TABLES

Table 1 Population and Urban Area in 1997 and 2020

Municipality	Type	Population			Urban Area(km^2)	
		1997	2010	2020	1997	2020
Itamaraca		11,826	17,808	24,639	6.3	12.56
Itapissuma		16,504	21,692	26,031	1.75	2.48
Aracoiaba		10,289	13,008	15,007	0.83	1.18
Moreno		32,162	32,973	33,638	4.16	4.33
Cabo		128,360	159,936	186,896	11.87	15.75
Ipojuca		31,605	44,493	55,472	8.86	11.01
Igarassu		54,874	79,165	104,140	12.36	17.61
Abreu e Lima		73,113	77,827	80,835	10.94	11.84
Paulista		234,144	292,896	337,248	30.89	38.32
Sao Lourenco de Mata		80,358	94,632	107,044	16.78	21.25
Camaragibe	Formal 1	78,342	97,966	112,912	21.03	27.11
	ZEIS-2	35,280	44,118	50,848	1.99	2.01
	Sub-total	113,622	142,084	163,760	