 402, 318, and 32 near Hohola reservoir.
- Inadequate pressure at nodes 405 in Hohola No.4.
- Inadequate pressure at nodes 9284, 9283, 9295, 9281 in Korobosea.
- Inadequate pressure at nodes 178, 21, 9217 in Boroko.
- Low pressure at 501 in Gerehu.

The main problem is insufficient water supply from the water treatment plant, causingresulted in unequal distribution, namely, existence of inadequate pressure areas, low pressure areas, and unnecessarily high pressure areas. An equal distribution water supply system is storngly recommended. Moreover, aged (older than 27 years service) pipes exist in Town, Korobosea, and Boroko areas. AC pipes are used mainly in Gerehu, Tokalala, and Waigani areas.

It is clear that with no improvement of the system, the situation of the water supply system in NCD will worsen with time.

6. HYDRAULIC ANALYSIS FOR THE FUTURE SYSTEM

6.1 CONDITIONS FOR ANALYSIS AND PROCEDURE

After the completion of the model for NCD water supply, hydraulic analysis was conducted for building up an appropriate water supply system in future consisting of treatment plant, transmission, distribution reservoir and distribution pipes. Two cases; one for the master plan and one for the feasibility study, are analyzed. In each case, transmission and distribution systems of each reservoir block are separately analyzed and future facilities are proposed.

The procedure of the analysis involves two steps for the master plan and feasibility study;

1. Water supply system for the master plan is analyzed for estimated demand and proposed water supply system (reservoir block distribution system) in 2015 and works for the master plan are proposed.

2. Analysis for the feasibility study is conducted for estimated demand and proposed water supply system (4 area distribution system)in 2002. The analysis give, facilities

in master plan works needed for the feasibility study.

In each step, pipe design, route and diameter are decided as given below;

1. Orthodox pipe routes, which are preferred generally, are selected.

2. On the basis of these routes, pipe diameters are checked for capability of distributing water to all consumers. Up to this step, one series of pipe diameters and routes in NCD water supply system are fixed.

3. Using this series of data, detailed network analysis is repeatedly performed for alternative routes and diameters.

4. Finally, the optimum solution is found.

The analysis and design are used mainly for the improvement in the distribution network within the existing urban area, where reticulation system is relatively developed. While pipe design in the new development area in future does not use this method since the JICA study team could not identify precisely th location and future developments o the town. Accordingly, the size of pipes in new development areas is simply estimated, considering the pipe diameter and length in the existing fully reticulated area.

In master plan, the pipe line (diameter 600mm, length 12.5km) from 9 mile to 3mile reservoir was proposed as immediate remedial measure for the existing water supply system . In addition to the existing distribution facilities, this pipe line was considered as existing for the analysis.

6.2 THE MASTER PLAN

Conditions for analysis are as follows:

1. Water Supply System	11-reservoir block distribution
2. Demand	
Transmission	daily maximum demand in 2015
Distribution	hourly maximum demand in 2015
3. Residual pressure	10 m approximately
4. Pumped area	Air new guinea estate (MSL 120mm)
	Touagaba hill
	(Ground level is higher than Town reservoir)

The results of analysis of the master plan are shown below.

Item	Pressure Data	Flow Rate and hydraulic Gradient Data
Transmission	Table 12-1	Table 12-2
Distribution	Table 13-1	Table 13-2

Proposed facilities are explained in the master plan main report.

6.3 THE FEASIBILITY STUDY

Conditions for analysis are as follows;

1. Water Supply System	4-area block distribution (2 high and 2 low)
2. Demand	
Transmission	daily maximum demand in 2002
Distribution	hourly maximum demand in 2002
3. Residual pressure	10 m approximately
4. Pumped area	Air new guinea estate (MSL 120mm)
	Touagaba hill
	(Ground level is higher than Town reservoir)

In the feasibility study, with target year 2000, distribution facilities are planned for demand in 2002.
The results of analysis of the master plan are shown below.

Item	Pressure Data	Flow Rate and hydraulic Gradient Data
Transmission	Table 14.1	Table 14.2
Distribution	Table 15.1	Table 15.2

Proposed facilities are explained in the feasibility study main report.

TABLES AND FIGURES

Table F.9 Node Data

Map No.	System No.	Node No.	Cordinate X -	Y -	Ground Level (m)	Valve No. in Maps
2	1	1	11250	1850	149.6	1
1	1	21	6573	3995	132.3	25
1	1	22	6160	1211	115.9	35
1	1	23	4240	2182	120.7	53
1	1	24	2500	2246	109.8	140
1	1	25	966	1793	105.8	45
2	1	31	2090	2499	132	9
1	1	32	3311	5806	123.1	15
2	1	40	8600	1200	105	
2	1	41	3574	4736	88	
1	1	42	6250	6746	98	
2	1	43	7000	2300	93	
2	2	111	11210	1950	152	
2	2	112	11130	2000	152	120
2	2	113	10050	2750	44	128
2	2	114	9960	3050	42	129
2	2	115	8856	2070	33	2
1	2	116	6610	6746	39	
1	2	117	6078	5466	38	
1	2	118	6398	4166	76	27
1	2	119	6369	4000	66	64
1	2	120	5106	2833	58	41
1	2	121	4356	2195	90	40
1	2	122	3262	1655	9	66
1	2	123	2460	2227	116	139
1	2	124	2445	2238	92	52
1	2	125	1946	2318	61	138
1	2	126	1846	2157	95	237
1	2	127	1674	1541	1	137
1	2	128	1258	1451	1.5	43
1	2	129	5737	3316	47	
2	2	131	11180	1850	152	122
2	2	132	10300	3200	42	130
2	2	135	10160	3200	42	131
1	2	136	6305	6072	41	28
1	2	137	6329	5910	41	23
1	2	138	6464	4024	90	26
1	2	139	6360	3952	66	134
1	2	140	6191	3844	58	32
1	2	141	6106	3784	58	33
1	2	142	4743	2578	61	19
1	2	143	4384	2166	79	142
2	2	146	8756	1970	33	
2	2	151	8856	2200	35	
2	2	152	4776	2747	20	5
2	2	153	2450	2974	40	6
2	2	154	2411	2739	50	7
2	2	155	2241	2707	60	8
2	2	156	8483	2250	44	
2	2	161	10300	3000	38	
2	2	2101	8300	1300	60	
2	2	2102	7900	1500	31	
1	2	2103	6398	6746	40	
2	2	2104	5497	1986	30	
2	2	2105	4947	1736	27	
2	2	2106	4497	1986	44	
2	2	2107	4097	3686	49	
2	2	2151	8800	1900	44	
2	2	2152	7850	1300	31	
1	2	2153	6298	6546	40	
2	2	2154	5397	1886	30	
2	2	2155	5297	1936	37	
2	2	2156	4597	1008	35	
2	2	2157	3846	812	45	
2	2	2158	2311	2639	50	
2	2	2160	3896	609	45	
2	2	2161	3123	246	58	
1	2	2162	2959	5953	83	
1	2	2163	3058	5942	100	
1	9	901	6298	6446	40	
1	9	902	6100	5866	39	
1	9	903	5808	5800	37	
1	9	904	5482	4568	45	
1	9	905	4658	4538	50	
1	9	906	3858	4050	65	
1	9	907	4008	3475	75	
1	9	908	3950	3350	72	
1	9	909	4370	2880	75	
1	9	910	4730	2638	75	
1	9	911	4500	1982	85	
1	9	912	3760	2022	60	
1	9	913	3322	1930	34	
1	9	914	3166	1783	30	
1	9	915	2580	2046	50	
1	11	21	6573	3995	123.5	25
1	11	140	6191	3844	58	32
1	11	141	6106	3784	58	33
1	11	175	7366	5066	64	89
1	11	176	7200	4890	60	
1	11	177	7018	4552	55	90
1	11	178	6648	4125	118	24
1	11	9201	5998	5706	37	29
1	11	9202	5697	5430	40	22
1	11	9203	5674	5229	40	84
1	11	9204	6046	4948	60	232
1	11	9205	6114	4398	70	59
1	11	9206	5838	4282	61	31
1	11	9207	6190	3923	61	30
1	11	9208	6131	3745	38	115
1	11	9209	6202	3539	70	197
1	11	9210	5895	3379	49	198
1	11	9211	6077	3159	56	72
1	11	9212	5927	2858	48	73
1	11	9213	6109	2646	50	200
1	11	9214	6177	2712	52	204
1	11	9215	6242	2945	53	199
1	11	9216	6543	2978	70	201
1	11	9217	6781	2967	92	203
1	11	9218	6609	2862	72	71
1	11	9219	6762	2708	72	202
1	11	9220	6659	2593	64	57
1	11	9221	6615	2501	58	211
1	11	9222	6202	2532	50	210
1	11	9223	6546	2179	54	212
1	11	9224	6854	2142	58	213
1	11	9225	6920	2564	67	215
1	11	9226	7222	2209	79	214
1	11	9227	7062	2109	82	
1	11	9228	5791	3536	47	116
1	11	9230	6150	5800	36	
1	11	9231	6398	5400	40	
1	12	22	6160	1211	107.9	35
1	12	9251	5490	3256	49	20
1	12	9252	5617	3110	49	205
1	12	9253	5518	2751	52	74
1	12	9254	5274	2714	55	163
1	12	9255	5180	2762	55	162
1	12	9256	5143	2810	58	103
1	12	9257	5109	2785	58	104
1	12	9258	5136	2769	58	118

Table F.9 Node Data (CONT.)

Map No.	System No.	Node No.	Cordinate X -	Y -	Ground Level (m)	Valve No. in Maps
1	12	9259	5625	2350	47	206
1	12	9260	5357	2282	55	208
1	12	9261	5904	2004	52	75
1	12	9262	6161	1909	53	209
1	12	9263	6462	1834	56	56
1	12	9264	6418	1632	61	55
1	12	9265	6388	1557	67	171
1	12	9266	6406	1549	70	34
1	12	9267	6320	1375	78	420
1	12	9268	6060	1515	67	182
1	12	9269	5886	1575	67	180
1	12	9270	5809	1373	70	181
1	12	9271	5770	1238	76	54
1	12	9272	5512	1229	70	108
1	12	9273	5546	1466	61	178
1	12	9274	5621	1665	58	179
1	12	9275	5691	1850	55	158
1	12	9276	5338	2154	58	157
1	12	9277	5224	2233	58	207
1	12	9278	4852	2483	61	156
1	12	9279	4767	2548	61	135
1	12	9287	6122	1381	85	183
1	12	9295	5009	330	6	184
1	12	9296	5210	440	12	
1	12	9297	5930	240	20	
1	12	9298	8000	300	30	
1	13	23	4240	2182	112.8	53
1	13	8201	4299	2183	100	235
1	13	8202	4278	2163	113	236
1	13	8203	4324	2184	95	39
1	13	8204	4116	1910	76	67
1	13	8205	4067	1899	76	37
1	13	8206	3672	1843	34	165
1	13	8207	3678	1827	34	164
1	13	8208	3642	1833	31	68
1	13	8209	3937	1360	54	58
1	13	8210	3700	330	20	
1	13	8212	4500	775	10	
1	13	8213	4200	1086	25	
1	13	8214	5170	1303	82	159
1	13	8215	4798	1450	130	
1	13	8216	4798	1540	81	161
1	13	8217	4702	1647	81	160
1	13	8218	4556	1755	79	155
1	13	8219	4462	1803	84	154
1	13	8220	4386	1852	88	153
1	13	8221	4316	2039	79	36
1	13	8222	4403	2157	79	38
1	13	8223	3250	1750	8	
1	13	8224	3050	1450	3	
1	13	8226	4762	2354	63	173
1	13	8227	4674	2102	96	172
1	13	8228	4487	2328	70	
1	13	8229	4632	1834	73	174
1	13	8230	4837	1887	76	176
1	13	8231	4730	1767	72	175
1	13	8232	4882	1635	76	177
1	14	24	2500	2246	101.8	140
1	14	124	2445	2238	92	52
1	14	8251	3725	2050	55	
1	14	8252	3642	1982	55	169
1	14	8253	3202	2010	34	70
1	14	8254	3086	1782	30	218
1	14	8255	2638	1465	3.1	65
1	14	8256	1971	2326	61	51
1	14	8259	1941	2006	85	216
1	14	8260	2217	1595	98	217
1	14	8261	1780	2005	64	50
1	14	8262	1706	1526	1	42
1	14	8263	1696	2150	52	186
1	14	8264	1586	2198	52	167
1	14	8265	1649	2487	23	49
1	14	8266	1390	2826	1.5	48
1	14	8267	1370	3266	10	
1	14	8268	1250	3666	5	
1	14	8269	1170	3826	8	
1	14	8270	1100	4300	8	
1	14	8271	1020	4540	10	
1	15	25	966	1793	101.2	45
1	15	7201	1671	1518	1	136
1	15	7202	1251	1478	1.5	44
1	15	7203	981	1763	104	149
1	15	7204	964	1755	104	148
1	15	7205	900	1741	85	166
1	15	7206	894	1793	85	168
1	15	7207	900	2500	60	
1	15	7208	900	2660	3	
1	15	7209	787	1822	43	47
1	15	7210	806	1715	46	46
1	15	7211	584	1664	46	69
1	15	7212	753	1490	31	63
1	15	7213	814	1352	3.1	62
1	15	7214	522	1224	3.7	61
1	15	7215	434	1072	3.7	151
1	15	7216	450	1399	17	185
1	15	7217	374	1573	1.5	60
2	23	31	2090	2499	124.1	9
2	23	154	2411	2739	50	7
2	23	155	2241	2707	60	8
2	23	301	1500	2600	58	
2	23	302	800	2500	78	
2	23	303	600	2200	93	
2	23	304	50	1800	4	
2	23	305	50	700	11	
1	23	306	100	5800	1	
1	23	307	150	5400	2	
2	23	309	2651	1800	76	
2	23	310	2830	1100	66	
2	23	311	2881	900	66	
2	23	312	2335	500	105	
2	23	313	2925	347	57	12
2	23	314	3023	346	54	10
2	23	315	2374	68	64	147
2	23	316	2396	46	64	113
1	23	317	2859	5953	88	91
1	23	318	2958	5842	100	14
2	23	520	2104	3626	40	
2	23	2301	1500	2807	58	
2	23	2302	1400	3447	51	
2	23	2303	1200	4247	80	
2	23	2304	1100	5257	60	
2	23	2305	2141	2707	60	
1	24	32	3311	5806	115.2	15
1	24	318	2958	5842	100	14
1	24	401	3066	5566	98	145
1	24	402	3170	5454	90	146
1	24	403	3060	4947	79	
1	24	404	3408	4867	68	

Table F.9 Node Data (CONT.)

Map No.	System No.	Node No.	Cordinate X -	Y -	Ground Level (m)	Valve No. In Maps
1	24	405	2908	4787	85	
1	24	406	3228	4467	80	
1	24	407	3488	4407	70	16
1	24	408	3918	4916	60	76
1	24	409	3405	3762	74	114
1	24	410	3485	3640	74.5	
1	24	411	3872	3275	73	105
1	24	412	4051	3176	75	
1	24	413	3963	3080	78	
1	24	414	4048	3105	75	106
1	24	415	4203	2848	75	
1	24	416	4323	2800	79	
1	24	417	4403	2368	80	
1	24	418	4523	3350	60	
2	25	41	3574	4736	80	
2	25	501	1709	6769	31	102
2	25	502	1872	6307	24	101
2	25	503	2179	6391	20	190
2	25	504	2338	6321	20	189
2	25	505	1594	6053	28	192
2	25	506	1959	6054	25	193
2	25	507	2085	6046	25	100
2	25	508	2272	6024	22	188
2	25	509	2462	5778	25	187
2	25	510	2562	5175	35	96
2	25	511	2154	5404	30	98
2	25	512	1683	4993	30	191
2	25	513	2227	5192	30	97
2	25	514	2834	4758	40	95
2	25	515	3174	4886	40	94
2	25	516	1795	4214	35	99
2	25	517	1984	4026	35	92
2	25	518	2387	4090	38	93
2	25	519	3100	4210	30	
2	25	2501	2562	5878	25	
2	25	2502	2338	6621	20	
1	26	42	6370	6746	90	
2	26	601	2709	2603	45	111
2	26	602	3629	1608	46	
2	26	603	3709	1408	51	109
2	26	604	4452	1801	44	194
2	26	605	4864	1956	20	195
2	26	606	4797	1486	44	196
2	26	607	3946	912	44	110
2	26	608	3996	709	43	11
2	26	609	3900	1	55	
1	26	610	3921	5972	62	18
1	26	611	4406	6253	45	87
1	26	612	4191	5388	55	17
1	26	613	4686	5577	45	77
1	26	614	4961	5561	40	78
1	26	615	5334	5557	40	79
1	26	616	5021	6589	47	230
1	26	617	5030	6177	50	231
1	26	618	5186	6169	60	228
1	26	619	4850	5963	42	227
1	26	620	5177	5994	45	229
1	26	621	5526	6400	65	226
1	26	622	5440	6021	39	86
1	26	623	5431	5761	39	85
1	26	624	5704	6090	50	225
1	26	625	5728	5881	37	224
1	26	626	5891	6151	50	222
1	26	627	6046	6420	65	220
1	26	628	6370	6266	38	221
1	26	629	6214	6105	38	219
1	26	630	6026	5946	38	223
1	26	631	4235	5174	54	107
1	26	632	4498	4698	54	234
1	26	633	5303	4993	43	233
1	26	634	5162	4488	45	83
1	26	635	4878	4291	42	81
1	26	636	4798	4229	40	21
1	26	637	5319	4180	41	82
1	26	638	4000	5772	60	
2	26	639	4800	650	60	
2	26	640	4850	3331	23	
2	26	641	4864	2644	23	
2	26	642	5302	3206	16	
2	26	643	5239	2769	35	
2	26	644	5739	2519	37	
2	26	645	4927	2269	30	
1	26	646	5490	3400	49	
2	26	2601	5097	1800	27	
1	26	2602	6100	6500	46	
2	27	40	8600	1200	105	
2	27	133	11500	3200	42	
2	27	134	11500	2800	46	
2	27	145	10600	3200	60	
2	27	171	11000	2800	46	126
2	27	172	9976	2600	34	132
1	27	173	8458	5821	54	400
1	27	174	7578	5021	53	88
2	27	179	8800	1850	43	
2	27	180	8483	1400	62	
2	27	701	8300	2974	30	
2	27	702	11000	4000	45	
2	27	703	11200	4886	39	
2	27	704	10160	4886	40	
2	27	705	9960	4900	40	
2	27	706	9850	5100	40	
2	27	2701	8200	1200	60	
2	27	2702	8000	1600	31	
2	28	43	7000	2300	85	
2	99	521	1984	3975	35	

TABLE F.10 PIPE DATA

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map No.	Sys. No.	Node No.	Map No.	Sys. No.	Node No.	Pipe Dia (m)	Length (m)	Asbest Pipe	Laid Year	posed Pipe	placed Pipe
Transmission Pipe											
2	1	1	2	2	111	600	20		1967		
2	1	1	2	2	131	525	20		1968		
1	1	21	1	2	138	450	90		1966		
1	1	24	1	2	124	300	40		1965		
1	1	24	1	2	123	300	20		1965		
2	2	111	2	2	161	1000	2010		1990		
2	2	111	2	2	112	600	10		1967		
2	2	112	2	2	113	600	1650		1967		
2	2	113	2	2	151	600	1500				
2	2	113	2	2	114	600	32		1967		
2	2	114	2	2	115	600	1950		1967		
2	2	115	2	2	156	600	10				
2	2	115	1	2	116	600	3840		1967		
1	2	116	1	2	117	600	1480		1967		
1	2	116	1	9	901	600	10				
1	2	117	1	2	118	600	1400		1967		
1	2	118	1	1	21	600	250		1969		
1	2	118	1	2	119	600	170		1971		
1	2	119	1	2	129	600	880		1971		
1	2	119	1	2	139	600	50		1971		
1	2	120	1	2	121	525	950		1971		
1	2	121	1	1	23	600	80				
1	2	121	1	2	143	450	10				
1	2	121	1	2	122	600	1240		1975		
1	2	122	1	2	123	600	1020		1965		
1	2	123	1	2	124	300	20		1965		
1	2	124	1	2	125	450	620	AC	1975		
1	2	125	1	2	126	450	200	AC	1975		
1	2	126	1	2	127	450	700	AC	1972		
1	2	127	1	2	128	450	420	AC	1975		
1	2	128	1	1	25	375	570		1975		
1	2	129	1	2	120	600	840				
2	2	131	2	2	132	525	1530		1968		
2	2	132	2	2	135	450	40		1966		
2	2	135	2	2	146	450	2040		1966		
2	2	135	2	2	161	600	10				
1	2	136	1	2	137	450	180		1966		
1	2	137	1	2	138	450	1950		1966		
1	2	138	1	2	139	450	130		1966		
1	2	139	1	2	140	450	200		1966		
1	2	140	1	2	141	450	105		1966		
1	2	141	1	2	142	450	1950		1966		
1	2	142	1	2	143	450	410		1966		
1	2	143	1	1	23	300	120				
2	2	146	2	2	115	450	10				
2	2	146	1	2	136	450	4540				
2	2	151	2	2	156	525	200				
2	2	152	2	2	153	525	2400		1968		
2	2	153	2	2	154	525	270		1968		
2	23	154	2	23	520	250	900				
2	93	154	2	23	309	375	900	AC			rep-old
2	23	154	2	23	309	500	900			MP	rep-new
2	23	155	2	23	2305	525	1				
2	23	155	2	23	301	150	1120				
2	99	155	2	2	154	525	180				
2	2	156	2	2	152	525	5800		1966		
2	2	161	2	2	113	600	1				
2	2	161	2	2	115	1200	1450				
Transmission Pipe with Closed Valve											
1	97	120	1	12	9258	375	60	AC	1970		
1	97	121	1	13	8203	300	50		1965		
1	97	127	1	15	7201	250	15		1962		
1	97	128	1	15	7202	250	45		1962		
2	99	132	2	2	145	450	820				
1	97	136	1	26	629	250	100	AC	1969		
1	97	137	1	11	9230	250	20	AC	1966		
1	97	140	1	11	9207	250	80	AC	1966		
1	97	141	1	11	9208	375	40		1961		
1	99	142	1	24	416	250	480		1959		
1	99	143	1	13	8203	300	90		1965		
1	97	143	1	12	9286	250	10		1965		
2	97	152	2	26	605	150	900	AC	1969		
2	97	152	2	26	640	150	520				
2	97	153	2	25	520	250	720	AC	1969		
2	97	154	2	2	155	525	195		1968		
2	97	155	2	26	601	250	500	AC	1967		
2	97	156	2	27	701	100	1400				
Proposed Pipe											
Immediate Remedial Measure (I.R.M)											
2	2	115	1	9	901	600	3850			I.R.M.	
1	9	901	1	9	902	600	1180			I.R.M.	
1	9	902	1	9	903	600	400			I.R.M.	
1	9	903	1	9	904	600	1240			I.R.M.	
1	9	904	1	9	905	600	800			I.R.M.	
1	9	905	1	9	906	600	960			I.R.M.	
1	9	906	1	9	907	600	600			I.R.M.	
1	9	907	1	9	908	600	160			I.R.M.	
1	9	908	1	9	909	600	640			I.R.M.	
1	9	909	1	9	910	600	720			I.R.M.	
1	9	910	1	9	911	600	880			I.R.M.	
1	9	911	1	1	23	600	100			MP	
1	9	911	1	9	912	600	750			I.R.M.	
1	9	912	1	9	913	600	480			I.R.M.	
1	9	913	1	9	914	600	280			I.R.M.	
1	9	914	1	9	915	600	480			I.R.M.	
1	9	915	1	2	123	600	200			I.R.M.	
Transmission Pipe for Low Zone											
2	1	40	2	2	2101	1200	560			MP	
2	2	2101	2	2	2102	1100	720			MP	
2	2	2102	2	1	43	500	2340			MP	
2	99	2102	1	2	2103	1100	2000			MP	
1	99	2103	2	2	2104	1100	2580			MP	
2	2	2104	2	1	42	700	680			MP	
2	2	2104	2	2	2105	700	980			MP	
2	2	2105	2	2	2106	700	680			MP	
2	2	2106	2	2	2107	700	1000			MP	
2	2	2107	2	1	41	700	1940			MP	
Transmission Pipe for High Zone											
2	1	1	2	2	111	1000	20			MS	
2	2	2151	2	2	2152	1350	2180			MP	
2	2	2152	1	2	2153	1350	2000			MP	
1	2	2153	1	1	21	900	3300			MP	
1	2	2153	2	2	2154	1000	2580			MP	
1	2	2153	1	2	116	600	10			MP	
2	2	2154	2	2	2155	1000	640			MP	
2	2	2155	2	2	2156	1000	1000			MP	
2	2	2156	2	2	2157	1000	740			MP	
2	2	2157	2	2	2158	800	2500			MP	
2	2	2158	2	1	31	800	440			MP	
2	2	2157	2	2	2160	600	220			MP	
2	2	2160	2	2	2161	600	1220			MP	
2	2	2161	1	2	2162	600	1200			MP	
1	2	2162	1	2	2163	600	220			MP	
1	2	2163	1	1	32	600	140			MP	
2	2	115	2	2	2151	1350	10			MP	
2	2	154	2	2	2158	525	20			MP	
1	2	129	1	1	22	500	2760			MP	
2	23	155	2	23	154	500	180			MP	
Pipe from reservoir to distribution											
1	11	21	1	11	178	250	130		1960		
1	11	21	1	11	140	375	440				
1	12	22	1	12	9266	300	420	AC	1970		
1	12	22	1	12	9267	375	240		1970		
1	13	23	1	13	8201	300	40		1965		
1	13	23	1	13	8202	300	2		1965		
1	14	24	1	14	124	300	40				
1	15	25	1	15	7204	200	20		1962		
2	23	31	2	23	155	375	250		1967		
2	23	31	2	23	2305	500	250			MP	
1	93	32	1	24	318	375	300	AC	1975		rep-old
1	24	32	1	24	318	600	300			MP	rep-new
2	27	40	2	27	2701	800	560			MP	
2	25	41	2	25	515	600	400			MP	
1	26	42	2	26	639	700	840			MP	
1	26	42	2	26	2601	500	400			MP	
Distribution Pipe											
Boroko Reservoir Block											
1	11	140	1	11	141	375	105				
1	11	140	1	11	9207	300	80				

TABLE F.10 PIPE DATA (CONT.)

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map No.	Sys. No.	Node No.	Map No.	Sys. No.	Node No.	Pipe Dia. (m)	Length (m)	Asbest Pipe	Laid Year	posed Pipe	placed Pipe
1	11	140	1	11	9207	250	80			MP	
1	11	141	1	11	9220	250	1390		1961		
1	99	174	1	11	175	250	350		1960		
1	11	175	1	11	176	250	200		1960		
1	11	176	1	11	177	250	450		1960		
1	11	177	1	11	178	250	570		1960		
1	11	177	1	11	178	250	570			MP	
1	11	178	1	11	9208	250	750		1960		
1	93	9201	1	11	9204	150	800	AC	1966		rep-old
1	11	9201	1	11	9204	300	800	AC		MP	rep-new
1	11	9201	1	11	9202	250	500	AC	1966		
1	11	9201	1	11	9230	250	400	AC	1966		
1	97	9202	1	26	615	250	550		1960		
1	11	9203	1	11	9202	250	200	AC	1966		
1	93	9201	1	11	9205	150	650	AC	1966		rep-old
1	11	9204	1	11	9205	300	650			MP	rep-new
1	11	9204	1	11	9203	100	550	AC	1966		
1	11	9205	1	11	9206	150	300	AC	1966		
1	11	9206	1	11	9203	250	1050	AC	1966		
1	97	9206	1	26	637	200	550	AC	1967		
1	11	9207	1	11	9206	250	500	AC	1966		
1	93	9207	1	11	9205	150	700	AC	1966		rep-old
1	11	9207	1	11	9205	300	700			MP	rep-new
1	99	9208	1	11	9220	250	1370		1961		
1	11	9208	1	11	9209	100	220		1960		
1	11	9208	1	11	9228	250	400		1960		
1	11	9209	1	11	9210	100	350		1959		
1	11	9209	1	11	9216	100	670		1960		
1	11	9211	1	11	9210	150	290		1959		
1	11	9212	1	11	9211	100	400		1960		
1	11	9213	1	11	9212	100	280		1960		
1	11	9214	1	11	9215	100	300		1960		
1	11	9214	1	11	9213	100	100		1960		
1	11	9215	1	11	9211	150	270		1959		
1	11	9216	1	11	9217	100	250		1960		
1	11	9216	1	11	9215	100	300		1960		
1	11	9218	1	11	9216	100	100		1960		
1	11	9219	1	11	9225	150	220		1959		
1	11	9219	1	11	9218	100	230		1960		
1	11	9219	1	11	9217	100	380		1960		
1	11	9220	1	11	9221	200	100		1962		
1	11	9220	1	11	9214	100	520		1960		
1	11	9220	1	11	9219	150	150		1959		
1	11	9222	1	11	9213	100	150		1960		
1	11	9223	1	11	9221	200	320		1962		
1	11	9223	1	11	9222	100	550		1960		
1	11	9224	1	11	9223	100	320		1965		
1	11	9225	1	11	9224	100	450		1961		
1	11	9225	1	11	9226	150	480		1961		
1	11	9226	1	11	9227	150	400		1961		
1	11	9227	1	11	9224	150	300		1961		
1	11	9228	1	11	9210	150	190		1959		
1	95	9228	1	12	9251	250	400		1960		
1	11	9230	1	11	9231	150	600				
1	11	9230	1	11	9231	100	600				
1	95	9253	1	11	9212	100	430		1960		
1	95	9263	1	11	9223	200	350		1962		
Korobosea Reservoir Block											
1	12	9251	1	12	9252	100	230		1960		
1	97	9251	1	26	646	150	200		1		
1	12	9252	1	12	9253	100	400		1959		
1	12	9253	1	12	9254	150	260		1960		
1	12	9255	1	12	9254	150	110		1960		
1	12	9255	1	12	9277	100	500		1962		
1	12	9256	1	12	9255	150	60		1960		
1	12	9256	1	12	9251	250	600		1961		
1	12	9257	1	12	9256	250	40		1961		
1	12	9258	1	12	9277	375	500	AC	1970		
1	12	9277	1	12	9276	375	140	AC	1970		
1	12	9276	1	12	9275	375	400	AC	1970		
1	12	9275	1	12	9266	375	800	AC	1970		
1	12	9258	1	12	9257	250	30				
1	12	9259	1	12	9260	150	260		1960		
1	12	9259	1	12	9253	150	430		1960		
1	12	9260	1	12	9254	150	450		1960		

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map No.	Sys. No.	Node No.	Map No.	Sys. No.	Node No.	Pipe Dia. (m)	Length (m)	Asbest Pipe	Laid Year	posed Pipe	placed Pipe
1	12	9261	1	12	9259	150	420		1962		
1	12	9262	1	12	9261	200	300		1962		
1	12	9263	1	12	9262	200	310		1962		
1	12	9264	1	12	9263	200	200		1962		
1	12	9264	1	12	9298	150	4800				
1	12	9265	1	12	9287	150	450	AC	1967		
1	12	9265	1	12	9264	200	90		1962		
1	12	9265	1	12	9268	200	330		1962		
1	12	9265	1	12	9271	200	950				
1	12	9267	1	12	9271	300	720			MP	
1	12	9266	1	12	9265	200	10		1962		
1	12	9266	1	12	9267	375	160		1970		
1	12	9268	1	12	9269	150	190		1962		
1	12	9268	1	12	9271	200	450		1962		
1	12	9269	1	12	9270	100	210		1962		
1	12	9269	1	12	9274	150	280		1962		
1	12	9270	1	12	9273	150	280		1962		
1	12	9271	1	12	9272	200	260		1962		
1	12	9271	1	12	9270	100	140		1962		
1	12	9271	1	12	9296	150	1040		1965		
1	12	9271	1	12	9296	300	1040			MP	
1	95	9272	1	13	8214	200	390		1964		
1	12	9273	1	12	9272	150	250		1962		
1	12	9274	1	12	9275	150	200		1962		
1	12	9274	1	12	9273	150	215		1962		
1	12	9275	1	12	9276	150	400		1962		
1	12	9277	1	12	9276	150	140		1962		
1	12	9278	1	12	9277	150	450		1962		
1	12	9279	1	12	9278	150	120		1962		
1	12	9279	1	12	9257	250	420		1961		
1	95	8226	1	12	9278	150	150		1961		
1	95	8228	1	12	9279	250	340		1962		
1	12	9287	1	12	9271	150	350	AC	1967		
1	95	8212	1	12	9295	150	550				
1	93	9296	1	12	9297	100	4000	AC	1976		rep-old
1	12	9296	1	12	9297	200	4000			MP	rep-new
1	12	9296	1	12	9295	150	260		1965		
1	12	9296	1	12	9295	300	260			MP	
3 Mile Reservoir Block											
1	13	8201	1	13	8202	300	30		1965		
1	13	8202	1	13	8206	300	850		1965		
1	13	8203	1	13	8201	300	15		1965		
1	13	8203	1	13	8222	300	30				
1	13	8204	1	13	8205	250	60		1962		
1	13	8204	1	13	8205	300	60			MP	
1	95	8204	1	14	8251	100	430		1970		
1	13	8205	1	13	8207	250	405		1962		
1	13	8205	1	13	8209	150	670	AC	1965		
1	13	8205	1	13	8209	300	670			MP	
1	13	8206	1	13	8207	200	2		1959		
1	95	8206	1	14	8254	300	720		1965		
1	13	8207	1	13	8208	250	25		1962		
1	95	8208	1	14	8252	150	150	AC	1965		
1	13	8208	1	13	8209	200	880	AC			
1	13	8208	1	13	8223	250	470		1962		
1	13	8209	1	13	8210	150	960		1964		
1	13	8209	1	13	8210	200	960			MP	
1	13	8209	1	13	8213	150	310				
1	13	8209	1	13	8213	150	310			MP	
1	13	8209	1	13	8223	100	750		1961		
1	13	8213	1	13	8212	150	500				
1	13	8213	1	13	8212	150	500			MP	
1	13	8214	1	13	8216	200	550		1964		
1	13	8215	1	13	8216	100	200				
1	13	8216	1	13	8217	200	150		1964		
1	13	8218	1	13	8217	200	180		1964		
1	13	8219	1	13	8218	200	100		1964		
1	13	8220	1	13	8219	200	90		1964		
1	13	8221	1	13	8220	200	240		1964		
1	13	8221	1	13	8204	250	250		1962		
1	13	8221	1	13	8204	300	250			MP	
1	13	8222	1	13	8221	250	150		1962		
1	13	8222	1	13	8221	300	150			MP	
1	13	8223	1	13	8224	250	640		1962		
1	97	8223	1	14	8254	100	250		1961		

TABLE F.10 PIPE DATA (CONT.)

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map	Sys.	Node	Map	Sys.	Node	Pipe Dia	Length	Asbest	Laid	posed	placed
No.	No.	No.	No.	No.	No.	(m)	(m)	Pipe	Year	Pipe	Pipe
1	97	8224	1	14	8255	250	200		1962		
1	13	8226	1	13	8227	100	410		1962		
1	13	8226	1	13	8229	150	540		1961		
1	13	8219	1	13	8227	100	370		1962		
1	95	8228	1	24	417	100	80		1970		
1	13	8222	1	13	8228	250	430		1962		
1	13	8216	1	13	8229	150	110		1961		
1	13	8229	1	13	8231	100	120		1962		
1	13	8231	1	13	8230	100	165		1964		
1	13	8232	1	13	8231	100	200		1964		
1	13	8232	1	13	8230	100	290		1964		
1	13	8216	1	13	8232	100	115		1964		
Koki Reservoir Block											
1	14	124	1	14	8256	300	590		1965		
1	14	124	1	14	8265	375	920		1965		
1	14	124	1	14	8254	300	840				
1	14	8251	1	14	8252	100	120		1970		
1	14	8252	1	14	8253	100	550		1970		
1	14	8253	1	14	8254	200	250	AC	1965		
1	14	8255	1	14	8262	250	1200		1962		
1	14	8255	1	14	8254	100	600		1961		
1	14	8256	1	14	8265	300	400		1965		
1	14	8259	1	14	8260	100	700		1964		
1	14	8261	1	14	8260	100	700		1964		
1	14	8261	1	14	8259	100	150		1964		
1	14	8262	1	14	8261	200	480		1959		
1	95	8262	1	15	7201	250	30		1962		
1	14	8263	1	14	8264	100	150		1962		
1	14	8263	1	14	8261	200	200		1960		
1	14	8265	1	14	8263	200	350		1960		
1	14	8265	1	14	8266	200	450		1960		
1	14	8265	1	14	8266	375	450		1965		
1	14	8266	1	14	8267	200	400		1959		
1	14	8266	1	14	8267	250	400		1959	MP	
1	95	8266	1	15	7208	200	500		1960		
1	14	8267	1	14	8268	200	480		1959		
1	14	8267	1	14	8268	250	480		1959	MP	
1	14	8268	1	14	8269	200	240		1959		
1	14	8268	1	14	8269	250	240		1959	MP	
1	14	8269	1	14	8270	200	500		1959		
1	14	8269	1	14	8270	250	500			MP	
1	14	8270	1	14	8271	150	240		1959		
1	95	8271	1	23	307	150	2260				
1	95	7207	1	14	8264	150	800		1962		
Town Reservoir Block											
1	15	7202	1	15	7213	150	500		1960		
1	15	7203	1	15	7202	250	500		1961		
1	15	7204	1	15	7205	250	120		1962		
1	15	7204	1	15	7203	250	1		1962		
1	15	7205	1	15	7206	100	20		1962		
1	15	7205	1	15	7210	250	180		1961		
1	15	7206	1	15	7207	150	760		1962		
1	15	7208	1	15	7209	200	800		1960		
1	15	7208	1	15	7207	150	108		1962		
1	15	7209	1	15	7210	200	100		1960		
1	15	7211	1	15	7209	150	260		1959		
1	15	7211	1	15	7217	150	250		1960		
1	15	7212	1	15	7216	100	350		1960		
1	15	7212	1	15	7211	150	230		1960		
1	15	7213	1	15	7212	100	150		1960		
1	15	7213	1	15	7214	150	330		1960		
1	15	7214	1	15	7216	150	200		1960		
1	15	7214	1	15	7215	100	200		1960		
1	15	7216	1	15	7217	150	200		1960		
1	15	7201	1	15	7202	250	410		1962		
Waigani Reservoir Block											
2	23	302	2	23	301	150	1220				
2	23	303	2	23	302	150	320				
2	23	303	2	23	302	300	320			MP	
2	23	304	2	23	303	150	1900				
2	23	304	2	23	303	150	1900			MP	
2	23	305	2	23	304	150	1040				
2	23	305	2	23	304	150	1040			MP	
1	23	306	2	23	305	150	680				
1	23	306	2	23	305	150	680			MP	

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map	Sys.	Node	Map	Sys.	Node	Pipe Dia	Length	Asbest	Laid	posed	placed
No.	No.	No.	No.	No.	No.	(m)	(m)	Pipe	Year	Pipe	Pipe
1	23	307	1	23	306	150	830				
2	93	309	2	23	310	375	700	AC			rep-old
2	23	309	2	23	310	500	700			MP	rep-new
2	93	310	2	23	311	375	100	AC			rep-old
2	23	310	2	23	311	500	100			MP	rep-new
2	93	311	2	23	314	375	850	AC			rep-old
2	23	311	2	23	314	500	850			MP	rep-new
2	23	311	2	23	312	150	980				
2	23	311	2	23	312	150	980			MP	
2	23	313	2	23	315	200	750	AC	1971		
2	23	314	2	23	316	200	750	AC	1972		
2	23	314	2	23	313	200	100	AC	1972		
2	23	316	2	23	315	150	35	AC	1971		
1	23	317	2	23	313	150	1100	AC	1972		
1	23	317	2	23	316	150	1100	AC	1971		
1	95	317	1	23	402	100	560	AC	1976		
1	23	317	1	23	318	375	10	AC			
2	23	2301	2	23	2302	300	600			MP	
2	23	2302	2	23	2303	300	800			MP	
2	23	2303	2	23	2304	300	900			MP	
2	23	2305	2	23	2301	450	1100			MP	
2	23	2301	2	23	301	150	10			MP	
2	23	2301	2	23	302	300	1220			MP	
1	23	318	2	23	314	375	1480	AC	1972		
2	97	602	2	23	310	150	720				
2	99	314	2	26	608	200	1100	AC	1971		
2	99	520	2	23	521	250	350				
2	99	521	2	23	2302	150	1100				
Hohola Reservoir Block											
1	24	318	1	24	401	200	300		1974		
1	24	318	1	24	401	600	300			MP	
1	24	401	1	24	402	200	170	AC	1975		
1	24	401	1	24	402	600	170			MP	
1	24	402	1	24	403	150	430		1961		
1	24	402	1	24	403	600	430			MP	
1	24	403	1	24	404	150	494		1961		
1	24	403	1	24	406	600	760			MP	
1	24	404	1	24	406	150	440		1961		
1	24	404	1	24	406	100	440		1961		
1	24	404	1	24	406	100	440		1961		
1	24	406	1	24	407	150	290		1961		
1	24	406	1	24	407	600	290			MP	
1	24	405	1	24	405	150	580		1961		
1	24	409	1	24	407	250	640	AC	1970		
1	24	407	1	24	408	250	720	AC			
1	24	409	1	24	407	150	700		1966		
1	24	409	1	24	407	400	700			MP	
1	24	410	1	24	409	250	120		1959		
1	24	410	1	24	409	400	120			MP	
1	24	411	1	24	410	250	570		1959		
1	24	411	1	24	410	400	570			MP	
1	24	412	1	24	418	150	720				
1	24	414	1	24	413	150	100		1964		
1	24	414	1	24	412	150	100		1964		
1	24	414	1	24	411	250	250		1959		
1	24	414	1	24	411	400	250			MP	
1	24	415	1	24	416	150	160		1964		
1	24	415	1	24	413	150	340		1964		
1	24	416	1	24	418	150	600				
1	24	416	1	24	414	250	420		1959		
1	24	416	1	24	414	400	420			MP	
1	24	417	1	24	415	150	700		1964		
1	95	317	1	24	401	100	400	AC	1975		
1	99	408	1	26	612	250	650	AC	1970		
Gerehu Reservoir Block											
2	25	502	2	25	503	150	350	AC	1971		
2	25	502	2	25	501	150	1200	AC	1971		
2	25	503	2	25	501	150	800	AC	1971		
2	25	504	2	25	503	150	190	AC	1971		
2	25	505	2	25	506	150	370	AC	1971		
2	25	506	2	25	502	200	300	AC	1971		
2	25	507	2	25	508	200	200	AC	1971		
2	25	507	2	25	506	200	120	AC	1971		
2	93	508	2	25	509	200	300	AC	1971		rep-old
2	25	508	2	25	509	600	300			MP	rep-new

TABLE F.10 PIPE DATA (CONT.)

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map No.	Sys. No.	Node No.	Map No.	Sys. No.	Node No.	Pipe Dia. (m)	Length (m)	Asbest Pipe	Laid Year	posed Pipe	placed Pipe
2	25	508	2	25	504	150	300	AC	1971		
2	25	508	2	25	2501	300	300			MP	
2	25	510	2	25	509	150	750	AC	1970		
2	93	510	2	25	509	250	750	AC			rep-old
2	25	510	2	25	509	600	750			MP	rep-new
2	25	510	2	25	517	250	1400				
2	25	511	2	25	507	200	750	AC	1971		
2	25	512	2	25	505	150	1200	AC	1971		
2	25	512	2	25	511	200	600	AC	1970		
2	25	513	2	25	510	150	550	AC	1970		
2	25	513	2	25	511	150	250	AC	1970		
2	25	514	2	25	510	150	520	AC	1969		
2	25	515	2	25	514	150	350	AC	1969		
2	25	515	2	25	510	600	880			MP	
2	25	516	2	25	512	200	1150	AC	1970		
2	25	516	2	25	513	150	1270	AC	1970		
2	25	517	2	25	518	200	500	AC	1969		
2	25	517	2	25	516	200	330	AC	1970		
2	25	518	2	25	519	200	800	AC	1969		
2	25	518	2	25	514	150	1050	AC	1969		
2	25	519	2	25	515	200	900	AC	1969		
2	25	2501	2	25	2502	300	440			MP	
2	25	2502	2	25	501	150	500			MP	
2	99	520	2	25	517	250	480	AC	1969		
Erima Reservoir Block											
2	26	601	2	26	602	250	1330	AC	1966		
2	26	602	2	26	603	250	240	AC	1966		
2	26	603	2	26	607	250	600		1965		
2	26	603	2	26	604	150	1000	AC	1969		
2	93	604	2	26	606	150	600	AC	1969		rep-old
2	26	604	2	26	606	250	600			MP	rep-new
2	26	605	2	26	604	150	900	AC	1973		
2	93	607	2	26	606	150	1100	AC	1969		rep-old
2	26	607	2	26	606	300	1100			MP	rep-new
2	26	608	2	26	607	250	220		1966		
2	26	609	2	26	608	250	720		1965		
1	26	610	1	26	611	200	550	AC	1972		
1	26	610	2	26	609	250	830		1965		
1	*26*	*611*	*1*	*26*	*616*	*200*	*840*	*AC*			
1	26	611	1	26	613	150	800				
1	26	612	1	26	638	250	480		1965		
1	26	612	1	26	631	150	230		1965		
1	26	612	1	26	631	400	230			MP	
1	26	613	1	26	612	250	580		1965		
1	26	613	1	26	612	450	580			MP	
1	26	614	1	26	613	250	400		1960		
1	26	614	1	26	613	450	400			MP	
1	26	614	1	26	619	450	400			MP	
1	26	619	1	26	616	450	880			MP	
1	93	615	1	26	614	250	500		1960		rep-old
1	26	615	1	26	614	450	500			MP	rep-new
1	26	615	1	26	623	150	270	AC	1967		
1	26	616	2	26	639	150	1200	AC			
1	26	616	2	26	639	700	1200			MP	
1	26	616	1	26	621	250	450			MP	
1	26	617	1	26	616	150	450	AC	1967		
1	26	617	1	26	618	100	150	AC	1967		
1	26	618	1	26	616	150	630	AC	1969		
1	26	619	1	26	617	150	400	AC	1967		
1	26	620	1	26	618	100	200	AC	1967		
1	26	621	1	26	622	150	450	AC	1967		
1	26	622	1	26	620	100	250	AC	1967		
1	26	623	1	26	619	150	600	AC	1967		
1	26	623	1	26	622	150	250	AC	1967		
1	93	624	1	26	621	150	350	AC	1967		rep-old
1	26	624	1	26	621	250	350			MP	rep-new
1	26	625	1	26	624	150	220	AC	1967		
1	26	625	1	26	623	150	400	AC	1967		
1	93	626	1	26	624	150	220	AC	1967		rep-old
1	26	626	1	26	624	250	220			MP	rep-new
1	93	627	1	26	626	150	350	AC	1967		rep-old
1	26	627	1	26	626	250	350			MP	rep-new
1	26	628	1	26	627	150	370	AC	1967		
1	26	629	1	26	630	150	250	AC	1969		
1	26	629	1	26	628	100	230	AC	1969		

Start Node			End Node			Pipe Characteristic				Pro-	Re-
Map No.	Sys. No.	Node No.	Map No.	Sys. No.	Node No.	Pipe Dia (m)	Length (m)	Asbest Pipe	Laid Year	posed Pipe	placed Pipe
1	26	630	1	26	625	150	320	AC	1969		
1	26	630	1	26	626	100	250	AC	1969		
1	26	632	1	26	631	150	550		1965		
1	26	632	1	26	631	400	550			MP	
1	26	633	1	26	632	150	1050	AC	1967		
1	26	634	1	26	633	150	700	AC	1967		
1	26	635	1	26	634	150	400	AC	1966		
1	26	635	1	26	634	250	400			MP	
1	26	636	1	26	632	150	550		1965		
1	26	636	1	26	632	400	550			MP	
1	26	636	1	26	646	150	1090				
1	26	637	1	26	634	150	470	AC	1967		
1	26	637	1	26	635	200	570	AC	1966		
1	26	638	1	26	610	250	90		1965		
2	26	640	2	26	641	150	800				
2	26	641	2	26	645	100	400				
2	26	641	2	26	645	200	400			MP	
2	26	641	2	26	642	150	840				
2	26	642	2	26	644	150	950				
2	26	642	2	26	643	150	600				
2	26	643	2	26	644	150	600				
2	26	644	2	26	645	150	800				
2	26	644	2	26	645	150	800			MP	
2	26	645	2	26	605	100	420				
2	26	2601	2	26	645	250	620			MP	
2	26	2601	2	26	606	400	340			MP	
1	26	613	1	26	611	150	850		1960		
1	26	635	1	26	636	150	100		1965		
1	26	635	1	26	636	250	100		1965	MP	
9 Mile Reservoir Block											
2	27	133	2	27	134	450	400		1966		
2	27	134	2	27	171	250	1200		1966		
2	27	145	2	27	702	300	760				
2	27	145	2	27	133	450	1400				
2	27	171	2	27	172	250	1200		1966		
2	27	172	2	27	179	250	1840				
1	27	173	1	27	174	250	3360		1966		
2	27	179	2	27	180	250	640				
2	*27*	*179*	*2*	*27*	*701*	*250*	*500*			MP	
2	27	180	1	27	173	250	3500				
2	27	702	2	27	704	300	1580				
2	27	702	2	27	703	150	1600				
2	27	704	2	27	705	300	1180				
2	27	705	2	27	706	100	1040				
2	27	2701	2	27	2702	600	720			MP	
2	27	2701	2	27	180	600	10			MP	

TABLE F.11 NETWORK ANALYSIS FOR EXISTING SYSTEM

Node No.	Demand (m3/day)	Water Head (m)	Ground Level (m)	Residual Head (m)	Location
1	0	150	152	-2	Mt.Eriama WTP
21	0	91.2	133	-41.84	Boroko reservoir
22	0	83.7	116	-32.26	Korobosea reservoir
23	0	84.7	113	-28.31	3 mile reservoir
24	0	82.8	102	-19.21	Koki reservoir
25	0	81.9	106	-24.06	Town reservoir
31	0	102	132	-30.03	Waigani reservoir
32	0	97.8	123	-25.2	Hohola reservoir
111	0	149.9	152	-2.14	Transmission pipe
112	0	149.8	152	-2.2	Transmission pipe
113	0	140.4	44	96.37	Transmission pipe
114	298	140.2	42	98.19	Transmission pipe
115	0	129.2	33	96.19	Transmission pipe
116	7	107.5	39	68.51	Transmission pipe
117	0	99.2	38	61.17	Transmission pipe
118	0	91.3	76	15.27	Transmission pipe
119	0	90.7	66	24.7	Transmission pipe
120	17	86.6	58	28.56	Transmission pipe
121	0	84.7	90	-5.28	Transmission pipe
122	1858	83.4	9	74.39	Transmission pipe
123	0	82.9	116	-33.15	Transmission pipe
124	0	82.7	92	-9.33	Transmission pipe
125	0	82.3	61	21.31	Transmission pipe
126	0	82.3	95	-12.74	Transmission pipe
127	0	82.1	1	81.05	Transmission pipe
128	0	82	1.5	80.47	Transmission pipe
131	0	149.9	152	-2.12	Transmission pipe
132	4702	140.4	42	98.41	Transmission pipe
133	440	139.8	42	97.84	Transmission pipe
134	0	139.7	46	93.7	Transmission pipe
135	0	140.1	42	98.14	Transmission pipe
136	997	94.6	41	53.61	Transmission pipe
137	997	93.9	41	52.92	Transmission pipe
138	0	91.1	90	1.12	Transmission pipe
139	0	90.7	66	24.69	Transmission pipe
140	0	89.6	58	31.56	Transmission pipe
141	826	89.2	58	31.18	Transmission pipe
142	0	85.4	61	24.4	Transmission pipe
143	0	85	79	5.98	Transmission pipe
151	0	140.9	35	105.87	Transmission pipe
152	1451	111.1	20	91.11	Transmission pipe
153	0	102.4	40	62.37	Transmission pipe
154	0	102	50	52.04	Transmission pipe
155	0	102	60	41.97	Transmission pipe
161	0	149.5	38	111.45	Transmission pipe
171	0	137.3	46	91.27	Transmission pipe
172	0	120.7	34	86.74	Transmission pipe
173	0	93.9	54	39.87	Transmission pipe
174	3545	73.4	53	20.45	Transmission pipe
175	1880	73.3	64	9.27	Transmission pipe
176	997	88	60	28	Transmission pipe
177	2529	88.1	55	33.15	Transmission pipe
178	0	90.1	118	-27.89	Transmission pipe
313	1242	97.3	57	40.35	Waigani res. block
314	1107	98	54	43.97	Waigani res. block
315	2432	96.5	64	32.46	Waigani res. block
316	0	96.7	64	32.67	Waigani res. block
317	1175	96.6	88	8.57	Waigani res. block
318	0	97.8	100	-2.2	Waigani res. block
401	0	97	98	-0.95	Hohola res. block
402	579	87.7	90	-2.28	Hohola res. block
403	579	84.2	79	5.19	Hohola res. block
404	579	81.2	68	13.16	Hohola res. block
405	579	80.2	85	-4.78	Hohola res. block
406	579	80.2	80	0.22	Hohola res. block
407	1988	79.6	70	9.6	Hohola res. block
408	137	80.3	60	20.32	Hohola res. block
409	0	80.9	74	6.87	Hohola res. block
410	1617	81	74.5	6.49	Hohola res. block
411	845	82.1	73	9.07	Hohola res. block
412	469	82.7	75	7.71	Hohola res. block
413	469	82.8	78	4.85	Hohola res. block
414	0	82.7	75	7.75	Hohola res. block
415	786	83.4	75	8.45	Hohola res. block
416	0	83.7	79	4.74	Hohola res. block
417	469	84.1	80	4.12	Hohola res. block
501	984	36.7	31	5.66	Gerehu res. block
502	1010	36.8	24	12.84	Gerehu res. block
503	0	36.8	20	16.84	Gerehu res. block
504	298	36.9	20	16.88	Gerehu res. block
505	691	38.8	28	10.76	Gerehu res. block
506	0	37.2	25	12.17	Gerehu res. block
507	477	37.2	25	12.17	Gerehu res. block
508	298	37.2	22	15.21	Gerehu res. block
509	655	37.6	25	12.65	Gerehu res. block
510	776	46.6	35	11.59	Gerehu res. block
511	813	49	30	19.02	Gerehu res. block
512	858	49.6	30	19.55	Gerehu res. block
513	667	49	30	18.98	Gerehu res. block
514	1150	50.4	40	10.36	Gerehu res. block
515	1076	51.3	40	11.26	Gerehu res. block
516	1007	60	35	25.03	Gerehu res. block
517	0	68.5	35	33.5	Gerehu res. block
518	1124	58.3	38	20.26	Gerehu res. block
519	1076	53.4	30	23.44	Gerehu res. block
520	78	81.9	40	41.94	Gerehu res. block
601	1101	96.1	45	51.08	Erima res. block
602	1525	84.6	46	38.57	Erima res. block
603	674	83.4	51	32.36	Erima res. block
604	893	81.4	44	37.39	Erima res. block
605	2643	82.5	20	62.47	Erima res. block
606	722	81.1	44	37.06	Erima res. block
607	857	81.7	44	37.7	Erima res. block
608	0	81.5	43	38.46	Erima res. block
609	153	80.7	55	25.66	Erima res. block
610	369	79.9	62	17.88	Erima res. block

TABLE F.11 NETWORK ANALYSIS FOR EXISTING SYSTEM (CONT.)

Node No.	Demand	Water Head	Ground Level	Residual Head	Location
	m3/day	m	m	m	
611	1769	78.4	45	33.42	Erima res. block
612	829	80.1	55	25.12	Erima res. block
613	299	81.5	45	36.52	Erima res. block
614	739	82.7	40	42.67	Erima res. block
615	0	84.8	40	44.8	Erima res. block
616	767	68.5	47	21.5	Erima res. block
617	337	68.9	50	18.88	Erima res. block
618	337	68.8	60	8.78	Erima res. block
619	337	70.2	42	28.15	Erima res. block
620	337	69.8	45	24.76	Erima res. block
621	337	75.2	65	10.23	Erima res. block
622	337	73.5	39	34.55	Erima res. block
623	337	73.6	39	34.56	Erima res. block
624	337	77.2	50	27.2	Erima res. block
625	337	77.4	37	40.38	Erima res. block
626	337	78.3	50	28.25	Erima res. block
627	488	78.8	65	13.76	Erima res. block
628	446	80.4	38	42.35	Erima res. block
629	379	93.9	38	55.87	Erima res. block
630	337	83.6	38	45.58	Erima res. block
631	367	77.2	54	23.2	Erima res. block
632	1531	72.6	54	18.57	Erima res. block
633	2858	68.1	43	25.05	Erima res. block
634	1198	75.6	45	30.62	Erima res. block
635	585	78.2	42	36.2	Erima res. block
636	369	75.3	40	35.29	Erima res. block
637	611	80	41	38.97	Erima res. block
638	852	79.9	60	19.88	Erima res. block
7201	0	82	1	81.05	Town res. block
7202	180	81.9	1.5	80.39	Town res. block
7203	0	81.9	104	-22.09	Town res. block
7204	0	81.9	104	-22.09	Town res. block
7205	0	81.9	85	-3.13	Town res. block
7206	180	81.8	85	-3.16	Town res. block
7207	180	81.7	60	21.68	Town res. block
7208	180	81.7	3	78.7	Town res. block
7209	253	81.8	43	38.8	Town res. block
7210	180	81.8	46	35.83	Town res. block
7211	333	67.2	46	21.18	Town res. block
7212	464	67.4	31	36.41	Town res. block
7213	180	70.8	3.1	67.74	Town res. block
7214	336	68.2	3.7	64.49	Town res. block
7215	180	67.9	3.7	64.25	Town res. block
7216	257	67.5	17	50.48	Town res. block
7217	761	67.1	1.5	65.65	Town res. block
8201	0	84.7	100	-15.29	3 mile res. block
8202	0	84.7	113	-28.31	3 mile res. block
8203	0	84.7	95	-10.27	3 mile res. block
8204	0	83.5	76	7.49	3 mile res. block
8205	1000	83.3	76	7.32	3 mile res. block
8206	0	83.4	34	49.38	3 mile res. block
8207	1020	83.4	34	49.37	3 mile res. block
8208	0	83.4	31	52.37	3 mile res. block
8209	4898	61.7	54	7.74	3 mile res. block
8210	0	61.7	20	41.74	3 mile res. block
8211	4082	49.1	6	43.08	3 mile res. block
8251	0	83.2	55	28.15	Koki res. block
8252	0	83.1	55	28.06	Koki res. block
8253	1626	70.6	34	36.65	Koki res. block
8254	1406	70.8	30	40.78	Koki res. block
8255	1020	82.5	3.1	79.44	Koki res. block
8256	0	82.3	61	21.3	Koki res. block
8259	0	81.7	85	-3.33	Koki res. block
8260	180	81.7	98	-16.33	Koki res. block
8261	180	81.7	64	17.67	Koki res. block
8262	0	82	1	81.04	Koki res. block
8263	180	81.6	52	29.57	Koki res. block
8264	180	81.6	52	29.57	Koki res. block
8265	302	81.5	23	58.48	Koki res. block
8266	10557	80.3	1.5	78.79	Koki res. block
8267	0	80.3	10	70.29	Koki res. block
8268	0	80.3	5	75.29	Koki res. block
8269	0	80.3	8	72.29	Koki res. block
8270	0	80.3	8	72.29	Koki res. block
8271	0	80.3	10	70.29	Koki res. block
9201	404	90.1	37	53.08	Boroko res. block
9202	404	87.1	40	47.13	Boroko res. block
9203	404	87.1	40	47.11	Boroko res. block
9204	404	87.5	60	27.54	Boroko res. block
9205	404	87.2	70	17.17	Boroko res. block
9206	404	87.1	61	26.08	Boroko res. block
9207	404	89.1	61	28.12	Boroko res. block
9208	0	89.2	38	51.15	Boroko res. block
9209	252	87.5	70	17.47	Boroko res. block
9210	307	87	49	37.98	Boroko res. block
9211	252	86.5	56	30.53	Boroko res. block
9212	252	85.6	48	37.59	Boroko res. block
9213	0	86.2	50	36.19	Boroko res. block
9214	252	86.3	52	34.33	Boroko res. block
9215	252	86.5	53	33.52	Boroko res. block
9216	47	87.4	70	17.42	Boroko res. block
9217	47	87.6	92	-4.39	Boroko res. block
9218	47	87.5	72	15.52	Boroko res. block
9219	102	87.9	72	15.9	Boroko res. block
9220	142	88.1	64	24.12	Boroko res. block
9221	55	88.1	58	30.09	Boroko res. block
9222	252	86.2	50	36.22	Boroko res. block
9223	55	88	54	34.01	Boroko res. block
9224	102	87.9	58	29.87	Boroko res. block
9225	0	87.9	67	20.89	Boroko res. block
9226	102	87.9	79	8.87	Boroko res. block
9227	102	87.9	82	5.87	Boroko res. block
9228	0	87.4	47	40.38	Boroko res. block
9251	1478	86.1	49	37.13	Korobosea res. block
9252	166	85.2	49	36.15	Korobosea res. block
9253	231	84.6	52	32.62	Korobosea res. block

TABLE F.11 NETWORK ANALYSIS FOR EXISTING SYSTEM (CONT.)

Node No.	Demand	Water Head	Ground Level	Residual Head	Location
	m3/day	m	m	m	
9254	231	84.8	55	29.81	Korobosea res. block
9255	0	85.4	55	30.45	Korobosea res. block
9256	0	86.1	58	28.14	Korobosea res. block
9257	0	86.2	58	28.17	Korobosea res. block
9258	0	86.3	58	28.34	Korobosea res. block
9259	322	83.9	47	36.93	Korobosea res. block
9260	231	84.1	55	29.11	Korobosea res. block
9261	349	83.2	52	31.16	Korobosea res. block
9262	349	83.1	53	30.13	Korobosea res. block
9263	349	83.1	56	27.13	Korobosea res. block
9264	1436	83.2	61	22.17	Korobosea res. block
9265	287	83.4	67	16.44	Korobosea res. block
9266	0	83.7	70	13.74	Korobosea res. block
9267	0	83.7	78	5.74	Korobosea res. block
9268	0	80.9	67	13.94	Korobosea res. block
9269	338	80	67	12.98	Korobosea res. block
9270	287	79.5	70	9.52	Korobosea res. block
9271	1629	79.5	76	3.52	Korobosea res. block
9272	44	79.5	70	9.52	Korobosea res. block
9273	287	79.5	61	18.52	Korobosea res. block
9274	287	79.6	58	21.58	Korobosea res. block
9275	0	79.6	55	24.58	Korobosea res. block
9276	1686	79.6	58	21.57	Korobosea res. block
9277	231	81	58	22.98	Korobosea res. block
9278	231	84.1	61	23.08	Korobosea res. block
9279	0	85.2	61	24.2	Korobosea res. block
9280	195	83.9	63	20.86	Korobosea res. block
9281	195	83.9	96	-12.06	Korobosea res. block
9282	0	84	84	0.01	Korobosea res. block
9283	461	84.1	88	-3.93	Korobosea res. block
9284	207	84.2	79	5.24	Korobosea res. block
9285	0	85	70	15.02	Korobosea res. block
9286	0	84.9	79	5.95	Korobosea res. block
9287	98	81.2	85	-3.77	Korobosea res. block
9288	0	83.9	79	4.95	Korobosea res. block
9289	195	83.9	73	10.91	Korobosea res. block
9290	195	83.2	76	7.22	Korobosea res. block
9291	195	83.2	72	11.22	Korobosea res. block
9292	195	83.4	76	7.38	Korobosea res. block
9293	457	83.9	81	2.9	Korobosea res. block
9294	118	83.9	81	2.88	Korobosea res. block
9295	168	83.9	82	1.88	Korobosea res. block
9296	0	55.2	12	43.17	Korobosea res. block
9297	0	55.2	20	35.17	Korobosea res. block

TABLE 12-1 PRESSURE DATA
(MASTER PLAN; TRANSMISSION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
2	1	1	0	149.6	149.6	0
1	1	21	31532	132.7	132.3	0.41
1	1	22	22202	115.1	115.9	-0.84
1	1	23	30557	122.5	120.7	1.76
1	1	24	21803	120.2	109.8	10.41
1	1	25	7452	117.3	105.8	11.5
2	1	31	36217	132.3	132	0.31
1	1	32	26848	126.7	123.1	3.65
2	1	40	61543	105	105	0
2	1	41	43225	90	88	1.98
1	1	42	51051	98.8	98	0.76
2	1	43	34857	93.8	93	0.76
2	2	111	0	149.5	152	-2.47
2	2	112	0	149.5	152	-2.5
2	2	113	0	143.2	44	99.19
2	2	114	0	143.2	42	101.2
2	2	115	0	140.9	33	107.9
1	2	116	0	137.5	39	98.46
1	2	117	0	134.9	38	96.91
1	2	118	0	132.5	76	56.5
1	2	119	0	131.7	66	65.73
1	2	120	0	125.3	58	67.32
1	2	121	0	122.6	90	32.56
1	2	122	0	121.6	9	112.6
1	2	123	0	120.8	116	4.76
1	2	124	0	120.4	92	28.37
1	2	125	0	119.8	61	58.8
1	2	126	0	119.6	95	24.61
1	2	127	0	119	1	118
1	2	128	0	118.6	1.5	117.1
1	2	129	0	126.6	47	79.59
2	2	131	0	149.5	152	-2.48
2	2	132	0	143.5	42	101.5
2	2	135	0	143.2	42	101.2
1	2	136	0	135.2	41	94.19
1	2	137	0	135	41	93.97
1	2	138	0	132.5	90	42.52
1	2	139	0	131.7	66	65.73
1	2	140	0	131	58	73.05
1	2	141	0	130.7	58	72.68
1	2	142	0	124	61	62.99
1	2	143	0	122.6	79	43.58
2	2	146	0	140.9	33	107.9
2	2	151	0	141.4	35	106.4
2	2	152	0	135.3	20	115.4
2	2	153	0	133.1	40	93.05
2	2	154	0	132.8	50	82.79
2	2	156	0	140.9	44	96.89
2	2	161	0	143.2	38	105.2
1	9	901	0	137.5	40	97.46
1	9	902	0	135.1	39	96.13
1	9	903	0	134.3	37	97.34
1	9	904	0	131.9	45	86.89
1	9	905	0	130.3	50	80.31
1	9	906	0	128.4	65	63.41
1	9	907	0	127.2	75	52.23
1	9	908	0	126.9	72	54.91
1	9	909	0	125.7	75	50.65
1	9	910	0	124.2	75	49.23
1	9	911	0	122.5	85	37.49
1	9	912	0	121.9	60	61.9
1	9	913	0	121.5	34	87.52
1	9	914	0	121.3	30	91.3
1	9	915	0	120.9	50	70.92
2	2	2101	0	104.1	60	44.14
2	2	2102	0	103	31	72.04
1	2	2103	0	100.4	40	60.43
2	2	2104	0	96.7	30	66.67
2	2	2105	0	95.2	27	68.25
2	2	2106	0	94.3	44	50.26
2	2	2107	0	92.8	49	43.81
2	2	2151	0	140.9	44	96.88
2	2	2152	0	139.1	31	108.1
1	2	2153	0	137.5	40	97.47
2	2	2154	0	135.7	30	105.7
2	2	2155	0	135.3	37	98.27
2	2	2156	0	134.6	35	99.58
2	2	2157	0	134.1	45	89.08
2	2	2158	0	132.8	50	82.78
2	2	2160	0	133.5	45	88.54
2	2	2161	0	130.6	58	72.56
1	2	2162	0	127.6	83	44.63
1	2	2163	0	127.1	100	27.09

TABLE 12-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; TRANSMISSION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficien	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	1	1	2	2	111	1092	20	110	152245	1.88	3.3
2	1	1	2	2	131	525	20	110	24364	1.3	3.9
1	1	21	1	2	118	600	250	110	15301	0.63	0.86
1	1	21	1	2	138	450	90	110	11780	0.86	2.16
1	1	21	1	2	2153	900	3300	110	-58612	-1.07	1.44
1	1	22	1	2	129	500	2760	110	-22202	-1.31	4.18
1	1	23	1	2	121	600	80	110	-18538	-0.76	1.22
1	1	23	1	2	143	300	120	110	-2705	-0.44	1.02
1	1	24	1	2	123	300	20	110	-16037	-2.63	27.55
1	1	24	1	2	124	300	40	110	-5766	-0.94	4.15
1	1	25	1	2	128	375	570	110	-7452	-0.78	2.25
2	1	31	2	2	2158	800	440	110	-36217	-0.83	1.05
1	1	32	1	2	2163	600	140	110	-26848	-1.1	2.44
2	1	40	2	2	2101	1200	560	110	129133	1.32	1.53
2	1	41	2	2	2107	800	1940	110	-43225	-1	1.45
1	1	42	1	2	2103	700	440	110	-51051	-1.54	3.79
2	1	43	2	2	2102	600	2340	110	-34857	-1.43	3.96
2	2	111	2	2	112	600	10	110	34166	1.4	3.8
2	2	111	2	2	161	1000	2010	110	118083	1.74	3.15
2	2	112	2	2	113	600	1650	110	34166	1.4	3.82
2	2	113	2	2	114	600	32	110	17987	0.74	1.16
2	2	113	2	2	151	600	1500	110	18481	0.76	1.22
2	2	113	2	2	161	600	1	110	-2302	-0.09	0
2	2	114	2	2	115	600	1950	110	17987	0.74	1.16
2	2	115	1	2	116	600	3840	110	15585	0.64	0.89
2	2	115	2	2	146	450	10	110	459	0.03	0
2	2	115	2	2	156	600	10	110	-7101	-0.29	0.2
2	2	115	2	2	161	1200	1450	110	-131812	-1.35	1.59
2	2	115	2	2	2151	1350	10	110	125289	1.01	0.8
1	2	116	1	2	117	600	1480	110	22223	0.91	1.72
1	2	116	1	2	2153	600	10	110	-14992	-0.61	0.8
1	2	117	1	2	118	600	1400	110	22223	0.91	1.72
1	2	118	1	2	119	600	170	110	37524	1.54	4.55
1	2	119	1	2	129	600	880	110	42952	1.76	5.84
1	2	119	1	2	139	600	50	110	-5429	-0.22	0.14
1	2	120	1	2	121	525	950	110	20750	1.11	2.91
1	2	120	1	2	129	600	840	110	-20750	-0.85	1.52
1	2	121	1	2	122	600	1240	110	14647	0.6	0.8
1	2	121	1	2	143	450	10	110	-12434	-0.9	2.4
1	2	122	1	2	123	600	1020	110	14647	0.6	0.8
1	2	123	1	2	124	300	20	110	13218	2.16	19.25
1	2	124	1	2	125	450	620	110	7452	0.54	0.92
1	2	125	1	2	126	450	200	110	7452	0.54	0.93
1	2	126	1	2	127	450	700	110	7452	0.54	0.92
1	2	127	1	2	128	450	420	110	7452	0.54	0.92
2	2	131	2	2	132	525	1530	110	24364	1.3	3.91
2	2	132	2	2	135	450	40	110	24364	1.77	8.28
2	2	135	2	2	146	450	2040	110	8328	0.61	1.14
2	2	135	2	2	161	600	10	110	16035	0.66	1
1	2	136	1	2	137	450	180	110	8788	0.64	1.26
1	2	136	2	2	146	450	4540	110	-8788	-0.64	1.25
1	2	137	1	2	138	450	1950	110	8788	0.64	1.25

TABLE 12-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; TRANSMISSION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficier	Flow Rate	Velosity	Hydraulic
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	Gradient (1/1000)
1	2	138	1	2	139	450	130	110	20568	1.5	6.05
1	2	139	1	2	140	450	200	110	15139	1.1	3.43
1	2	140	1	2	141	450	105	110	15139	1.1	3.44
1	2	141	1	2	142	450	1950	110	15139	1.1	3.43
1	2	142	1	2	143	450	410	110	15139	1.1	3.43
2	2	151	2	2	156	525	200	110	18481	0.99	2.34
2	2	152	2	2	153	525	2400	110	11380	0.61	0.96
2	2	152	2	2	156	525	5800	110	-11380	-0.61	0.96
2	2	153	2	2	154	525	270	110	11380	0.61	0.96
2	2	154	2	2	2158	525	20	110	11380	0.61	0.95
1	9	901	2	2	115	600	3850	110	-15570	-0.64	0.89
1	9	901	1	2	116	600	10	110	-8353	-0.34	0.3
1	9	901	1	9	902	600	1180	110	23923	0.98	1.97
1	9	902	1	9	903	600	400	110	23923	0.98	1.97
1	9	903	1	9	904	600	1240	110	23923	0.98	1.97
1	9	904	1	9	905	600	800	110	23923	0.98	1.97
1	9	905	1	9	906	600	960	110	23923	0.98	1.97
1	9	906	1	9	907	600	600	110	23923	0.98	1.97
1	9	907	1	9	908	600	160	110	23923	0.98	1.98
1	9	908	1	9	909	600	640	110	23923	0.98	1.97
1	9	909	1	9	910	600	720	110	23923	0.98	1.98
1	9	910	1	9	911	600	880	110	23923	0.98	1.97
1	9	911	1	1	23	600	100	110	9315	0.38	0.34
1	9	911	1	9	912	600	750	110	14609	0.6	0.79
1	9	912	1	9	913	600	480	110	14609	0.6	0.79
1	9	913	1	9	914	600	280	110	14609	0.6	0.79
1	9	914	1	9	915	600	480	110	14609	0.6	0.79
1	9	915	1	2	123	600	200	110	14609	0.6	0.79
2	2	2101	2	2	2102	1200	720	110	129133	1.32	1.53
2	2	2102	1	2	2103	1100	2000	110	94280	1.15	1.31
1	2	2103	2	2	2104	800	2580	110	43225	1	1.45
2	2	2104	2	2	2105	800	980	110	43225	1	1.46
2	2	2105	2	2	2106	800	680	110	43225	1	1.45
2	2	2106	2	2	2107	800	1000	110	43225	1	1.45
2	2	2151	2	2	2152	1350	2180	110	125289	1.01	0.82
2	2	2152	1	2	2153	1350	2000	110	125289	1.01	0.82
1	2	2153	2	2	2154	1000	2580	110	51685	0.76	0.68
2	2	2154	2	2	2155	1000	640	110	51685	0.76	0.68
2	2	2155	2	2	2156	1000	1000	110	51685	0.76	0.68
2	2	2156	2	2	2157	1000	740	110	51685	0.76	0.68
2	2	2157	2	2	2158	800	2500	110	24837	0.57	0.52
2	2	2157	2	2	2160	600	220	110	26848	1.1	2.44
2	2	2160	2	2	2161	600	1220	110	26848	1.1	2.44
2	2	2161	1	2	2162	600	1200	110	26848	1.1	2.44
1	2	2162	1	2	2163	600	220	110	26848	1.1	2.45

TABLE 13-1 PRESSURE DATA
(MASTER PLAN ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	11	21	0	123.5	123.5	0
1	11	140	0	115.6	58	57.55
1	11	141	0	115.5	58	57.47
1	11	175	5901	69	64	5.01
1	11	176	5901	71.1	60	11.11
1	11	177	9964	88.2	55	33.17
1	11	178	0	106.9	118	-11.12
1	11	9201	982	91.4	37	54.44
1	11	9202	982	94.2	40	54.19
1	11	9203	982	95.8	40	55.81
1	11	9204	982	98.4	60	38.43
1	11	9205	982	105.8	70	35.83
1	11	9206	982	106.4	61	45.41
1	11	9207	982	114.3	61	53.35
1	11	9208	0	106.6	38	68.6
1	11	9209	484	104.2	70	34.19
1	11	9210	741	104	49	54.97
1	11	9211	484	102.6	56	46.56
1	11	9212	484	101.3	48	53.35
1	11	9213	0	101.9	50	51.89
1	11	9214	484	102.1	52	50.07
1	11	9215	484	102.5	53	49.46
1	11	9216	77	104.3	70	34.3
1	11	9217	77	104.8	92	12.79
1	11	9218	77	104.7	72	32.71
1	11	9219	214	106.1	72	34.1
1	11	9220	137	107.4	64	43.35
1	11	9221	137	107.2	58	49.22
1	11	9222	484	101.9	50	51.89
1	11	9223	137	106.9	54	52.88
1	11	9224	259	105.6	58	47.58
1	11	9225	0	105.9	67	38.86
1	11	9226	259	105.5	79	26.54
1	11	9227	259	105.5	82	23.52
1	11	9228	0	106.2	47	59.21
1	11	9230	5901	76.3	36	40.27
1	11	9231	5901	32.6	40	-7.41
1	12	22	0	107.9	107.9	0
1	12	9251	1541	95.3	49	46.34
1	12	9252	770	91.9	49	42.88
1	12	9253	437	92.2	52	40.18
1	12	9254	437	93.3	55	38.29
1	12	9255	0	95.4	55	40.44
1	12	9256	0	96.3	58	38.34
1	12	9257	0	96.5	58	38.55
1	12	9258	0	96.7	58	38.7
1	12	9259	587	91.8	47	44.84
1	12	9260	437	92	55	37
1	12	9261	669	91.8	52	39.79
1	12	9262	669	91.9	53	38.91
1	12	9263	669	92.4	56	36.42
1	12	9264	4388	93.2	61	32.18
1	12	9265	616	98.7	67	31.68
1	12	9266	0	100.9	70	30.94
1	12	9267	0	102.2	78	24.23
1	12	9268	0	94.3	67	27.31
1	12	9269	616	93.3	67	26.33
1	12	9270	616	90.9	70	20.92
1	12	9271	0	91.1	76	15.08
1	12	9272	3538	89.5	70	19.5
1	12	9273	616	90.9	61	29.9
1	12	9274	616	93.4	58	35.36
1	12	9275	0	98	55	42.97
1	12	9276	2226	97.2	58	39.2
1	12	9277	437	97.1	58	39.06
1	12	9278	437	96.5	61	35.55
1	12	9279	0	96.5	61	35.55
1	12	9287	215	93.9	85	8.9
1	12	9295	9194	67.7	6	61.72
1	12	9296	4858	69.6	12	57.64
1	12	9297	1937	53.8	20	33.81
1	12	9298	2225	-6.5	30	-36.53
1	13	23	0	112.8	112.8	0
1	13	8201	0	112	100	12.02
1	13	8202	0	112.7	113	-0.34
1	13	8203	0	110.9	95	15.92
1	13	8204	1629	99.2	76	23.19
1	13	8205	1188	98.1	76	22.15
1	13	8206	0	98.2	34	64.18
1	13	8207	1057	97.9	34	63.93
1	13	8208	0	96.9	31	65.88
1	13	8209	2195	81.3	54	27.34
1	13	8210	11001	35.4	20	15.35
1	13	8212	5961	37.5	10	27.51
1	13	8213	3441	55.5	25	30.46
1	13	8214	410	93.6	82	11.6
1	13	8215	109	93.6	130	-36.39
1	13	8216	225	93.7	81	12.72
1	13	8217	1045	94	81	13.02
1	13	8218	0	95.1	79	16.07

TABLE 13-1 PRESSURE DATA
(MASTER PLAN ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	13	8219	0	96.5	84	12.47
1	13	8220	1045	98	88	10.01
1	13	8221	161	104.2	79	25.18
1	13	8222	0	108.7	79	29.71
1	13	8223	3836	87.9	8	79.88
1	13	8224	3845	84.8	3	81.84
1	13	8226	414	93.6	63	30.62
1	13	8227	414	93.6	96	-2.36
1	13	8228	0	108.7	70	38.71
1	13	8229	414	94	73	21.05
1	13	8230	414	91.8	76	15.83
1	13	8231	414	92.2	72	20.23
1	13	8232	414	92.2	76	16.23
1	14	24	0	101.8	101.8	0
1	14	124	0	98	92	6.03
1	14	8251	0	87.8	55	32.78
1	14	8252	0	87.8	55	32.78
1	14	8253	4922	87.8	34	53.78
1	14	8254	1316	93.3	30	63.34
1	14	8255	1057	86.9	3.1	83.76
1	14	8256	0	93	61	32.03
1	14	8259	0	86.2	85	1.21
1	14	8260	852	81.8	98	-16.23
1	14	8261	426	87.2	64	23.16
1	14	8262	0	87	1	86
1	14	8263	426	87.9	52	35.85
1	14	8264	0	87.9	52	35.85
1	14	8265	852	89.6	23	66.64
1	14	8266	5367	84.5	1.5	83.04
1	14	8267	2875	72.9	10	62.92
1	14	8268	0	63.3	5	58.27
1	14	8269	8034	58.5	8	50.45
1	14	8270	0	56.7	8	48.74
1	14	8271	5026	34.2	10	24.19
1	15	25	0	101.2	101.2	0
1	15	7201	0	97.1	1	96.14
1	15	7202	852	97.1	1.5	95.64
1	15	7203	0	99.2	104	-4.8
1	15	7204	0	99.2	104	-4.8
1	15	7205	0	97.2	85	12.23
1	15	7206	852	95.4	85	10.36
1	15	7207	852	92.5	60	32.49
1	15	7208	852	92.5	3	89.49
1	15	7209	852	93.2	43	50.15
1	15	7210	852	95.4	46	49.4
1	15	7211	852	82.2	46	36.2
1	15	7212	852	81.4	31	50.36
1	15	7213	852	82.2	3.1	79.13
1	15	7214	852	79.1	3.7	75.36
1	15	7215	852	74	3.7	70.3
1	15	7216	852	79.1	17	62.13
1	15	7217	852	79.6	1.5	78.09
2	23	31	0	124.1	124.1	0
2	23	154	0	119.7	50	69.74
2	23	155	0	121.4	60	61.36
2	23	301	4189	114.4	58	56.36
2	23	302	0	111.4	78	33.4
2	23	303	0	110.5	93	17.5
2	23	304	0	53.1	4	49.14
2	23	305	1074	21.7	11	10.74
1	23	306	4355	8.1	1	7.09
1	23	307	0	8.1	2	6.09
2	23	309	7844	92.2	76	16.16
2	23	310	768	89.1	66	23.11
2	23	311	2094	88.7	66	22.7
2	23	312	1047	87.3	105	-17.7
2	23	313	4244	82.7	57	25.73
2	23	314	4244	86.1	54	32.09
2	23	315	6071	78.3	64	14.33
2	23	316	0	80.2	64	16.17
1	23	317	4244	84.1	88	-3.88
1	23	318	0	84.1	100	-15.86
2	23	520	2989	117.1	40	77.06
2	23	2301	0	114.9	58	56.9
2	23	2302	1693	105.6	51	54.58
2	23	2303	4271	96.3	80	16.27
2	23	2304	5807	92.5	60	32.49
2	23	2305	0	121.4	60	61.36
1	24	32	0	115.2	115.2	0
1	24	318	0	113.6	100	13.65
1	24	401	0	112.2	98	14.23
1	24	402	1410	111.4	90	21.44
1	24	403	1410	109.4	79	30.45
1	24	404	1410	106.2	68	38.17
1	24	405	1410	101	85	16.03
1	24	406	1410	106.2	80	26.21
1	24	407	3026	105.2	70	35.21
1	24	408	8498	90.3	60	30.35
1	24	409	0	100.6	74	26.64
1	24	410	3752	99.8	74.5	25.25

TABLE 13-1 PRESSURE DATA
(MASTER PLAN ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	24	411	2690	96.8	73	23.79
1	24	412	2941	89	75	13.96
1	24	413	2941	88.1	78	10.07
1	24	414	0	95.8	75	20.83
1	24	415	2941	84.3	75	9.28
1	24	416	0	95.5	79	16.5
1	24	417	2941	59.9	80	-20.09
1	24	418	3495	83.4	60	23.39
2	25	41	8709	80	80	0
2	25	501	3995	36.4	31	5.37
2	25	502	3677	39.8	24	15.8
2	25	503	0	41.1	20	21.11
2	25	504	1151	44.4	20	24.4
2	25	505	1751	41.3	28	13.27
2	25	506	0	43.5	25	18.45
2	25	507	1751	45.9	25	20.89
2	25	508	1151	56.4	22	34.37
2	25	509	2594	60.5	25	35.48
2	25	510	1580	71.4	35	36.4
2	25	511	1923	44.3	30	14.29
2	25	512	1923	43.6	30	13.65
2	25	513	1923	46.8	30	16.78
2	25	514	5549	54	40	13.99
2	25	515	5549	76.1	40	36.09
2	25	516	1923	46.8	35	11.8
2	25	517	0	50.8	35	15.84
2	25	518	5549	44.9	38	6.9
2	25	519	5549	45.3	30	15.33
2	25	2501	0	52.1	25	27.06
2	25	2502	9192	45.7	20	25.73
1	26	42	0	90	90	0
2	26	601	4467	50.6	45	5.58
2	26	602	1143	58.9	46	12.93
2	26	603	1715	61.2	51	10.22
2	26	604	5181	69.5	44	25.47
2	26	605	1083	66.3	20	46.29
2	26	606	2281	73.4	44	29.4
2	26	607	2487	67.7	44	23.67
2	26	608	0	67.5	43	24.52
2	26	609	0	67	55	12.05
1	26	610	4850	66.5	62	4.49
1	26	611	4850	67.7	45	22.71
1	26	612	0	67.4	55	12.38
1	26	613	794	70.1	45	25.1
1	26	614	1687	72.4	40	32.37
1	26	615	0	72.4	40	32.35
1	26	616	893	85.1	47	38.05
1	26	617	893	77.7	50	27.72
1	26	618	893	77.6	60	17.57
1	26	619	893	76.1	42	34.12
1	26	620	893	72	45	27
1	26	621	893	72.5	65	7.53
1	26	622	893	72	39	33
1	26	623	893	72.2	39	33.23
1	26	624	893	73.3	50	23.26
1	26	625	893	72.2	37	35.17
1	26	626	893	75.6	50	25.57
1	26	627	893	83	65	18.02
1	26	628	893	78	38	40.03
1	26	629	893	72	38	34.01
1	26	630	893	72	38	34.01
1	26	631	0	65.4	54	11.4
1	26	632	2801	60.7	54	6.65
1	26	633	2801	49.3	43	6.3
1	26	634	2801	54.2	45	9.2
1	26	635	2801	56	42	13.98
1	26	636	2801	57.7	40	17.68
1	26	637	2801	53.2	41	12.22
1	26	638	0	66.6	60	6.63
2	26	639	2207	60.5	60	0.5
2	26	640	912	53.9	23	30.94
2	26	641	1369	57.1	23	34.12
2	26	642	1293	52.8	16	36.79
2	26	643	1273	52.3	35	17.33
2	26	644	2297	54.6	37	17.65
2	26	645	1284	67.2	30	37.22
1	26	646	2801	23	49	-26.01
2	26	2601	0	72.7	27	45.67
1	26	2602	0	88.3	46	42.3

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	Gradient (1/1000)
2	23	154	2	23	520	250	900	110	2990	0.7	2.98
2	23	154	2	23	309	375	900	110	30556	3.2	30.64
2	23	155	2	23	2305	525	1	110	-17159	-0.92	2
2	23	155	2	23	301	150	1120	110	1163	0.76	6.25
2	23	154	2	23	155	500	180	110	-33546	-1.98	8.97
1	11	21	1	11	178	250	130	110	22747	5.36	127.82
1	11	21	1	11	140	375	440	110	22973	2.41	18.07
1	12	22	1	12	9266	300	420	110	12188	2	16.56
1	12	22	1	12	9267	375	240	110	26563	2.78	23.64
1	13	23	1	13	8201	300	40	110	13288	2.18	19.45
1	13	23	1	13	8202	300	2	110	26343	4.31	69
1	14	24	1	14	124	300	40	110	31153	5.1	94.15
1	15	25	1	15	7204	200	20	110	11076	4.08	99.95
2	23	31	2	23	155	375	250	110	17550	1.84	10.97
2	23	31	2	23	2305	500	250	110	37384	2.2	10.96
1	24	32	1	24	318	600	300	110	40275	1.65	5.18
2	25	41	2	25	515	600	400	110	56730	2.32	9.77
1	26	42	1	26	2602	800	430	110	74177	1.71	3.95
1	11	140	1	11	141	375	105	110	4296	0.45	0.81
1	11	140	1	11	9207	360	80	110	18676	2.12	15.03
1	11	141	1	11	9220	250	1390	110	4296	1.01	5.84
1	11	175	1	11	176	250	200	110	-5901	-1.39	10.5
1	11	176	1	11	177	250	450	110	-11802	-2.78	37.92
1	11	177	1	11	178	325	570	110	-21766	-3.04	32.82
1	11	178	1	11	9208	250	750	110	982	0.23	0.38
1	11	9201	1	11	9204	300	800	110	-8627	-1.41	8.73
1	11	9201	1	11	9202	250	500	110	-4157	-0.98	5.49
1	11	9201	1	11	9230	250	400	110	11802	2.78	37.92
1	11	9202	1	11	9203	250	200	110	-5139	-1.21	8.14
1	11	9204	1	11	9205	300	650	110	-9955	-1.63	11.39
1	11	9203	1	11	9204	100	550	110	-346	-0.51	4.76
1	11	9205	1	11	9206	150	300	110	-618	-0.4	1.94
1	11	9203	1	11	9206	250	1050	110	-5775	-1.36	10.09
1	11	9206	1	11	9207	250	500	110	-7375	-1.74	15.87
1	11	9205	1	11	9207	300	700	110	-10320	-1.69	12.17
1	11	9208	1	11	9220	250	1370	110	-1199	-0.28	0.55
1	11	9208	1	11	9209	100	220	110	542	0.8	10.96
1	11	9208	1	11	9228	250	400	110	1639	0.39	0.98
1	11	9209	1	11	9210	100	350	110	116	0.17	0.63
1	11	9209	1	11	9216	100	670	110	-57	-0.08	0.17
1	11	9210	1	11	9211	150	290	110	1013	0.66	4.84
1	11	9211	1	11	9212	100	400	110	271	0.4	3.04
1	11	9212	1	11	9213	100	280	110	-213	-0.31	1.94
1	11	9214	1	11	9215	100	300	110	-171	-0.25	1.29
1	11	9213	1	11	9214	100	100	110	-207	-0.3	1.84
1	11	9211	1	11	9215	150	270	110	258	0.17	0.38
1	11	9216	1	11	9217	100	250	110	-214	-0.32	1.96
1	11	9215	1	11	9216	100	300	110	-397	-0.58	6.14
1	11	9216	1	11	9218	100	100	110	-317	-0.47	4.06
1	11	9219	1	11	9225	150	220	110	459	0.3	1.12
1	11	9218	1	11	9219	100	230	110	-394	-0.58	6.07

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	11	9217	1	11	9219	100	380	110	-291	-0.43	3.46
1	11	9220	1	11	9221	200	100	110	1082	0.4	1.34
1	11	9214	1	11	9220	100	520	110	-520	-0.77	10.15
1	11	9219	1	11	9220	150	150	110	-1358	-0.89	8.32
1	11	9213	1	11	9222	100	150	110	-6	-0.01	0
1	11	9221	1	11	9223	200	320	110	945	0.35	1.05
1	11	9222	1	11	9223	100	550	110	-490	-0.72	9.08
1	11	9223	1	11	9224	100	320	110	318	0.47	4.08
1	11	9224	1	11	9225	100	450	110	-115	-0.17	0.62
1	11	9225	1	11	9226	150	480	110	344	0.23	0.66
1	11	9226	1	11	9227	150	400	110	85	0.06	0.05
1	11	9224	1	11	9227	150	300	110	174	0.11	0.19
1	11	9210	1	11	9228	150	190	110	-1639	-1.07	11.79
1	11	9230	1	11	9231	168	600	110	5901	3.08	72.81
1	12	9251	1	12	9252	100	230	110	643	0.95	15.02
1	12	9252	1	12	9253	100	400	110	-127	-0.19	0.75
1	12	9253	1	12	9254	150	260	110	-948	-0.62	4.28
1	12	9254	1	12	9255	150	110	110	-2149	-1.41	19.48
1	12	9255	1	12	9277	100	500	110	-281	-0.41	3.25
1	12	9255	1	12	9256	150	60	110	-1868	-1.22	15.02
1	12	9251	1	12	9256	250	600	110	-2184	-0.51	1.67
1	12	9256	1	12	9257	250	40	110	-4052	-0.96	5.22
1	12	9258	1	12	9277	375	500	110	-4024	-0.42	0.72
1	12	9276	1	12	9277	387	140	110	5207	0.51	0.99
1	12	9275	1	12	9276	387	400	110	7433	0.73	1.92
1	12	9266	1	12	9275	375	800	110	9786	1.03	3.72
1	12	9257	1	12	9258	250	30	110	-4024	-0.95	5.17
1	12	9259	1	12	9260	150	280	110	-327	-0.21	0.59
1	12	9253	1	12	9259	150	430	110	384	0.25	0.8
1	12	9254	1	12	9260	150	450	110	764	0.5	2.87
1	12	9259	1	12	9261	150	420	110	124	0.08	0.1
1	12	9261	1	12	9262	200	300	110	-545	-0.2	0.38
1	12	9262	1	12	9263	200	310	110	-1214	-0.45	1.66
1	12	9263	1	12	9264	200	200	110	-1883	-0.69	3.76
1	12	9264	1	12	9298	150	4800	110	2225	1.46	20.77
1	12	9287	1	12	9265	150	450	110	-1549	-1.01	10.63
1	12	9264	1	12	9265	200	90	110	-8496	-3.13	61.17
1	12	9265	1	12	9268	200	330	110	3719	1.37	13.25
1	12	9265	1	12	9271	200	950	110	2833	1.04	8
1	12	9267	1	12	9271	300	720	110	11751	1.92	15.48
1	12	9265	1	12	9266	200	10	110	-17213	-6.34	226.2
1	12	9266	1	12	9267	375	160	110	-14811	-1.55	8.01
1	12	9268	1	12	9269	150	190	110	1048	0.69	5.15
1	12	9268	1	12	9271	200	450	110	2671	0.98	7.18
1	12	9269	1	12	9270	100	210	110	556	0.82	11.49
1	12	9269	1	12	9274	150	280	110	-125	-0.08	0.1
1	12	9270	1	12	9273	150	280	110	100	0.07	0.07
1	12	9271	1	12	9272	200	260	110	2441	0.9	6.08
1	12	9270	1	12	9271	100	140	110	-160	-0.24	1.14
1	12	9271	1	12	9296	318	1040	110	15988	2.33	20.61
1	12	9272	1	12	9273	150	250	110	-1097	-0.72	5.6

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	12	9274	1	12	9275	150	200	110	-2353	-1.54	23.04
1	12	9273	1	12	9274	150	215	110	-1612	-1.06	11.44
1	12	9277	1	12	9278	150	450	110	464	0.3	1.14
1	12	9278	1	12	9279	150	120	110	27	0.02	0
1	12	9257	1	12	9279	250	420	110	-27	-0.01	0
1	12	9287	1	12	9271	150	350	110	1334	0.87	8.06
1	12	9296	1	12	9297	200	4000	110	1937	0.71	3.96
1	12	9295	1	12	9296	318	260	110	-9194	-1.34	7.4
1	13	8201	1	13	8202	300	30	110	-13967	-2.29	21.33
1	13	8202	1	13	8206	300	850	110	12377	2.03	17.04
1	13	8201	1	13	8203	300	15	110	27256	4.46	73.47
1	13	8203	1	13	8222	300	30	110	27256	4.46	73.53
1	13	8204	1	13	8205	360	60	110	20147	2.29	17.28
1	13	8205	1	13	8207	250	405	110	1183	0.28	0.54
1	13	8205	1	13	8209	318	670	110	17776	2.59	25.09
1	13	8206	1	13	8207	200	2	110	12377	4.56	122.5
1	13	8207	1	13	8208	250	25	110	12503	2.95	42.2
1	13	8208	1	13	8209	200	880	110	4343	1.6	17.65
1	13	8208	1	13	8223	250	470	110	8160	1.92	19.15
1	13	8209	1	13	8210	232	960	110	11001	3.01	47.91
1	13	8209	1	13	8213	195	310	110	9402	3.64	83.48
1	13	8209	1	13	8223	100	750	110	-479	-0.71	8.71
1	13	8212	1	13	8213	195	500	110	-5961	-2.31	35.9
1	13	8214	1	13	8216	200	550	110	-410	-0.15	0.22
1	13	8215	1	13	8216	100	200	110	-110	-0.16	0.56
1	13	8216	1	13	8217	200	150	110	-1340	-0.49	2
1	13	8217	1	13	8218	200	180	110	-2385	-0.88	5.82
1	13	8218	1	13	8219	200	100	110	-3827	-1.41	13.97
1	13	8219	1	13	8220	200	90	110	-4274	-1.57	17.13
1	13	8220	1	13	8221	200	240	110	-5319	-1.96	25.7
1	13	8204	1	13	8221	360	250	110	-21776	-2.48	19.96
1	13	8221	1	13	8222	360	150	110	-27256	-3.1	30.25
1	13	8223	1	13	8224	250	640	110	3845	0.91	4.75
1	13	8226	1	13	8227	100	410	110	-32	-0.05	0.06
1	13	8226	1	13	8229	150	540	110	-382	-0.25	0.79
1	13	8219	1	13	8227	100	370	110	446	0.66	7.64
1	13	8222	1	13	8228	250	430	110	0	0	0
1	13	8218	1	13	8229	150	110	110	1442	0.94	9.31
1	13	8229	1	13	8231	100	120	110	647	0.95	15.17
1	13	8230	1	13	8231	100	165	110	-238	-0.35	2.39
1	13	8231	1	13	8232	100	200	110	-6	-0.01	0
1	13	8230	1	13	8232	100	290	110	-176	-0.26	1.36
1	13	8216	1	13	8232	100	115	110	595	0.88	13.03
1	14	124	1	14	8256	300	590	110	8491	1.39	8.48
1	14	124	1	14	8265	375	920	110	15886	1.66	9.13
1	14	124	1	14	8254	300	840	110	6776	1.11	5.59
1	14	8251	1	14	8252	100	120	110	0	0	0
1	14	8252	1	14	8253	100	550	110	0	0	0
1	14	8253	1	14	8254	200	250	110	-4922	-1.81	22.26
1	14	8255	1	14	8262	250	1200	110	-519	-0.12	0.12
1	14	8254	1	14	8255	100	600	110	538	0.79	10.81

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	14	8256	1	14	8265	300	400	110	8491	1.39	8.48
1	14	8259	1	14	8260	100	700	110	404	0.59	6.34
1	14	8260	1	14	8261	100	700	110	-448	-0.66	7.7
1	14	8259	1	14	8261	100	150	110	-404	-0.59	6.34
1	14	8261	1	14	8262	200	480	110	519	0.19	0.34
1	14	8263	1	14	8264	100	150	110	0	0	0
1	14	8261	1	14	8263	200	200	110	-1797	-0.66	3.44
1	14	8263	1	14	8265	200	350	110	-2223	-0.82	5.11
1	14	8265	1	14	8266	401	450	110	21302	1.95	11.33
1	14	8266	1	14	8267	296	400	110	15935	2.68	29.05
1	14	8267	1	14	8268	296	480	110	13060	2.2	20.1
1	14	8268	1	14	8269	296	240	110	13060	2.2	20.09
1	14	8269	1	14	8270	296	500	110	5026	0.85	3.43
1	14	8270	1	14	8271	150	240	110	5026	3.29	93.93
1	15	7202	1	15	7213	150	500	110	2705	1.77	29.82
1	15	7202	1	15	7203	250	500	110	-3557	-0.84	4.11
1	15	7204	1	15	7205	250	120	110	7519	1.77	16.46
1	15	7203	1	15	7204	250	1	110	-3557	-0.84	4
1	15	7205	1	15	7206	100	20	110	1725	2.54	93.4
1	15	7205	1	15	7210	250	180	110	5795	1.37	10.16
1	15	7206	1	15	7207	150	780	110	873	0.57	3.67
1	15	7208	1	15	7209	200	800	110	-831	-0.31	0.83
1	15	7207	1	15	7208	150	108	110	21	0.01	0
1	15	7209	1	15	7210	200	100	110	-4943	-1.82	22.43
1	15	7209	1	15	7211	150	260	110	3259	2.13	42.12
1	15	7211	1	15	7217	150	250	110	1535	1.01	10.45
1	15	7212	1	15	7216	100	350	110	405	0.6	6.39
1	15	7211	1	15	7212	150	230	110	872	0.57	3.67
1	15	7212	1	15	7213	100	150	110	-385	-0.57	5.81
1	15	7213	1	15	7214	150	330	110	1468	0.96	9.61
1	15	7214	1	15	7216	150	200	110	-236	-0.15	0.33
1	15	7214	1	15	7215	100	200	110	852	1.26	25.29
1	15	7216	1	15	7217	150	200	110	-683	-0.45	2.33
1	15	7201	1	15	7202	250	410	110	0	0	0
2	23	301	2	23	302	150	1220	110	698	0.46	2.43
2	23	302	2	23	303	318	320	110	5429	0.79	2.79
2	23	303	2	23	304	195	1900	110	5429	2.1	30.19
2	23	304	2	23	305	195	1040	110	5429	2.1	30.19
2	23	305	1	23	306	195	680	110	4355	1.69	20.07
1	23	306	1	23	307	150	830	110	0	0	0
2	23	309	2	23	310	500	700	110	22712	1.34	4.36
2	23	310	2	23	311	500	100	110	21944	1.29	4.09
2	23	311	2	23	314	500	850	110	18803	1.11	3.07
2	23	311	2	23	312	195	980	110	1047	0.41	1.43
2	23	313	2	23	315	200	750	110	2396	0.88	5.87
2	23	314	2	23	316	200	750	110	2812	1.04	7.9
2	23	313	2	23	314	200	100	110	-6149	-2.27	33.61
2	23	315	2	23	316	150	35	110	-3675	-2.41	52.6
2	23	313	1	23	317	150	1100	110	-491	-0.32	1.26
2	23	316	1	23	317	150	1100	110	-863	-0.56	3.59
1	23	317	1	23	318	375	10	110	-5598	-0.59	1.3

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	23	2301	2	23	2302	300	600	110	11770	1.93	15.53
2	23	2302	2	23	2303	300	800	110	10077	1.65	11.65
2	23	2303	2	23	2304	300	900	110	5807	0.95	4.2
2	23	2301	2	23	2305	450	1100	110	-20225	-1.47	5.87
2	23	301	2	23	2301	150	10	110	-3724	-2.44	54
2	23	302	2	23	2301	300	1220	110	-4731	-0.77	2.87
2	23	314	1	23	318	375	1480	110	5598	0.59	1.32
1	24	318	1	24	401	612	300	110	40275	1.58	4.7
1	24	401	1	24	402	612	170	110	40275	1.58	4.7
1	24	402	1	24	403	606	430	110	38865	1.56	4.62
1	24	403	1	24	404	150	494	110	1202	0.79	6.64
1	24	403	1	24	406	600	760	110	36253	1.48	4.26
1	24	404	1	24	406	183	440	110	-208	-0.09	0.1
1	24	406	1	24	407	606	290	110	33225	1.33	3.46
1	24	405	1	24	406	150	580	110	-1410	-0.92	8.93
1	24	407	1	24	409	444	640	110	21701	1.62	7.14
1	24	407	1	24	408	250	720	110	8498	2	20.64
1	24	409	1	24	410	441	120	110	21701	1.64	7.38
1	24	410	1	24	411	441	570	110	17949	1.36	5.19
1	24	412	1	24	418	150	720	110	1305	0.85	7.73
1	24	413	1	24	414	150	100	110	-4532	-2.97	77.54
1	24	412	1	24	414	150	100	110	-4246	-2.78	68.72
1	24	411	1	24	414	441	250	110	15259	1.16	3.85
1	24	415	1	24	416	150	160	110	-4291	-2.81	70.1
1	24	413	1	24	415	150	340	110	1591	1.04	11.16
1	24	416	1	24	418	150	600	110	2190	1.43	20.18
1	24	414	1	24	416	441	420	110	6482	0.49	0.79
1	24	415	1	24	417	150	700	110	2941	1.93	34.82
2	25	502	2	25	503	150	350	110	-884	-0.58	3.76
2	25	501	2	25	502	150	1200	110	-762	-0.5	2.85
2	25	501	2	25	503	150	800	110	-1130	-0.74	5.93
2	25	503	2	25	504	150	190	110	-2015	-1.32	17.28
2	25	505	2	25	506	150	370	110	-1126	-0.74	5.89
2	25	502	2	25	506	200	300	110	-3554	-1.31	12.18
2	25	507	2	25	508	200	200	110	-7817	-2.88	52.42
2	25	506	2	25	507	200	120	110	-4681	-1.72	20.28
2	25	508	2	25	509	400	300	110	-23428	-2.16	13.68
2	25	504	2	25	508	150	300	110	-3166	-2.07	39.91
2	25	508	2	25	2501	300	300	110	11295	1.85	14.38
2	25	509	2	25	510	411	750	110	-26022	-2.27	14.56
2	25	510	2	25	517	250	1400	110	7070	1.67	14.68
2	25	507	2	25	511	200	750	110	1385	0.51	2.13
2	25	505	2	25	512	150	1200	110	-625	-0.41	1.98
2	25	511	2	25	512	200	600	110	958	0.35	1.07
2	25	510	2	25	513	150	550	110	3368	2.21	44.76
2	25	511	2	25	513	150	250	110	-1496	-0.98	9.96
2	25	510	2	25	514	150	520	110	2879	1.89	33.48
2	25	514	2	25	515	150	350	110	-4056	-2.66	63.16
2	25	510	2	25	515	600	880	110	-40920	-1.68	5.33
2	25	512	2	25	516	200	1150	110	-1590	-0.59	2.75
2	25	513	2	25	516	150	1270	110	-51	-0.03	0.02

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	25	517	2	25	518	200	500	110	3507	1.29	11.88
2	25	516	2	25	517	200	330	110	-3564	-1.31	12.24
2	25	518	2	25	519	200	800	110	-656	-0.24	0.53
2	25	514	2	25	518	150	1050	110	1387	0.91	8.65
2	25	515	2	25	519	200	900	110	6205	2.29	34.18
2	25	2501	2	25	2502	300	440	110	11295	1.85	14.39
2	25	501	2	25	2502	150	500	110	-2103	-1.38	18.71
2	26	601	2	26	602	250	1330	110	-4467	-1.05	6.27
2	26	602	2	26	603	250	240	110	-5610	-1.32	9.57
2	26	603	2	26	607	250	600	110	-5974	-1.41	10.74
2	26	603	2	26	604	150	1000	110	-1351	-0.89	8.25
2	26	604	2	26	606	300	600	110	-7387	-1.21	6.55
2	26	604	2	26	605	150	900	110	855	0.56	3.53
2	26	606	2	26	607	350	1100	110	9792	1.18	5.21
2	26	607	2	26	608	250	220	110	1331	0.31	0.66
2	26	608	2	26	609	250	720	110	1331	0.31	0.67
1	26	610	1	26	611	200	550	110	-1414	-0.52	2.21
2	26	609	1	26	610	250	830	110	1331	0.31	0.67
1	26	611	1	26	616	200	840	110	-4726	-1.74	20.65
1	26	611	1	26	613	194	800	110	-1538	-0.6	2.99
1	26	612	1	26	638	250	480	110	2105	0.5	1.56
1	26	612	1	26	631	411	230	110	19608	1.71	8.63
1	26	612	1	26	613	484	580	110	-21712	-1.37	4.7
1	26	613	1	26	614	484	400	110	-24045	-1.51	5.68
1	26	614	1	26	619	450	400	110	-26015	-1.89	9.36
1	26	616	1	26	619	450	880	110	27181	1.98	10.15
1	26	614	1	26	615	250	500	110	283	0.07	0.04
1	26	615	1	26	623	150	270	110	283	0.19	0.46
1	26	616	2	26	639	150	1200	110	2207	1.45	20.46
1	26	616	1	26	2602	800	1000	110	-66720	-1.54	3.25
2	26	606	1	26	616	500	1800	110	-28117	-1.66	6.47
1	26	616	1	26	617	150	450	110	1952	1.28	16.3
1	26	617	1	26	618	100	150	110	146	0.21	0.96
1	26	616	1	26	618	150	630	110	1645	1.08	11.87
1	26	617	1	26	619	150	400	110	913	0.6	3.99
1	26	618	1	26	620	100	200	110	898	1.32	27.85
1	26	621	1	26	622	150	450	110	473	0.31	1.18
1	26	620	1	26	622	100	250	110	5	0.01	0
1	26	619	1	26	623	150	600	110	1186	0.78	6.48
1	26	622	1	26	623	150	250	110	-415	-0.27	0.93
1	26	621	1	26	624	200	350	110	-1366	-0.5	2.07
1	26	624	1	26	625	150	220	110	1026	0.67	4.95
1	26	623	1	26	625	150	400	110	161	0.11	0.16
1	26	624	1	26	626	200	220	110	-3285	-1.21	10.53
1	26	626	1	26	627	200	350	110	-4802	-1.77	21.27
1	26	627	1	26	2602	200	110	110	-7456	-2.75	48.04
1	26	627	1	26	628	150	370	110	1761	1.15	13.47
1	26	629	1	26	630	150	250	110	-25	-0.02	0.01
1	26	628	1	26	629	100	230	110	868	1.28	26.18
1	26	625	1	26	630	150	320	110	293	0.19	0.48
1	26	626	1	26	630	100	250	110	625	0.92	14.24

TABLE 13-2 FLOW RATE AND HYDRAULIC GRADIENT
(MASTER PLAN ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	26	631	1	26	632	411	550	110	19608	1.71	8.62
1	26	632	1	26	633	150	1050	110	1564	1.02	10.82
1	26	633	1	26	634	150	700	110	-1237	-0.81	7
1	26	634	1	26	635	273	400	110	-4680	-0.93	4.45
1	26	632	1	26	636	411	550	110	15242	1.33	5.41
1	26	636	1	26	646	150	1090	110	2801	1.83	31.82
1	26	634	1	26	637	150	470	110	642	0.42	2.08
1	26	635	1	26	637	200	570	110	2159	0.8	4.84
1	26	610	1	26	638	250	90	110	-2105	-0.5	1.56
2	26	640	2	26	641	150	800	110	-912	-0.6	3.98
2	26	641	2	26	645	168	400	110	-3330	-1.74	25.24
2	26	641	2	26	642	150	840	110	1048	0.69	5.16
2	26	642	2	26	644	150	950	110	-621	-0.41	1.95
2	26	642	2	26	643	150	600	110	376	0.25	0.77
2	26	643	2	26	644	150	600	110	-897	-0.59	3.86
2	26	644	2	26	645	195	800	110	-3815	-1.48	15.71
2	26	605	2	26	645	100	420	110	-228	-0.34	2.2
2	26	645	2	26	2601	300	620	110	-8657	-1.42	8.79
2	26	606	2	26	2601	400	340	110	8657	0.8	2.16
1	26	635	1	26	636	273	100	110	-9640	-1.91	16.98

TABLE 14-1 PRESSURE DATA
(FEASIBILITY ; TRANSMISSION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	9	901	0	141.7	40	101.7
1	9	902	0	140.1	39	101.1
1	9	903	0	139.5	37	102.5
1	9	904	0	137.9	45	92.86
1	9	905	0	136.8	50	86.77
1	9	906	0	135.5	65	70.47
1	9	907	0	134.7	75	59.65
1	9	908	0	134.4	72	62.44
1	9	909	0	133.6	75	58.57
1	9	910	0	132.6	75	57.59
1	9	911	0	131.4	85	46.4
1	9	912	0	131	60	70.98
1	9	913	0	130.7	34	96.72
1	9	914	0	130.6	30	100.6
1	9	915	0	130.3	50	80.3
2	1	1	0	149.6	149.6	0
1	1	21	30587	138	132.3	5.69
1	1	22	20026	124.2	115.9	8.32
1	1	23	22785	131.4	120.7	10.68
1	1	24	18026	129.8	109.8	20
1	1	25	6018	127.9	105.8	22.05
2	1	31	21204	139.5	132	7.51
1	1	32	21359	135.3	123.1	12.18
2	1	40	27226	105	105	0
2	1	41	23105	99.9	88	11.85
1	1	42	42124	102	98	3.96
2	1	43	5482	0	93	-93
2	2	111	0	149.6	152	-2.44
2	2	112	0	149.5	152	-2.47
2	2	113	0	145.4	44	101.4
2	2	114	0	145.4	42	103.4
2	2	115	0	143.9	33	110.9
1	2	116	0	141.7	39	102.7
1	2	117	0	139.7	38	101.7
1	2	118	0	137.9	76	61.86
1	2	119	0	137.3	66	71.33
1	2	120	0	133	58	75.01
1	2	121	0	131.4	90	41.43
1	2	122	0	130.7	9	121.8
1	2	123	0	130.2	116	14.19
1	2	124	0	129.9	92	37.92
1	2	125	0	129.5	61	68.53
1	2	126	0	129.4	95	34.41
1	2	127	0	129	1	128
1	2	128	0	128.7	1.5	127.2
1	2	129	0	133.7	47	86.74
2	2	131	0	149.5	152	-2.45
2	2	132	0	145.7	42	103.7
2	2	135	0	145.4	42	103.4
1	2	136	0	139.8	41	98.8
1	2	137	0	139.6	41	98.64
1	2	138	0	137.9	90	47.86
1	2	139	0	137.3	66	71.33
1	2	140	0	136.9	58	78.89
1	2	141	0	136.7	58	78.66
1	2	142	0	132.4	61	71.35
1	2	143	0	131.4	79	52.44
2	2	146	0	143.9	33	110.9
2	2	151	0	144.2	35	109.2
2	2	152	0	141	20	121
2	2	153	0	139.8	40	99.83
2	2	154	0	139.7	50	89.69
2	2	156	0	143.9	44	99.93
2	2	161	0	145.4	38	107.4
2	2	2101	0	104.8	60	44.76
2	2	2102	0	104.4	31	73.45
1	2	2103	0	103.1	40	63.13
2	2	2104	0	101.9	30	71.95
2	2	2105	0	101.5	27	74.5
2	2	2106	0	101.2	44	57.19
2	2	2107	0	100.7	49	51.74
2	2	2151	0	143.9	44	99.93
2	2	2152	0	142.8	31	111.8
1	2	2153	0	141.7	40	101.7
2	2	2154	0	140.9	30	110.9
2	2	2155	0	140.6	37	103.7
2	2	2156	0	140.3	35	105.3
2	2	2157	0	140.1	45	95.08
2	2	2158	0	139.7	50	89.68
2	2	2160	0	139.7	45	94.73
2	2	2161	0	137.8	58	79.78
1	2	2162	0	135.9	83	52.86
1	2	2163	0	135.5	100	35.51

TABLE 14-2 FLOW RATE AND HYDRAULIC GRADIENT

(FEASIBILITY STUDY ; TRANSMISSION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficier	Flow Rate	Velosity	Hydraulic
Map No.	System No.	Node No.	Map No.	System No.	No.						Gradient
						(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	1	1	2	2	111	1092	20	110	120692	1.49	2.15
2	1	1	2	2	131	525	20	110	19314	1.03	2.55
1	1	21	1	2	138	450	90	110	9221	0.67	1.38
1	1	24	1	2	124	300	40	110	-4812	-0.79	2.98
1	1	24	1	2	123	300	20	110	-13214	-2.16	19.25
2	2	111	2	2	161	1000	2010	110	93606	1.38	2.05
2	2	111	2	2	112	600	10	110	27084	1.11	2.5
2	2	112	2	2	113	600	1650	110	27084	1.11	2.48
2	2	113	2	2	151	600	1500	110	14648	0.6	0.8
2	2	113	2	2	114	600	32	110	14259	0.58	0.75
2	2	114	2	2	115	600	1950	110	14259	0.58	0.76
2	2	115	2	2	156	600	10	110	-6619	-0.27	0.2
2	2	115	1	2	116	600	3840	110	12416	0.51	0.59
1	2	116	1	2	117	600	1480	110	19301	0.79	1.33
1	9	901	1	2	116	600	10	110	-7130	-0.29	0.3
1	2	117	1	2	118	600	1400	110	19301	0.79	1.33
1	1	21	1	2	118	600	250	110	11410	0.47	0.5
1	2	118	1	2	119	600	170	110	30712	1.26	3.14
1	2	119	1	2	129	600	880	110	35389	1.45	4.08
1	2	119	1	2	139	600	50	110	-4678	-0.19	0.1
1	2	120	1	2	121	525	950	110	15363	0.82	1.67
1	1	23	1	2	121	600	80	110	-13307	-0.54	0.66
1	2	121	1	2	143	450	10	110	-9945	-0.72	1.6
1	2	121	1	2	122	600	1240	110	12000	0.49	0.55
1	2	122	1	2	123	600	1020	110	12000	0.49	0.55
1	2	123	1	2	124	300	20	110	10830	1.77	13.3
1	2	124	1	2	125	450	620	110	6018	0.44	0.62
1	2	125	1	2	126	450	200	110	6018	0.44	0.63
1	2	126	1	2	127	450	700	110	6018	0.44	0.62
1	2	127	1	2	128	450	420	110	6018	0.44	0.62
1	1	25	1	2	128	375	570	110	-6018	-0.63	1.51
1	2	120	1	2	129	600	840	110	-15363	-0.63	0.87
2	2	131	2	2	132	525	1530	110	19314	1.03	2.55
2	2	132	2	2	135	450	40	110	19314	1.41	5.37
2	2	135	2	2	146	450	2040	110	6603	0.48	0.74
2	2	135	2	2	161	600	10	110	12711	0.52	0.7
1	2	136	1	2	137	450	180	110	7389	0.54	0.91
1	2	137	1	2	138	450	1950	110	7389	0.54	0.91
1	2	138	1	2	139	450	130	110	16609	1.21	4.08
1	2	139	1	2	140	450	200	110	11931	0.87	2.21
1	2	140	1	2	141	450	105	110	11931	0.87	2.21
1	2	141	1	2	142	450	1950	110	11931	0.87	2.21
1	2	142	1	2	143	450	410	110	11931	0.87	2.21
1	1	23	1	2	143	300	120	110	-1987	-0.33	0.58
2	2	115	2	2	146	450	10	110	786	0.06	0
1	2	136	2	2	146	450	4540	110	-7389	-0.54	0.91
2	2	151	2	2	156	525	200	110	14648	0.78	1.53
2	2	152	2	2	153	525	2400	110	8029	0.43	0.5
2	2	153	2	2	154	525	270	110	8029	0.43	0.5
2	2	152	2	2	156	525	5800	110	-8029	-0.43	0.5
2	2	113	2	2	161	600	1	110	-1823	-0.07	0
2	2	115	2	2	161	1200	1450	110	-104492	-1.07	1.03

TABLE 14-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY STUDY ; TRANSMISSION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficien	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	Node No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	9	901	2	2	115	600	3850	110	-12404	-0.51	0.59
1	9	901	1	9	902	600	1180	110	19535	0.8	1.36
1	9	902	1	9	903	600	400	110	19535	0.8	1.36
1	9	903	1	9	904	600	1240	110	19535	0.8	1.36
1	9	904	1	9	905	600	800	110	19535	0.8	1.36
1	9	905	1	9	906	600	960	110	19535	0.8	1.36
1	9	906	1	9	907	600	600	110	19535	0.8	1.36
1	9	907	1	9	908	600	160	110	19535	0.8	1.36
1	9	908	1	9	909	600	640	110	19535	0.8	1.36
1	9	909	1	9	910	600	720	110	19535	0.8	1.36
1	9	910	1	9	911	600	880	110	19535	0.8	1.36
1	9	911	1	1	23	600	100	110	7491	0.31	0.23
1	9	911	1	9	912	600	750	110	12044	0.49	0.55
1	9	912	1	9	913	600	480	110	12044	0.49	0.55
1	9	913	1	9	914	600	280	110	12044	0.49	0.56
1	9	914	1	9	915	600	480	110	12044	0.49	0.55
1	9	915	1	2	123	600	200	110	12044	0.49	0.55
2	1	40	2	2	2101	1200	560	110	65229	0.67	0.43
2	2	2101	2	2	2102	1200	720	110	65229	0.67	0.43
2	2	2102	1	2	2103	1100	2000	110	65229	0.79	0.66
1	2	2103	2	2	2104	800	2580	110	23105	0.53	0.46
1	1	42	1	2	2103	700	440	110	-42124	-1.27	2.66
2	2	2104	2	2	2105	800	980	110	23105	0.53	0.46
2	2	2105	2	2	2106	800	680	110	23105	0.53	0.46
2	2	2106	2	2	2107	800	1000	110	23105	0.53	0.46
2	1	41	2	2	2107	800	1940	110	-23105	-0.53	0.46
2	2	2151	2	2	2152	1350	2180	110	99766	0.81	0.54
2	2	2152	1	2	2153	1350	2000	110	99766	0.81	0.53
1	1	21	1	2	2153	900	3300	110	-51218	-0.93	1.12
1	2	2153	2	2	2154	1000	2580	110	34534	0.51	0.32
1	2	116	1	2	2153	600	10	110	-14016	-0.57	0.7
2	2	2154	2	2	2155	1000	640	110	34534	0.51	0.32
2	2	2155	2	2	2156	1000	1000	110	34534	0.51	0.32
2	2	2156	2	2	2157	1000	740	110	34534	0.51	0.32
2	2	2157	2	2	2158	800	2500	110	13175	0.3	0.16
2	1	31	2	2	2158	900	440	110	-21204	-0.49	0.39
2	2	2157	2	2	2160	600	220	110	21359	0.87	1.6
2	2	2160	2	2	2161	600	1220	110	21359	0.87	1.6
2	2	2161	1	2	2162	600	1200	110	21359	0.87	1.6
1	2	2162	1	2	2163	600	220	110	21359	0.87	1.6
1	1	32	1	2	2163	600	140	110	-21359	-0.87	1.6
2	2	115	2	2	2151	1350	10	110	99766	0.81	0.6
2	2	154	2	2	2158	525	20	110	8029	0.43	0.5
1	1	22	1	2	129	500	2760	110	-20026	-1.18	3.45

TABLE 15-1 PRESSURE DATA
(FEASIBILITY STUDY ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	11	21	0	123.5	123.5	0
1	12	22	0	107.9	107.9	0
1	13	23	0	112.8	112.8	0
1	14	24	0	101.8	101.8	0
1	15	25	0	101.2	101.2	0
2	23	31	0	124.1	124.1	0
1	24	32	0	115.2	115.2	0
2	25	41	1276	80	80	0
1	26	42	0	90	90	0
1	14	124	0	100.1	92	8.14
1	11	140	0	115.4	58	57.37
1	11	141	0	115.3	58	57.25
2	23	154	0	122.5	50	72.52
2	23	155	0	123.2	60	63.21
1	15	7201	0	95.2	1	94.2
1	15	7202	680	95.7	1.5	94.21
1	15	7203	0	99.1	104	-4.91
1	15	7204	0	99.1	104	-4.91
1	15	7205	0	97.5	85	12.48
1	15	7206	680	95.9	85	10.93
1	15	7207	680	93.1	60	33.05
1	15	7208	680	92.8	3	89.84
1	15	7209	680	94.1	43	51.09
1	15	7210	680	96	46	49.98
1	15	7211	680	86.6	46	40.56
1	15	7212	680	85.9	31	54.94
1	15	7213	680	86.4	3.1	83.3
1	15	7214	680	84.4	3.7	80.69
1	15	7215	680	81.1	3.7	77.36
1	15	7216	680	84.4	17	67.45
1	15	7217	680	84.8	1.5	83.28
1	13	8201	0	112.1	100	12.09
1	13	8202	0	112.7	113	-0.32
1	13	8203	0	111.1	95	16.08
1	13	8204	1500	102.9	76	26.93
1	13	8205	1039	102.3	76	26.31
1	13	8206	0	101.4	34	67.39
1	13	8207	846	101.3	34	67.31
1	13	8208	0	100.8	31	69.81
1	13	8209	1836	94.8	54	40.77
1	13	8210	5898	80.3	20	60.27
1	13	8212	4969	74	10	64.02
1	13	8213	2972	81.3	25	56.25
1	13	8214	314	97.5	82	15.52
1	13	8215	110	98	130	-31.95
1	13	8216	188	98.2	81	17.16
1	13	8217	964	98.7	81	17.66
1	13	8218	0	100	79	21
1	13	8219	0	101	84	16.98
1	13	8220	964	102	88	13.95
1	13	8221	161	106.1	79	27.11
1	13	8222	0	109	79	30.05
1	13	8223	3189	96.3	8	88.27
1	13	8224	3586	94.5	3	91.54
1	13	8226	414	101.4	63	38.42
1	13	8227	414	100.5	96	4.46
1	13	8228	0	106.3	70	36.29
1	12	9287	215	99.3	85	14.26
1	13	8229	414	99.9	73	26.89
1	13	8230	414	96.9	76	20.89
1	13	8231	414	97.3	72	25.33
1	13	8232	414	97.2	76	21.22
1	14	8251	0	101.3	55	46.25
1	14	8252	0	100.8	55	45.78
1	14	8253	4451	96	34	61.95
1	14	8254	1105	99.7	30	69.69
1	14	8255	846	94.6	3.1	91.48
1	14	8256	0	97.2	61	36.25
1	14	8259	0	94.2	85	9.21
1	14	8260	680	91.3	98	-6.72
1	14	8261	340	94.8	64	30.83
1	14	8262	0	95.2	1	94.16
1	14	8263	340	94.9	52	42.85
1	14	8264	0	93.8	52	41.82
1	14	8265	680	95.3	23	72.29
1	14	8266	4233	92.1	1.5	90.64
1	14	8267	2069	83.8	10	73.84
1	14	8268	0	76.6	5	71.55
1	14	8269	7235	72.9	8	64.91
1	14	8270	0	71.8	8	63.79
1	14	8271	3987	57.1	10	47.11
1	11	175	5676	72.7	64	8.65
1	11	176	5676	74.6	60	14.61
1	11	177	8563	90.5	55	35.49
1	11	178	0	106.4	118	-11.64
1	11	9201	961	92.8	37	55.76
1	11	9202	961	95.3	40	55.31
1	11	9203	961	96.8	40	56.82
1	11	9204	961	99.3	60	39.29
1	11	9205	961	106.2	70	36.23
1	11	9206	961	106.8	61	45.77
1	11	9207	961	114.2	61	53.24
1	11	9208	0	103.8	38	65.79
1	11	9209	485	100.8	70	30.76
1	11	9210	740	100.5	49	51.52
1	11	9211	485	99.1	56	43.12
1	11	9212	485	98.2	48	50.17
1	11	9213	0	98.3	50	48.29
1	11	9214	485	98.5	52	46.51
1	11	9215	485	99	53	45.99

TABLE 15-1 PRESSURE DATA
(FEASIBILITY STUDY ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
1	11	9216	77	100.8	70	30.76
1	11	9217	77	101.1	92	9.13
1	11	9218	77	101.1	72	29.07
1	11	9219	214	102.2	72	30.2
1	11	9220	137	103.8	64	39.82
1	11	9221	137	103	58	45.05
1	11	9222	485	98.2	50	48.16
1	11	9223	137	100.8	54	46.82
1	11	9224	259	100.8	58	42.78
1	11	9225	0	101.6	67	34.62
1	11	9226	259	100.9	79	21.94
1	11	9227	259	100.8	82	18.78
1	11	9228	0	102.7	47	55.74
1	11	9230	5676	78.6	36	42.64
1	11	9231	5676	38	40	-2.01
1	12	9251	1535	102.5	49	53.53
1	12	9252	767	98.5	49	49.53
1	12	9253	437	98.6	52	46.63
1	12	9254	437	99.8	55	44.76
1	12	9255	0	101.9	55	46.87
1	12	9256	0	102.8	58	44.8
1	12	9257	0	102.9	58	44.92
1	12	9258	0	102.9	58	44.92
1	12	9259	587	98.4	47	51.43
1	12	9260	437	98.6	55	43.57
1	12	9261	669	98.4	52	46.43
1	12	9262	669	98.6	53	45.59
1	12	9263	669	99.2	56	43.21
1	12	9264	4389	99.2	61	38.2
1	12	9265	616	102.6	67	35.57
1	12	9266	0	104.1	70	34.05
1	12	9267	0	104.7	78	26.69
1	12	9268	0	99.7	67	32.66
1	12	9269	616	99.1	67	32.06
1	12	9270	616	97.5	70	27.46
1	12	9271	0	97.4	76	21.43
1	12	9272	1752	97.3	70	27.3
1	12	9273	616	97.5	61	36.55
1	12	9274	616	99.2	58	41.16
1	12	9275	0	103.1	55	48.08
1	12	9276	2226	102.9	58	44.92
1	12	9277	437	102.9	58	44.92
1	12	9278	437	102.8	61	41.76
1	12	9279	0	104.1	61	43.11
1	12	9295	7140	78.4	6	72.36
1	12	9296	3897	80	12	68.01
1	12	9297	1937	64.2	20	44.17
1	12	9298	2225	-0.5	30	-30.5
2	23	301	2396	121.7	58	63.71
2	23	302	0	120	78	41.99
2	23	303	0	119.5	93	26.48
2	23	304	0	87.1	4	83.1
2	23	305	529	69.4	11	58.37
1	23	306	3458	60.5	1	59.46
1	23	307	0	60.5	2	58.46
2	23	309	4335	109.4	76	33.38
2	23	310	533	102.8	66	36.8
2	23	311	1198	101.9	66	35.91
2	23	312	599	101.4	105	-3.59
2	23	313	3517	93.6	57	36.58
2	23	314	3517	95.9	54	41.93
2	23	315	5355	90.1	64	26.08
2	23	316	0	91.5	64	27.54
1	23	317	3517	95.4	88	7.37
1	24	318	0	114.1	100	14.06
1	23	318	0	95.4	100	-4.63
2	23	2301	0	122	58	63.96
2	23	2302	248	121.4	51	70.44
2	23	2303	1361	120.9	80	40.88
2	23	2304	851	120.8	60	60.77
2	23	2305	0	123.2	60	63.21
1	24	401	0	113	98	15.02
1	24	402	1255	112.5	90	22.47
1	24	403	1255	111.2	79	32.17
1	24	404	1255	109	68	41.01
1	24	405	1255	104.9	85	19.92
1	24	406	1255	109.1	80	29.09
1	24	407	2622	108.5	70	38.47
1	24	408	5790	101.2	60	41.16
1	24	409	0	105.4	74	31.44
1	24	410	3402	104.9	74.5	30.36
1	24	411	2286	103	73	30
1	24	412	2127	97.9	75	22.92
1	24	413	2127	98.2	78	20.15
1	24	414	0	102.4	75	27.42
1	24	415	2127	96.1	75	21.06
1	24	416	0	102.2	79	23.21
1	24	417	2127	82.7	80	2.69
1	24	418	3158	92.8	60	32.81
2	25	501	2735	37.4	31	6.37
2	25	502	2581	38.8	24	14.78
2	25	503	0	39.1	20	19.06
2	25	504	721	40	20	20.01
2	25	505	1271	40.4	28	12.42
2	25	506	0	40.9	25	15.93
2	25	507	1271	42.1	25	17.12
2	25	508	721	44	22	22.02
2	25	509	1715	62.6	25	37.56
2	25	510	1373	76.9	35	41.85
2	25	511	1639	43.6	30	13.63

TABLE 15-1 PRESSURE DATA
(FEASIBILITY STUDY ; DISTRIBUTION)

Map No.	System No.	Node No.	Demand m3/day	Water Head m	Ground Level MSL(m)	Residual Head m
2	25	512	1639	43.8	30	13.79
2	25	513	1639	50.3	30	20.25
2	25	514	3377	68.2	40	28.23
2	25	515	3377	78.5	40	38.5
2	25	516	1639	53.1	35	18.06
2	25	517	0	61	35	26.04
2	25	518	3377	60.5	38	22.47
2	25	519	3377	61.6	30	31.6
2	23	520	656	122.4	40	82.36
2	25	2501	0	43.7	25	18.66
2	25	2502	1347	43.1	20	23.12
2	26	601	3181	53.4	45	8.41
2	26	602	818	57.9	46	11.86
2	26	603	1641	59.1	51	8.08
2	26	604	2801	79.3	44	35.3
2	26	605	1074	75.9	20	55.85
2	26	606	1330	81.9	44	37.88
2	26	607	2188	61.4	44	17.41
2	26	608	0	62.3	43	19.31
2	26	609	0	65.2	55	10.24
1	26	610	2219	68.6	62	6.63
1	26	611	2219	72.5	45	27.54
1	26	612	0	70.4	55	15.44
1	26	613	787	73	45	28.02
1	26	614	1672	75	40	35.03
1	26	615	0	75	40	34.97
1	26	616	885	86.7	47	39.65
1	26	617	885	79.8	50	29.78
1	26	618	885	79.6	60	19.59
1	26	619	885	78.4	42	36.44
1	26	620	885	74.2	45	29.21
1	26	621	885	74.6	65	9.57
1	26	622	885	74.2	39	35.21
1	26	623	885	74.6	39	35.55
1	26	624	885	75.2	50	25.2
1	26	625	885	74.3	37	37.3
1	26	626	885	77.2	50	27.24
1	26	627	885	84	65	18.97
1	26	628	885	79.3	38	41.33
1	26	629	885	74	38	36.05
1	26	630	885	74.1	38	36.06
1	26	631	0	68.8	54	14.76
1	26	632	2568	64.7	54	10.72
1	26	633	2568	55	43	12.05
1	26	634	2568	59.2	45	14.22
1	26	635	2568	60.7	42	18.74
1	26	636	2568	62.2	40	22.18
1	26	637	2568	58.4	41	17.39
1	26	638	0	68.9	60	8.91
2	26	639	1753	70.6	60	10.62
2	26	640	809	65.2	23	42.19
2	26	641	1246	67.7	23	44.75
2	26	642	1276	63.6	16	47.62
2	26	643	1183	63.2	35	28.24
2	26	644	2136	65.3	37	28.32
2	26	645	1225	76.5	30	46.46
1	26	646	2568	32.7	49	-16.35
2	26	2601	0	81.2	27	54.23
1	26	2602	0	88.8	46	42.82

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No. No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	23	154	2	23	520	250	900	110	656	0.15	0.18
2	23	154	2	23	309	375	900	110	20478	2.15	14.6
2	23	155	2	23	2305	525	1	110	-12061	-0.64	1
2	23	155	2	23	301	150	1120	110	505	0.33	1.33
2	23	154	2	23	155	500	180	110	-21133	-1.25	3.81
1	11	21	1	11	178	250	130	110	23134	5.45	131.88
1	11	21	1	11	140	375	440	110	23250	2.44	18.47
1	12	22	1	12	9266	300	420	110	8850	1.45	9.16
1	12	22	1	12	9267	375	240	110	19512	2.04	13.35
1	13	23	1	13	8201	300	40	110	12655	2.07	17.75
1	13	23	1	13	8202	300	2	110	24219	3.97	59
1	14	24	1	14	124	300	40	110	20031	3.28	41.55
1	15	25	1	15	7204	200	20	110	11394	4.2	105.35
2	23	31	2	23	155	375	250	110	9578	1	3.58
2	23	31	2	23	2305	500	250	110	20398	1.2	3.57
1	24	32	1	24	318	600	300	110	34135	1.4	3.81
2	25	41	2	25	515	600	400	110	33799	1.38	3.75
1	26	42	1	26	2602	800	430	110	60810	1.4	2.74
1	11	140	1	11	141	375	105	110	5171	0.54	1.14
1	11	140	1	11	9207	360	80	110	18079	2.06	14.14
1	11	141	1	11	9220	250	1390	110	5171	1.22	8.23
1	11	175	1	11	176	250	200	110	-5676	-1.34	9.78
1	11	176	1	11	177	250	450	110	-11352	-2.68	35.29
1	11	177	1	11	178	325	570	110	-19915	-2.78	27.84
1	11	178	1	11	9208	250	750	110	3219	0.76	3.42
1	11	9201	1	11	9204	300	800	110	-8320	-1.36	8.17
1	11	9201	1	11	9202	250	500	110	-3993	-0.94	5.1
1	11	9201	1	11	9230	250	400	110	11352	2.68	35.29
1	11	9202	1	11	9203	250	200	110	-4954	-1.17	7.59
1	11	9204	1	11	9205	300	650	110	-9615	-1.57	10.68
1	11	9203	1	11	9204	100	550	110	-335	-0.49	4.48
1	11	9205	1	11	9206	150	300	110	-595	-0.39	1.8
1	11	9203	1	11	9206	250	1050	110	-5580	-1.32	9.47
1	11	9206	1	11	9207	250	500	110	-7136	-1.68	14.94
1	11	9205	1	11	9207	300	700	110	-9982	-1.63	11.44
1	11	9208	1	11	9220	250	1370	110	-187	-0.04	0.02
1	11	9208	1	11	9209	100	220	110	613	0.9	13.76
1	11	9208	1	11	9228	250	400	110	2792	0.66	2.63
1	11	9209	1	11	9210	100	350	110	122	0.18	0.69
1	11	9209	1	11	9216	100	670	110	6	0.01	0
1	11	9210	1	11	9211	150	290	110	1012	0.66	4.83
1	11	9211	1	11	9212	100	400	110	237	0.35	2.38
1	11	9212	1	11	9213	100	280	110	-93	-0.14	0.41
1	11	9214	1	11	9215	100	300	110	-192	-0.28	1.61
1	11	9213	1	11	9214	100	100	110	-229	-0.34	2.23
1	11	9211	1	11	9215	150	270	110	289	0.19	0.47
1	11	9216	1	11	9217	100	250	110	-184	-0.27	1.48
1	11	9215	1	11	9216	100	300	110	-388	-0.57	5.89
1	11	9216	1	11	9218	100	100	110	-275	-0.41	3.11
1	11	9219	1	11	9225	150	220	110	731	0.48	2.65
1	11	9218	1	11	9219	100	230	110	-352	-0.52	4.92

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT

(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosiiy	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	11	9217	1	11	9219	100	380	110	-261	-0.38	2.83
1	11	9220	1	11	9221	200	100	110	2768	1.02	7.67
1	11	9214	1	11	9220	100	520	110	-522	-0.77	10.2
1	11	9219	1	11	9220	150	150	110	-1558	-1.02	10.74
1	11	9213	1	11	9222	100	150	110	137	0.2	0.85
1	11	9221	1	11	9223	200	320	110	2631	0.97	6.98
1	11	9222	1	11	9223	100	550	110	-348	-0.51	4.83
1	11	9223	1	11	9224	100	320	110	46	0.07	0.11
1	11	9224	1	11	9225	100	450	110	-209	-0.31	1.87
1	11	9225	1	11	9226	150	480	110	523	0.34	1.42
1	11	9226	1	11	9227	150	400	110	264	0.17	0.4
1	11	9224	1	11	9227	150	300	110	-5	0	0
1	11	9210	1	11	9228	150	190	110	-1630	-1.07	11.67
1	11	9228	1	12	9251	250	400	110	1162	0.27	0.52
1	11	9230	1	11	9231	168	600	110	5676	2.96	67.75
1	11	9212	1	12	9253	100	430	110	-155	-0.23	1.08
1	11	9223	1	12	9263	200	350	110	2100	0.77	4.6
1	12	9251	1	12	9252	100	230	110	696	1.03	17.39
1	12	9252	1	12	9253	100	400	110	-71	-0.1	0.26
1	12	9253	1	12	9254	150	260	110	-956	-0.63	4.34
1	12	9254	1	12	9255	150	110	110	-2127	-1.39	19.1
1	12	9255	1	12	9277	100	500	110	-222	-0.33	2.11
1	12	9255	1	12	9256	150	60	110	-1904	-1.25	15.57
1	12	9251	1	12	9256	250	600	110	-1069	-0.25	0.44
1	12	9256	1	12	9257	250	40	110	-2973	-0.7	2.97
1	12	9258	1	12	9277	375	500	110	-56	-0.01	0
1	12	9276	1	12	9277	387	140	110	961	0.09	0.04
1	12	9275	1	12	9276	387	400	110	3187	0.31	0.4
1	12	9266	1	12	9275	375	800	110	5344	0.56	1.21
1	12	9257	1	12	9258	250	30	110	-56	-0.01	0
1	12	9259	1	12	9260	150	280	110	-297	-0.19	0.5
1	12	9253	1	12	9259	150	430	110	293	0.19	0.49
1	12	9254	1	12	9260	150	450	110	734	0.48	2.66
1	12	9259	1	12	9261	150	420	110	3	0	0
1	12	9261	1	12	9262	200	300	110	-666	-0.25	0.55
1	12	9262	1	12	9263	200	310	110	-1335	-0.49	1.99
1	12	9263	1	12	9264	200	200	110	96	0.04	0.01
1	12	9264	1	12	9298	150	4800	110	2225	1.46	20.77
1	12	9287	1	12	9265	150	450	110	-1271	-0.83	7.37
1	12	9264	1	12	9265	200	90	110	-6518	-2.4	37.44
1	12	9265	1	12	9268	200	330	110	2990	1.1	8.84
1	12	9265	1	12	9271	200	950	110	2295	0.85	5.42
1	12	9267	1	12	9271	300	720	110	9328	1.53	10.09
1	12	9265	1	12	9266	200	10	110	-13690	-5.04	148
1	12	9266	1	12	9267	375	160	110	-10184	-1.07	4.01
1	12	9268	1	12	9269	150	190	110	805	0.53	3.16
1	12	9268	1	12	9271	200	450	110	2185	0.81	4.95
1	12	9269	1	12	9270	100	210	110	445	0.66	7.6
1	12	9269	1	12	9274	150	280	110	-257	-0.17	0.38
1	12	9270	1	12	9273	150	280	110	-235	-0.15	0.32
1	12	9271	1	12	9272	200	260	110	634	0.23	0.5

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT

(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	12	9270	1	12	9271	100	140	110	64	0.09	0.21
1	12	9271	1	12	9296	318	1040	110	14294	2.08	16.75
1	13	8214	1	12	9272	200	390	110	685	0.25	0.58
1	12	9272	1	12	9273	150	250	110	-433	-0.28	1
1	12	9274	1	12	9275	150	200	110	-2157	-1.41	19.6
1	12	9273	1	12	9274	150	215	110	-1284	-0.84	7.51
1	12	9277	1	12	9278	150	450	110	246	0.16	0.35
1	12	9278	1	12	9279	150	120	110	-1601	-1.05	11.28
1	12	9257	1	12	9279	250	420	110	-2917	-0.69	2.85
1	13	8226	1	12	9278	150	150	110	-1409	-0.92	8.91
1	13	8228	1	12	9279	250	340	110	4518	1.07	6.41
1	12	9287	1	12	9271	150	350	110	1056	0.69	5.23
1	13	8212	1	12	9295	150	550	110	-1319	-0.86	7.89
1	12	9296	1	12	9297	200	4000	110	1937	0.71	3.96
1	12	9295	1	12	9296	318	260	110	-8459	-1.23	6.34
1	13	8201	1	13	8202	300	30	110	-13399	-2.19	19.73
1	13	8202	1	13	8206	300	850	110	10820	1.77	13.28
1	13	8201	1	13	8203	300	15	110	26054	4.27	67.67
1	13	8203	1	13	8222	300	30	110	26054	4.27	67.6
1	13	8204	1	13	8205	360	60	110	15265	1.74	10.33
1	13	8204	1	14	8251	100	430	110	311	0.46	3.91
1	13	8205	1	13	8207	250	405	110	2695	0.64	2.46
1	13	8205	1	13	8209	318	670	110	11531	1.68	11.25
1	13	8206	1	13	8207	200	2	110	6564	2.42	38
1	13	8206	1	14	8254	300	720	110	4256	0.7	2.36
1	13	8207	1	13	8208	250	25	110	8412	1.98	20.24
1	13	8208	1	14	8252	150	150	110	170	0.11	0.18
1	13	8208	1	13	8209	200	880	110	2607	0.96	6.86
1	13	8208	1	13	8223	250	470	110	5635	1.33	9.65
1	13	8209	1	13	8210	232	960	110	5898	1.61	15.1
1	13	8209	1	13	8213	195	310	110	6621	2.57	43.6
1	13	8209	1	13	8223	100	750	110	-217	-0.32	2
1	13	8212	1	13	8213	195	500	110	-3649	-1.41	14.47
1	13	8214	1	13	8216	200	550	110	-999	-0.37	1.16
1	13	8215	1	13	8216	100	200	110	-110	-0.16	0.57
1	13	8216	1	13	8217	200	150	110	-1761	-0.65	3.32
1	13	8217	1	13	8218	200	180	110	-2725	-1	7.45
1	13	8218	1	13	8219	200	100	110	-3157	-1.16	9.78
1	13	8219	1	13	8220	200	90	110	-3336	-1.23	10.83
1	13	8220	1	13	8221	200	240	110	-4300	-1.58	17.33
1	13	8204	1	13	8221	360	250	110	-17076	-1.94	12.73
1	13	8221	1	13	8222	360	150	110	-21536	-2.45	19.56
1	13	8223	1	13	8224	250	640	110	2841	0.67	2.71
1	13	8223	1	14	8254	100	250	110	-611	-0.9	13.67
1	13	8224	1	14	8255	250	200	110	-745	-0.18	0.22
1	13	8226	1	13	8227	100	410	110	236	0.35	2.34
1	13	8226	1	13	8229	150	540	110	759	0.5	2.84
1	13	8219	1	13	8227	100	370	110	178	0.26	1.4
1	13	8222	1	13	8228	250	430	110	4518	1.07	6.41
1	13	8218	1	13	8229	150	110	110	432	0.28	1
1	13	8229	1	13	8231	100	120	110	777	1.15	21.35

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	13	8230	1	13	8231	100	165	110	-254	-0.37	2.69
1	13	8231	1	13	8232	100	200	110	109	0.16	0.56
1	13	8230	1	13	8232	100	290	110	-160	-0.24	1.14
1	13	8216	1	13	8232	100	115	110	465	0.68	8.23
1	14	124	1	14	8256	300	590	110	6314	1.03	4.9
1	14	124	1	14	8265	375	920	110	11813	1.24	5.27
1	14	124	1	14	8254	300	840	110	1903	0.31	0.53
1	14	8251	1	14	8252	100	120	110	311	0.46	3.91
1	14	8252	1	14	8253	100	550	110	481	0.71	8.78
1	14	8253	1	14	8254	200	250	110	-3970	-1.46	14.95
1	14	8255	1	14	8262	250	1200	110	-1118	-0.26	0.48
1	14	8254	1	14	8255	100	600	110	473	0.7	8.51
1	14	8256	1	14	8265	300	400	110	6314	1.03	4.9
1	14	8259	1	14	8260	100	700	110	322	0.47	4.18
1	14	8260	1	14	8261	100	700	110	-358	-0.53	5.07
1	14	8259	1	14	8261	100	150	110	-322	-0.47	4.17
1	14	8261	1	14	8262	200	480	110	-750	-0.28	0.69
1	15	7201	1	14	8262	250	30	110	1869	0.44	1.23
1	14	8263	1	14	8264	100	150	110	423	0.62	6.91
1	14	8261	1	14	8263	200	200	110	-270	-0.1	0.11
1	14	8263	1	14	8265	200	350	110	-1032	-0.38	1.23
1	14	8265	1	14	8266	401	450	110	16415	1.5	7
1	14	8266	1	14	8267	296	400	110	13291	2.24	20.76
1	15	7208	1	14	8266	200	500	110	1109	0.41	1.41
1	14	8267	1	14	8268	296	480	110	11222	1.89	15.17
1	14	8268	1	14	8269	296	240	110	11222	1.89	15.17
1	14	8269	1	14	8270	296	500	110	3987	0.67	2.23
1	14	8270	1	14	8271	150	240	110	3987	2.61	61.17
1	15	7207	1	14	8264	150	800	110	-423	-0.28	0.96
1	15	7202	1	15	7213	150	500	110	2098	1.37	18.62
1	15	7202	1	15	7203	250	500	110	-4646	-1.1	6.75
1	15	7204	1	15	7205	250	120	110	6749	1.59	13.47
1	15	7203	1	15	7204	250	1	110	-4646	-1.1	7
1	15	7205	1	15	7206	100	20	110	1556	2.29	77.15
1	15	7205	1	15	7210	250	180	110	5193	1.22	8.29
1	15	7206	1	15	7207	150	780	110	876	0.57	3.69
1	15	7208	1	15	7209	200	800	110	-1170	-0.43	1.56
1	15	7207	1	15	7208	150	108	110	618	0.4	1.94
1	15	7209	1	15	7210	200	100	110	-4513	-1.66	18.95
1	15	7209	1	15	7211	150	260	110	2662	1.74	28.96
1	15	7211	1	15	7217	150	250	110	1248	0.82	7.12
1	15	7212	1	15	7216	100	350	110	326	0.48	4.27
1	15	7211	1	15	7212	150	230	110	735	0.48	2.67
1	15	7212	1	15	7213	100	150	110	-271	-0.4	3.04
1	15	7213	1	15	7214	150	330	110	1146	0.75	6.08
1	15	7214	1	15	7216	150	200	110	-214	-0.14	0.27
1	15	7214	1	15	7215	100	200	110	680	1	16.67
1	15	7216	1	15	7217	150	200	110	-568	-0.37	1.66
1	15	7201	1	15	7202	250	410	110	-1869	-0.44	1.25
2	23	301	2	23	302	150	1220	110	522	0.34	1.42
2	23	302	2	23	303	318	320	110	3987	0.58	1.57

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY ; DISTRIBUTION)

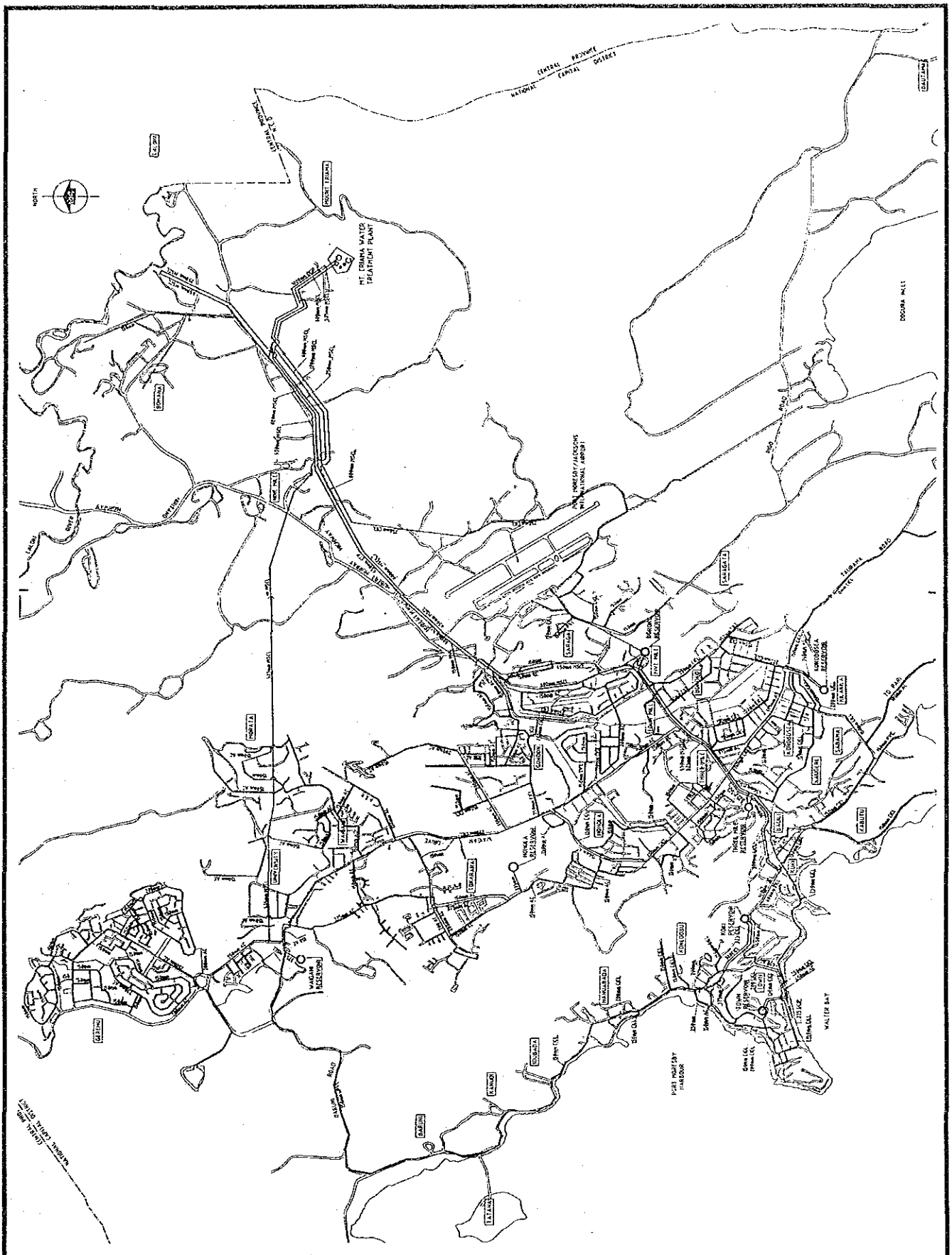
Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	23	303	2	23	304	195	1900	110	3987	1.55	17.05
2	23	304	2	23	305	195	1040	110	3987	1.55	17.05
2	23	305	1	23	306	195	680	110	3458	1.34	13.1
1	23	306	1	23	307	150	830	110	0	0	0
2	23	309	2	23	310	375	700	110	16142	1.69	9.4
2	23	310	2	23	311	375	100	110	15610	1.64	8.83
2	23	311	2	23	314	375	850	110	13813	1.45	7.04
2	23	311	2	23	312	195	980	110	599	0.23	0.51
2	23	313	2	23	315	200	750	110	2115	0.78	4.66
2	23	314	2	23	316	200	750	110	2392	0.88	5.85
2	23	313	2	23	314	200	100	110	-5069	-1.87	23.51
2	23	315	2	23	316	150	35	110	-3240	-2.12	41.66
2	23	313	1	23	317	150	1100	110	-563	-0.37	1.63
2	23	316	1	23	317	150	1100	110	-848	-0.56	3.48
1	23	317	1	24	402	100	560	110	-943	-1.39	30.53
1	23	317	1	23	318	375	10	110	-2834	-0.3	0.4
2	23	2301	2	23	2302	300	600	110	2460	0.4	0.86
2	23	2302	2	23	2303	300	800	110	2212	0.36	0.7
2	23	2303	2	23	2304	300	900	110	851	0.14	0.12
2	23	2301	2	23	2305	450	1100	110	-8338	-0.61	1.14
2	23	301	2	23	2301	150	10	110	-2413	-1.58	24.1
2	23	302	2	23	2301	300	1220	110	-3465	-0.57	1.61
2	23	314	1	23	318	375	1480	110	2834	0.3	0.38
1	24	318	1	24	401	612	300	110	34135	1.34	3.46
1	24	401	1	24	402	612	170	110	32984	1.3	3.25
1	24	402	1	24	403	606	430	110	30786	1.24	3
1	24	403	1	24	404	150	494	110	961	0.63	4.38
1	24	403	1	24	406	600	760	110	28571	1.17	2.74
1	24	404	1	24	406	183	440	110	-294	-0.13	0.19
1	24	406	1	24	407	606	290	110	25766	1.03	2.16
1	24	405	1	24	406	150	580	110	-1255	-0.82	7.19
1	24	407	1	24	409	444	640	110	17354	1.3	4.72
1	24	407	1	24	408	250	720	110	5790	1.37	10.14
1	24	409	1	24	410	441	120	110	17354	1.32	4.88
1	24	410	1	24	411	441	570	110	13952	1.06	3.26
1	24	412	1	24	418	150	720	110	1247	0.82	7.11
1	24	413	1	24	414	150	100	110	-3280	-2.15	42.62
1	24	412	1	24	414	150	100	110	-3374	-2.21	44.91
1	24	411	1	24	414	441	250	110	11666	0.88	2.34
1	24	415	1	24	416	150	160	110	-3101	-2.03	38.41
1	24	413	1	24	415	150	340	110	1153	0.76	6.15
1	24	416	1	24	418	150	600	110	1911	1.25	15.67
1	24	414	1	24	416	441	420	110	5012	0.38	0.49
1	24	415	1	24	417	150	700	110	2127	1.39	19.11
1	23	317	1	24	401	100	400	110	-1151	-1.7	44.12
2	25	502	2	25	503	150	350	110	-385	-0.25	0.8
2	25	501	2	25	502	150	1200	110	-471	-0.31	1.17
2	25	501	2	25	503	150	800	110	-647	-0.42	2.11
2	25	503	2	25	504	150	190	110	-1032	-0.68	5.01
2	25	505	2	25	506	150	370	110	-515	-0.34	1.38
2	25	502	2	25	506	200	300	110	-2668	-0.98	7.16

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	Node No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
2	25	507	2	25	508	200	200	110	-3107	-1.14	9.49
2	25	506	2	25	507	200	120	110	-3183	-1.17	9.93
2	25	508	2	25	509	200	300	110	-8544	-3.15	61.82
2	25	504	2	25	508	150	300	110	-1753	-1.15	13.35
2	25	508	2	25	2501	300	300	110	2964	0.49	1.21
2	25	509	2	25	510	273	750	110	-10259	-2.03	19.06
2	25	510	2	25	517	250	1400	110	6137	1.45	11.3
2	25	507	2	25	511	200	750	110	-1347	-0.5	2.02
2	25	505	2	25	512	150	1200	110	-756	-0.5	2.81
2	25	511	2	25	512	200	600	110	-449	-0.17	0.27
2	25	510	2	25	513	150	550	110	3512	2.3	48.37
2	25	511	2	25	513	150	250	110	-2537	-1.66	26.48
2	25	510	2	25	514	150	520	110	1970	1.29	16.58
2	25	514	2	25	515	150	350	110	-2681	-1.76	29.34
2	25	510	2	25	515	600	880	110	-23251	-0.95	1.87
2	25	512	2	25	516	200	1150	110	-2844	-1.05	8.06
2	25	513	2	25	516	150	1270	110	-664	-0.43	2.21
2	25	517	2	25	518	200	500	110	990	0.36	1.14
2	25	516	2	25	517	200	330	110	-5147	-1.9	24.18
2	25	518	2	25	519	200	800	110	-1113	-0.41	1.42
2	25	514	2	25	518	150	1050	110	1274	0.83	7.4
2	25	515	2	25	519	200	900	110	4490	1.65	18.78
2	25	2501	2	25	2502	300	440	110	2964	0.49	1.21
2	25	501	2	25	2502	150	500	110	-1617	-1.06	11.5
2	26	601	2	26	602	250	1330	110	-3181	-0.75	3.35
2	26	602	2	26	603	250	240	110	-3999	-0.94	5.11
2	26	603	2	26	607	250	600	110	-3447	-0.81	3.88
2	26	603	2	26	604	150	1000	110	-2193	-1.44	20.21
2	26	604	2	26	606	300	600	110	-5886	-0.96	4.3
2	26	604	2	26	605	150	900	110	892	0.58	3.82
2	26	606	2	26	607	150	1100	110	2096	1.37	18.61
2	26	607	2	26	608	250	220	110	-3539	-0.83	4.08
2	26	608	2	26	609	250	720	110	-3539	-0.83	4.07
1	26	610	1	26	611	200	550	110	-2658	-0.98	7.11
2	26	609	1	26	610	250	830	110	-3539	-0.83	4.08
1	26	611	1	26	616	200	840	110	-4228	-1.56	16.8
1	26	611	1	26	613	194	800	110	-649	-0.25	0.61
1	26	612	1	26	638	250	480	110	3100	0.73	3.19
1	26	612	1	26	631	411	230	110	17977	1.57	7.34
1	26	612	1	26	613	484	580	110	-21076	-1.33	4.44
1	26	613	1	26	614	484	400	110	-22512	-1.42	5.02
1	26	614	1	26	619	450	400	110	-24729	-1.8	8.52
1	26	616	1	26	619	450	880	110	25970	1.89	9.33
1	26	614	1	26	615	250	500	110	545	0.13	0.13
1	26	615	1	26	623	150	270	110	545	0.36	1.54
1	26	616	2	26	639	150	1200	110	1753	1.15	13.36
1	26	616	1	26	2602	800	1000	110	-53686	-1.24	2.17
2	26	606	1	26	616	500	1800	110	-17370	-1.02	2.65
1	26	616	1	26	617	150	450	110	1885	1.23	15.28
1	26	617	1	26	618	100	150	110	170	0.25	1.27
1	26	616	1	26	618	150	630	110	1595	1.04	11.21

TABLE 15-2 FLOW RATE AND HYDRAULIC GRADIENT
(FEASIBILITY ; DISTRIBUTION)

Node Data						Pipe Data			Result		
Start Node			End Node			Diameter	Length	Coefficient	Flow Rate	Velosity	Hydraulic Gradient
Map No.	System No.	Node No.	Map No.	System No.	No.	(mm)	(m)	(C)	(m3/day)	(m/s)	(1/1000)
1	26	617	1	26	619	150	400	110	830	0.54	3.34
1	26	618	1	26	620	100	200	110	880	1.3	26.86
1	26	621	1	26	622	150	450	110	380	0.25	0.79
1	26	620	1	26	622	100	250	110	-5	-0.01	0
1	26	619	1	26	623	150	600	110	1186	0.78	6.48
1	26	622	1	26	623	150	250	110	-510	-0.33	1.36
1	26	621	1	26	624	200	350	110	-1265	-0.47	1.8
1	26	624	1	26	625	150	220	110	922	0.6	4.07
1	26	623	1	26	625	150	400	110	336	0.22	0.63
1	26	624	1	26	626	200	220	110	-3072	-1.13	9.3
1	26	626	1	26	627	200	350	110	-4546	-1.67	19.21
1	26	627	1	26	2602	200	110	110	-7124	-2.62	44.15
1	26	627	1	26	628	150	370	110	1694	1.11	12.53
1	26	629	1	26	630	150	250	110	-76	-0.05	0.04
1	26	628	1	26	629	100	230	110	809	1.19	22.97
1	26	625	1	26	630	150	320	110	373	0.24	0.76
1	26	626	1	26	630	100	250	110	588	0.87	12.74
1	26	631	1	26	632	411	550	110	17977	1.57	7.34
1	26	632	1	26	633	150	1050	110	1434	0.94	9.21
1	26	633	1	26	634	150	700	110	-1134	-0.74	5.96
1	26	634	1	26	635	273	400	110	-4290	-0.85	3.79
1	26	632	1	26	636	411	550	110	13974	1.22	4.61
1	26	636	1	26	646	150	1090	110	2568	1.68	27.1
1	26	634	1	26	637	150	470	110	588	0.39	1.77
1	26	635	1	26	637	200	570	110	1980	0.73	4.12
1	26	610	1	26	638	250	90	110	-3100	-0.73	3.19
2	26	640	2	26	641	150	800	110	-809	-0.53	3.19
2	26	641	2	26	645	168	400	110	-3076	-1.61	21.79
2	26	641	2	26	642	150	840	110	1021	0.67	4.91
2	26	642	2	26	644	150	950	110	-592	-0.39	1.79
2	26	642	2	26	643	150	600	110	337	0.22	0.63
2	26	643	2	26	644	150	600	110	-846	-0.55	3.46
2	26	644	2	26	645	195	800	110	-3574	-1.39	13.92
2	26	605	2	26	645	100	420	110	-182	-0.27	1.45
2	26	645	2	26	2601	300	620	110	-8057	-1.32	7.7
2	26	606	2	26	2601	400	340	110	8057	0.74	1.9
1	26	635	1	26	636	273	100	110	-8838	-1.75	14.45



TITLE

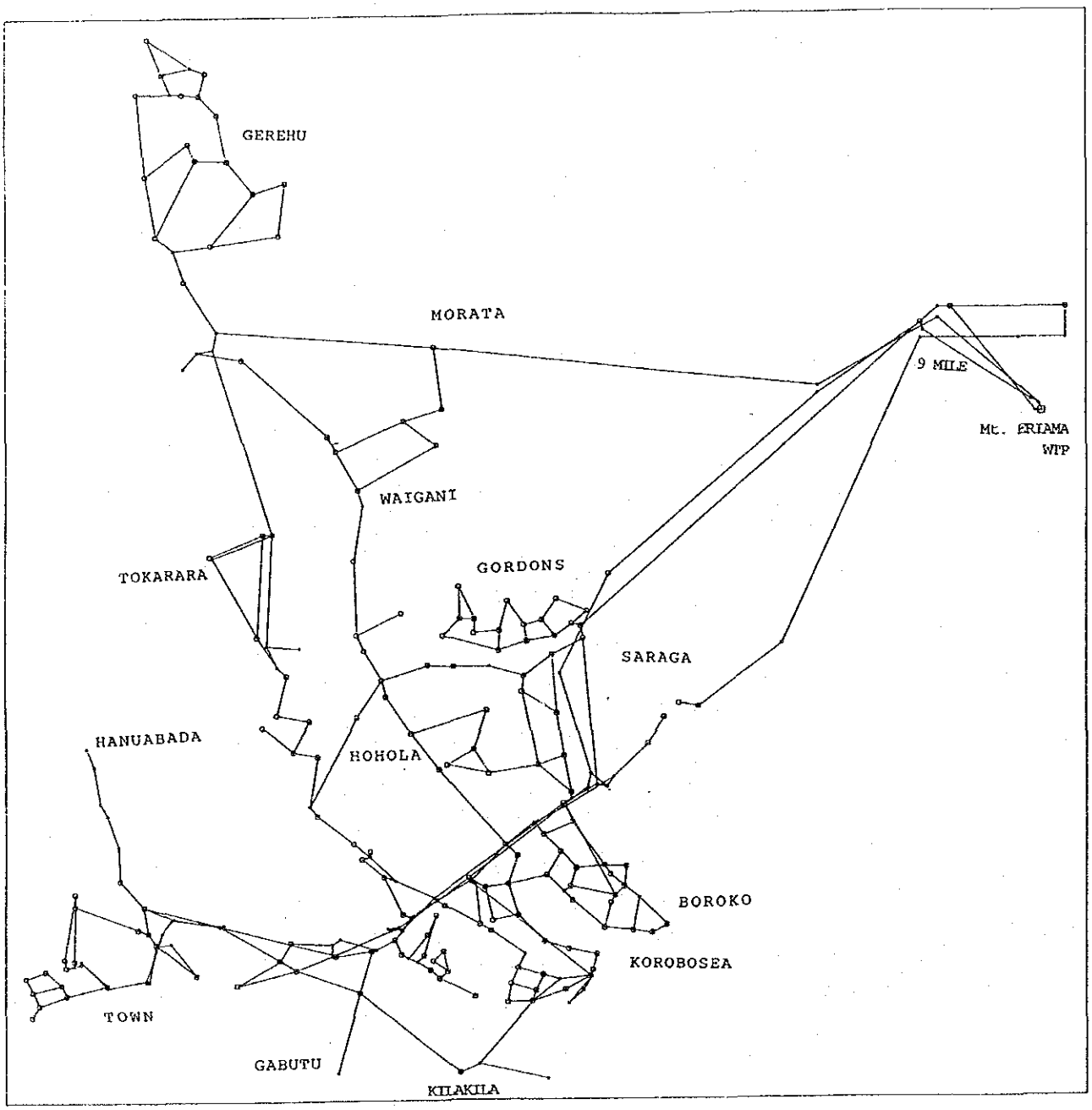
WATER SUPPLY SYSTEM

Fig. No.

F.1

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



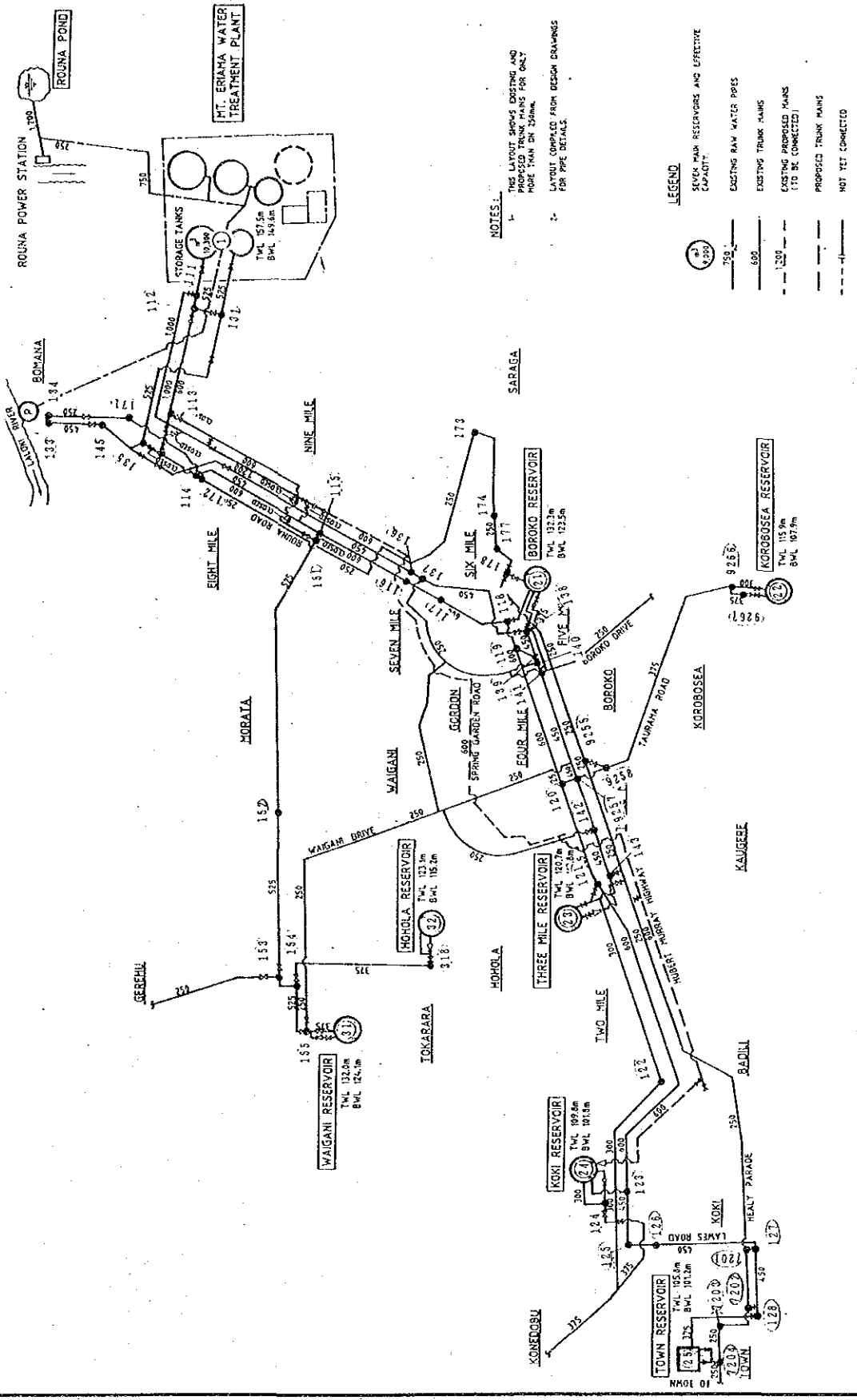
TITLE

EXISTING NETWORK MODEL FOR HYDRAULIC ANALYSIS

Fig. No. **F.2**

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

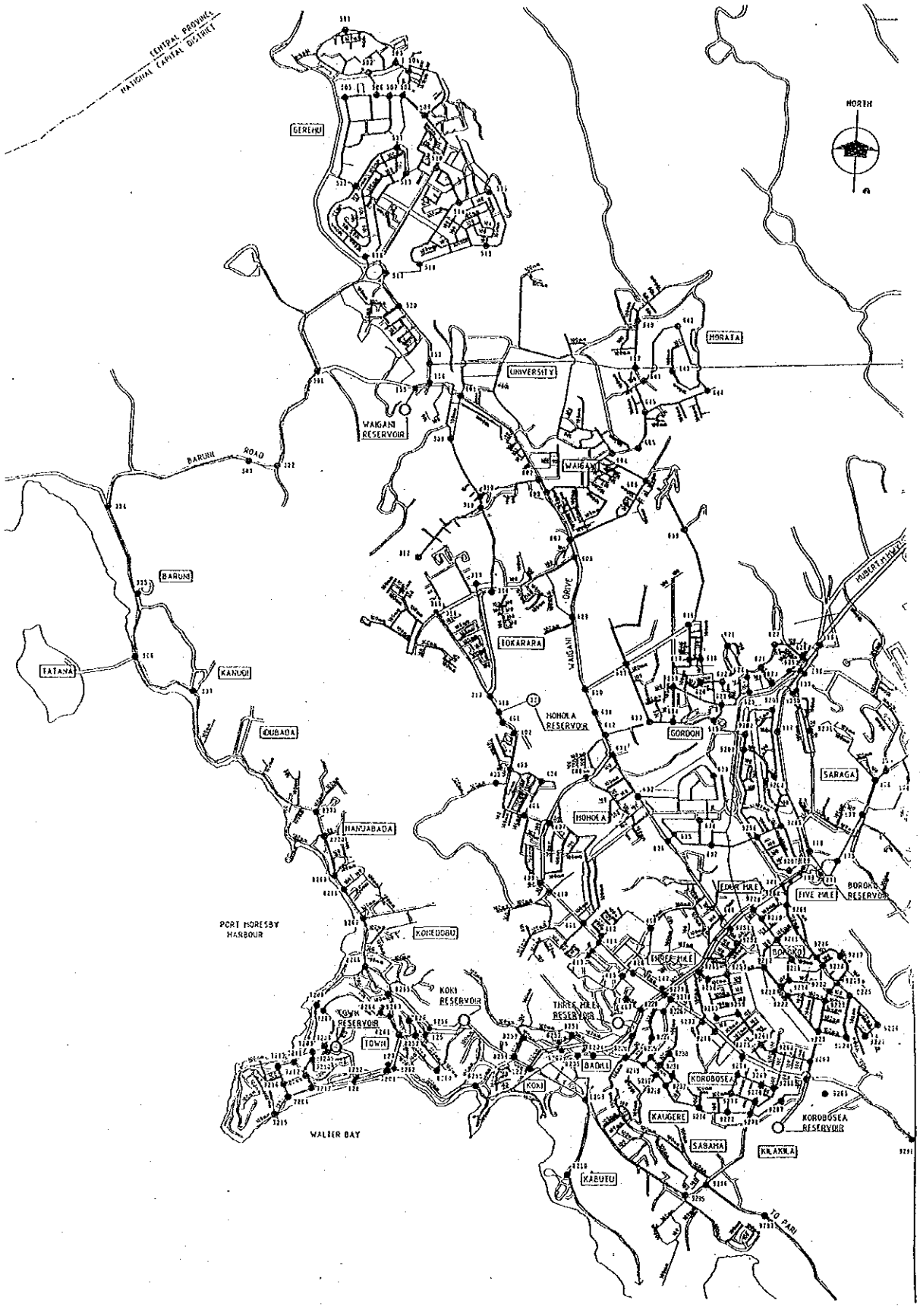
MAJOR NODE LOCATION

Fig. No.

F.3

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

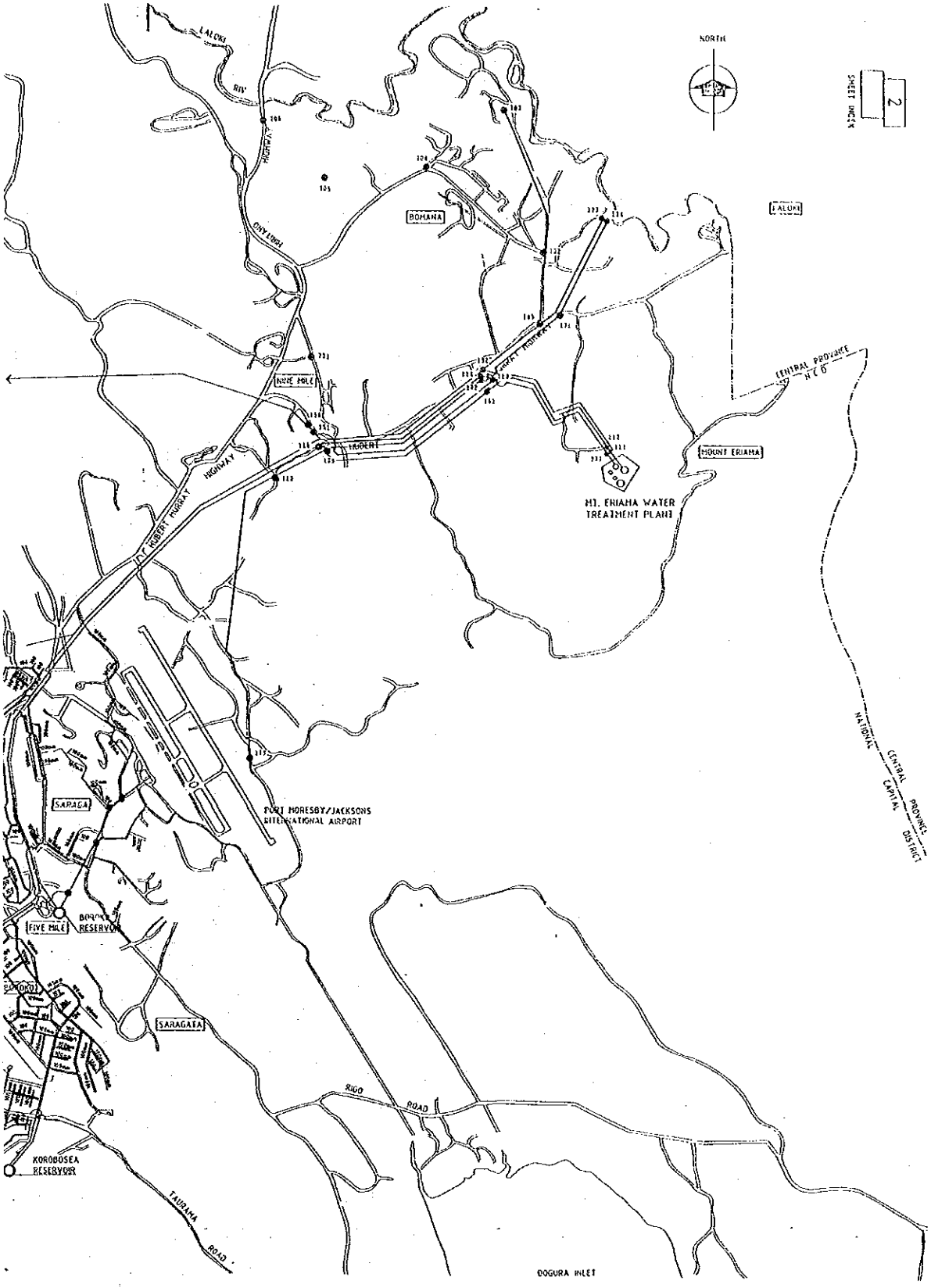
NODE LOCATION

Fig. No.

F.4

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

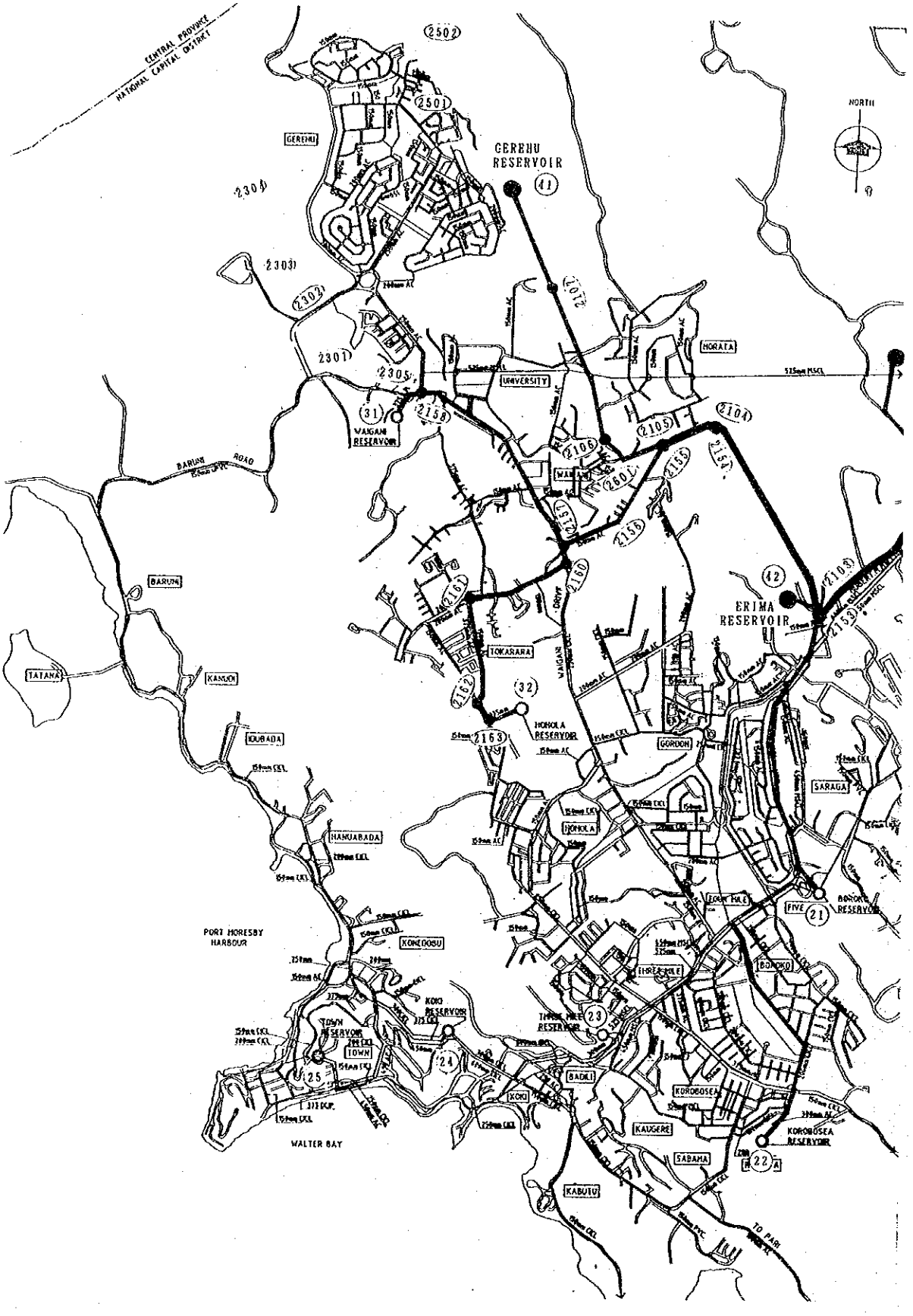
NODE LOCATION (CONT.)

Fig. No.

F.4

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

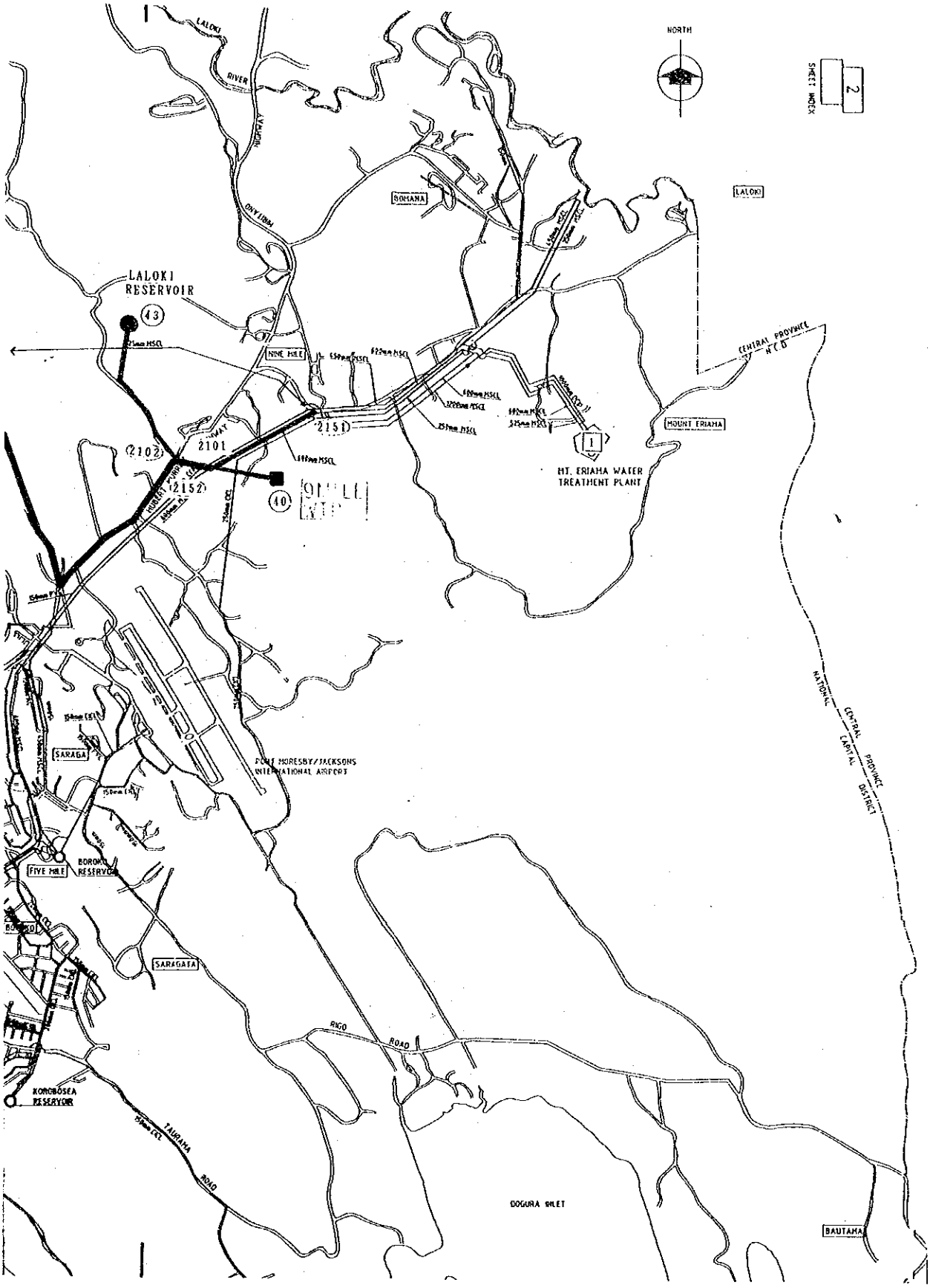
NEW NODE LOCATION

Fig. No.

F.5

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

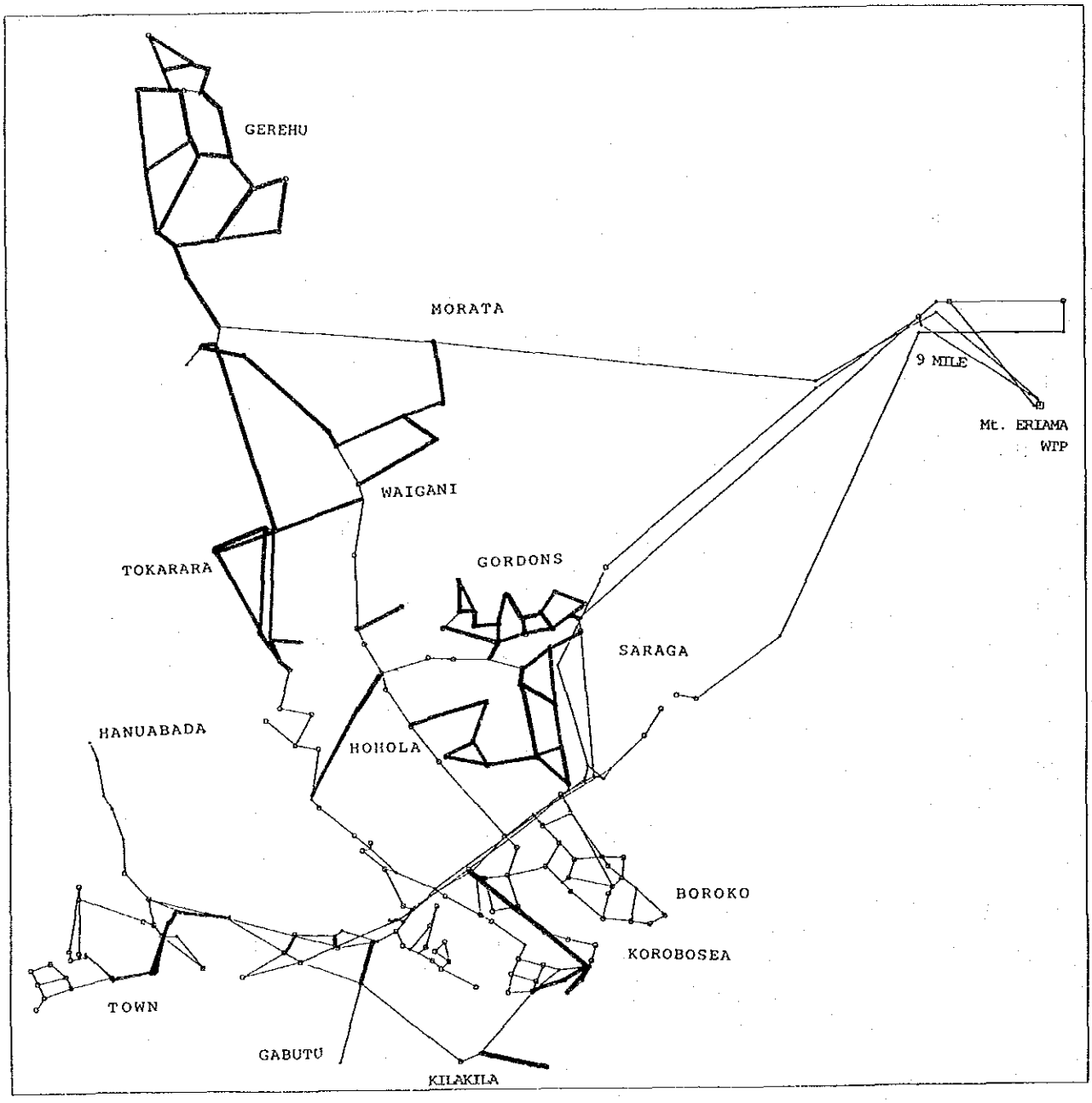
NEW NODE LOCATION (CONT.)

Fig. No.

F.5

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

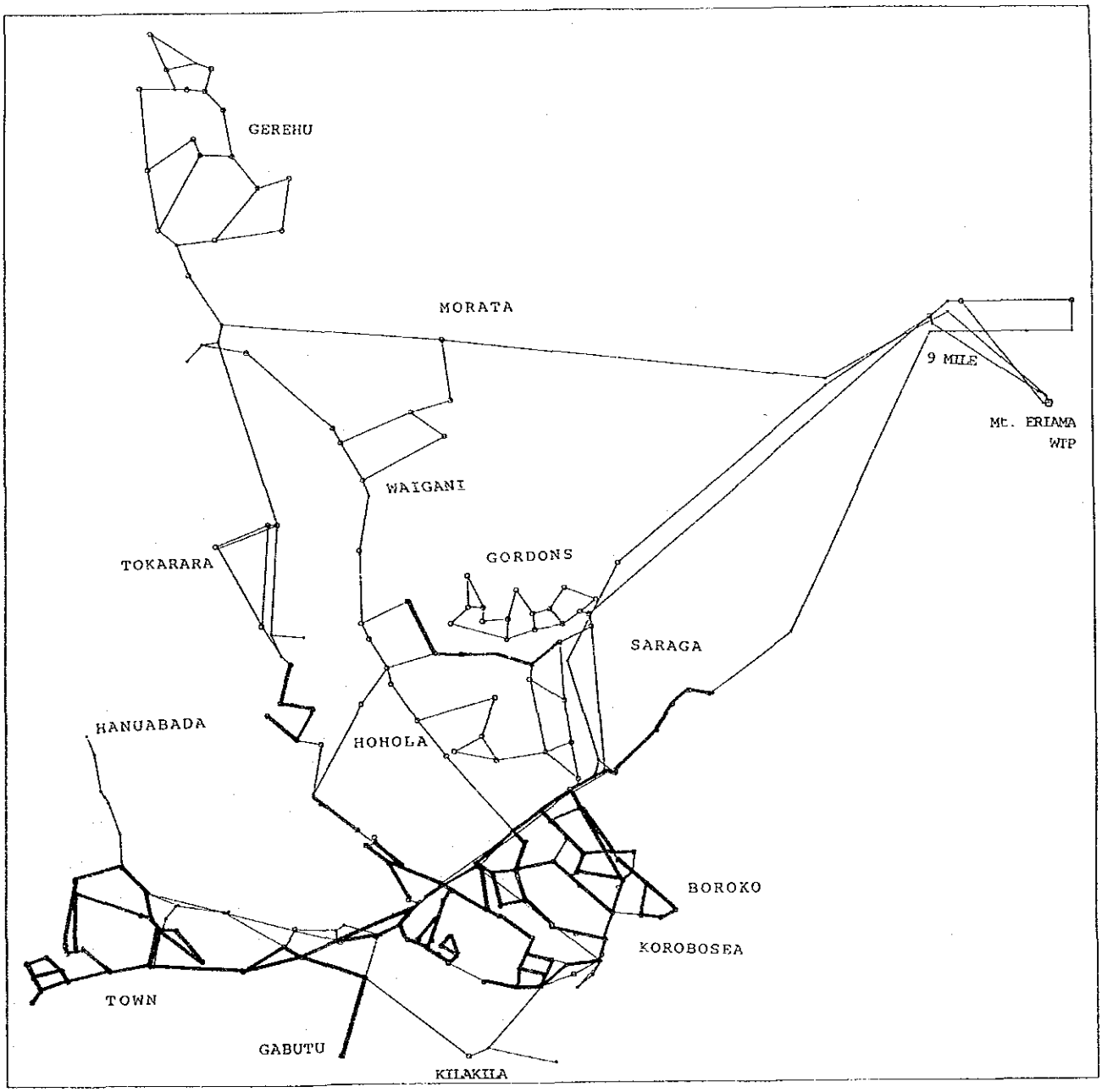
LOCATION OF AC PIPE

Fig. No.

F.6

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL



TITLE

OLD PIPE LOCATION (BEFORE 1965)

Fig. No.

F.7

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

TOKYO ENGINEERING CONSULTANTS in association with PACIFIC CONSULTANTS INTERNATIONAL

APPENDIX G

PORT MORESBY WATER SUPPLY DEVELOPMENT PLAN

COMPARISON OF ALTERNATIVES

LIST OF TABLES

TABLE G.1 DETAILS OF ALTERNATIVE RAW WATER MAIN PIPE

Item	Option A		Option B		Option C
Water Quality					
Mt. Eriama WTP Capacity (m^3/day)	177,000		136,000		95,000
9 Mile WTP Capacity (m^3/day)	*191,000*		*232,000*		*273,000*
Water Quantity Loss in WTP (%)	3		3		3
Existing Raw Water Main Capacity (m^3/day)	98,000		98,000		98,000
1. Rouna 4 Head Pond to 9 Mile WTP					
From	Rouna 4	Branch	Rouna 4	Branch	Rouna 4
To	Branch	9 Mile	Branch	9 Mile	9 Mile
Pipe Description					
Required Raw Water Main Capacity (m^3/day)	281,000	197,000	281,000	229,000	281,000
Length (m)	11,200	4,600	11,200	4,600	15,800
Required Diameter (mm)	1,600	1,350	1,600	1,500	1,600
Hydraulic Gradient (%)	1.36	1.62	1.36	1.38	1.36
Head Loss (m)	15.3	7.4	15.3	6.4	21.6
Water Level					
Start (Rouna 4 Head Pond)	145.4	130.1	145.4	130.1	145.4
End	130.1	122.7	130.1	123.7	123.8
2. Branch to Mt. Eriama Water Treatment Plant					
Route					
From	Branch		Branch		
To	Mt. Eriama		Mt. Eriama		
Pipe Description					
Required Raw Water Main Capacity (m3/day)	84,000		42,000		
Length (m)	2,000		2,000		
Required Diameter (mm)	900		700		
Hydraulic Gradient (%)	2.41		2.27		
Head Loss (m)	4.8		4.5		

TABLE G.2 DETAILS OF ALTERNATIVE PUMPING STATION (RAW WATER MAIN)

Item	Option A	Option B	Option C
Pumping Route			
From	NEW P.S.	NEW P.S.	
To	Mt.Eriama	Mt.Eriama	
Pump Specification			
Required Pumping Capacity (m3/day)	84,000	42,000	
N(included spare)	4	4	
q(m3/min/base)	19.4	9.7	
Required Head(m)	44	43	
Electromotor(kw)	190	100	
Total Electromotor (kw)	760	400	

TABLE G.3 DETAILS OF ALTERNATIVE PUMPING STATION (TRANSMISSION)

Item	Option A			Option B				Option C
Pumping Route								
From	New P.S.(Waigani)			New P.S.(Waigani)				
To	Waigani Res.	Hohola Res.	Total	Waigani Res.	Hohola Res.	3 Mile Res.	Total	
Pump Specification								
Required Pumping Capacity (m3/day)	36,000			36,000				
N(included spare)	3	1	4	3	2	1	6	
q(m3/min/base)	12.5			12.5				
Required Head(m)	48			48				
Electromotor(kw)	130	130	130	130	130	130	130	
Total Electromotor (kw)			520				780	

TABLE G.4 DETAILS OF ALTERNATIVE TRANSMISSION PIPE

Pipe Detail	Option					
	A		B		C	
	Diameter (mm)	Length (m)	Diameter (mm)	Length (m)	Diameter (mm)	Length (m)
Transmission Pipe						
for High Zone	1,000	6,800	1,000	6,800	800	6,800
	600	2,600	600	2,600	600	2,600
subtotal		9,400		9,400		9,400
for Low Zone	1,200	1,500	1,350	1,500	1,350	1,500
	1,000	4,000	1,100	4,000	1,200	4,000
	900	8,600	600	3,600	800	3,600
	900	5,000	900	5,000	900	5,000
	800	2,500	800	3,500	800	3,500
	700	5,000	700	4,000	700	4,000
	600	5,000	600	500	600	5,000
			400	4,500	400	9,200
subtotal		31,600		26,600		35,800
total		41,000		36,000		45,200

TABLE G.5 PIPE LENGTH BY DIAMETER AND RATIO BY DIAMETER

Selected Area	Pipe Length (m) by Diameter					Ratio by Diameter			
	100	150	200	250	Total	100	150	200	250
Gerehu	10480	17080	6840	2480	36880	28	46	19	7
Morata	5920	3800	0	0	9720	61	39	0	0
Gordons	4880	2480	0	2840	10200	48	24	0	28
Boroko	17280	5160	1520	3160	27120	63	19	6	12
Town	7240	5880	1600	0	14720	49	40	11	0
Total	45800	34400	9960	8480	98640	46	35	10	9

TABLE G.6 UNIT PIPE LENGTH BY CATEGORY

Selected Area	Area (ha)	Population 1990	Population Density (p/ha)	Demand day max. (m3/day)	Unit Pipe Length per category		
					Area (m/ha)	Population (m/p)	Demand (m/m3/day)
Gerehu	428	22727	53	15284	86	1.62	2.41
Morata	178	8775	49	5217	55	1.11	1.86
Gordons	111	3991	36	2824	92	2.56	3.61
Boroko	312	10625	34	8583	87	2.55	3.16
Town	149	3860	26	4161	99	3.81	3.54
Total	1178	49978	42	36069	84	1.97	2.73

TABLE G.7 DEVELOPMENT AREA EXPANSION ACCORDING TO POPULATION GROWTH BY 5-YEAR INTERVAL AND CENSUS DIVISION

Census Division No.	Name	Develop. Area	Development Area by 5 Years Interval 1993	- 1995	- 2000	- 2005	- 2010	- 2015
80	Gerehu	148	0	11.46161	27.68543	39.67437	52.06152	17.11707
81	Waigani/University	192	0	13.66425	32.31078	45.63959	58.76121	41.62417
82	Hohola/Tokalala	167	0	17.87219	43.70227	63.20021	42.22532	0
83	Gordons/Saraga	31	0	7.727184	20.9015	2.371313	0	0
84	Boroko/Korobosea	98	0	36.05627	61.94373	0	0	0
85	Kilakila/Kaugere	0	0	0	0	0	0	0
86	Town/Hanuabada	0	0	0	0	0	0	0
87	Laloki/Napanapa	1640	0	34.34229	160.2263	255.2192	363.4512	826.761
88	Bomana	1130	0	49.89554	172.0636	211.2232	241.2945	455.5231
Total		3406	0	171.0193	518.8336	617.328	757.7938	1341.025

TABLE G.8 PIPE LENGTH (LESS THAN 250 mm) BY 5-YEAR INTERVAL

Census Division No.	Name	Pipe Length (m) by 5-Year Interval 1993	1995	2000	2005	2010	2015 Total	
80	Gerehu	0	963	2326	3333	4373	1438	12432
81	Waigani/University	0	1148	2714	3834	4936	3496	16128
82	Hohola/Tokalala	0	1501	3671	5309	3547	0	14028
83	Gordons/Saraga	0	649	1756	199	0	0	2604
84	Boroko/Korobosea	0	3029	5203	0	0	0	8232
85	Kilakila/Kaugere	0	0	0	0	0	0	0
86	Town/Hanuabada	0	0	0	0	0	0	0
87	Laloki/Napanapa	0	2885	13459	21438	30530	69448	137760
88	Bomana	0	4191	14453	17743	20269	38264	94920
Total		0	14366	43582	51856	63655	112646	286104

TABLE G.9 PIPE LENGTH EXPANSION SCHEDULE BY CENSUS DIVISION AND ZONE

Census Division No.	Name	Ratio	Dia.	Total Pipe Length (m) 1993	1995 Total	1995 High	1995 Low	2000 Total	2000 High	2000 Low	2005 Total	2005 High	2005 Low	2010 Total
80	Gerehu													
	High	0	100	0	443	0	443	1070	0	1070	1533	0	1533	2012
	Low	1	150	0	337	0	337	814	0	814	1167	0	1167	1531
			200	0	96	0	96	233	0	233	333	0	333	437
			250	0	87	0	87	209	0	209	300	0	300	394
	sub-total			0	963	0	963	2326	0	2326	3333	0	3333	4374
81	Waigani/University													
	High	0.2	100	0	528	106	422	1248	250	998	1764	353	1411	2271
	Low	0.8	150	0	402	80	322	950	190	760	1342	268	1074	1728
			200	0	115	23	92	271	54	217	383	77	306	494
			250	0	103	21	82	244	49	195	345	69	276	444
	sub-total			0	1148	230	918	2713	543	2170	3834	767	3067	4937
82	Tokalala/Hohola													
	High	0.5	100	0	690	345	345	1689	845	844	2442	1221	1221	1632
	Low	0.5	150	0	525	263	262	1285	643	642	1858	929	929	1241
			200	0	150	75	75	367	184	183	531	266	265	355
			250	0	135	68	67	330	165	165	478	239	239	319
	sub-total			0	1500	751	749	3671	1837	1834	5309	2655	2654	3547
83	Gordons/Saraga													
	High	1	100	0	299	299	0	808	808	0	92	92	0	0
	Low	0	150	0	227	227	0	615	615	0	70	70	0	0
			200	0	65	65	0	176	176	0	20	20	0	0
			250	0	58	58	0	158	158	0	18	18	0	0
	sub-total			0	649	649	0	1757	1757	0	200	200	0	0
84	Boroko/Korobosea													
	High	1	100	0	1393	1393	0	2393	2393	0	0	0	0	0
	Low	0	150	0	1060	1060	0	1821	1821	0	0	0	0	0
			200	0	303	303	0	520	520	0	0	0	0	0
			250	0	273	273	0	468	468	0	0	0	0	0
	sub-total			0	3029	3029	0	5202	5202	0	0	0	0	0
87	Laloki/Napanapa													
	High	0.12	100	0	1327	159	1168	6191	743	5448	9861	1183	8678	14044
	Low	0.88	150	0	1010	121	889	4711	565	4146	7503	900	6603	10686
			200	0	289	35	254	1346	162	1184	2144	257	1887	3053
			250	0	260	31	229	1211	145	1066	1929	231	1698	2748
	sub-total			0	2886	346	2540	13459	1615	11844	21437	2571	18866	30531
88	Bomana													
	High	0	100	0	1928	0	1928	6648	0	6648	8162	0	8162	9324
	Low	1	150	0	1467	0	1467	5059	0	5059	6210	0	6210	7094
			200	0	419	0	419	1445	0	1445	1774	0	1774	2027
			250	0	377	0	377	1301	0	1301	1597	0	1597	1824
	sub-total			0	4191	0	4191	14453	0	14453	17743	0	17743	20269
	Total			0	14366	5005	9361	43581	10954	32627	51856	6193	45663	63658

TABLE G.10 DESIGN OF RAW WATER MAIN PIPE

Item	Design	
1. Rouna 4 Head Pond to 9 Mile Water Treatment Plant		
Supply Capacity (m3/day)		
Mt.Eriama Water Treatment Plant	180,000	
9 Mile Water Treatment Plant	200,000	
Water Quantity Loss(%) in WTP	3	
Existing Raw Water Main	98,000	
Pipe Route		
From	Rouna 4 Head Pond	Branch
To	Branch	9 Mile WTP
Pipe Specification		
Supply Quantity (m3/day)	293,400	206,000
Length (m)	10,400	5,400
Diameter (mm)	1,600	1,350
Hydraulic Gradient (%)	1.48	1.76
Head Loss (m)	15.4	9.5
Water Level		
Start	145.7	130.3
End	130.3	120.8

TABLE G.11 PUMPING STATION FOR RAW WATER MAIN

Description	Design
Pumping Route	
From	NEW Puping Station
To	Mt.Eriama WTP
Specification	
Pumping Capacity (m3/day)	87,400
N(included spare)	4
q(m3/min/base)	20.2
Required Head(m)	50
Electromotor(kw)	280
Total Electromotor (kw)	1,120

TABLE G.12 DESIGN OF WATER TREATMENT FACILITIES

Item	Type	Detention Time	Design Shape and Number	No. of Basin	Volume or Surface Are
Mt.Eriama W.T.P.					
Receiving Well		Vo=1.5min	Dia. 7.0m x H5.0m	1 Basin	V= 192m³
Circular Clarifier	Clarifier	Ve=40 mm/min	Dia. 41.2m x H6.4m	1 Basin	A= 1160m²
Filter Basin	Pressure	Ve=194m/day	W3.82m x L3.82m N=12	2 Basin	A= 350m²
Drainage System	Lagoon		W12.5m x L80.0m	4 Basin	A= 4000m²
Chemical Dosing Equipment	Alum,Lime, Chlorine				
9 Mile W.T.P.					
Receiving Well		Vo=1.5min	W 4.5m x L6.0m x H4.0m	2 Basin	V= 216m³
Rapid Mixing Chamber	Flush Mixer	Vo= 2 min	W 4.0m x L4.0m x H5.0m	2 Basin	V= 160m³
Flocculation Basin	Baffling	Vo=20 min	W1.15m x L153.0m x H4.0m	2 Basin	V= 1410m³
Sedimentation Basin	Conventional Laternal Flow	Ve=30 mm/min	W25.3m x L 46.0m x H4.0m	2 Basin	A= 2330m²
Filter Basin	Gravity,Back-washing-Tank	Ve=150m/day	W 9.6m x L10.0m	8 Basin	A= 768m²
Chlorination Equipment	Baffling	Vo= 5 min	W1.65m x L 42.2m x H2.6m	2 Basin	V= 362m³
Clear Water Reservoir		Vo= 1 hr(6hr)	W20.0m x L 50.0m x H6.0m	2 Basin	V=12000m³
Drainage System	Lagoon		W12.5m x L80.0m	5 Basin	A= 5000m²
Chemical Dosing Equipment	Alum,Lime, Chlorine				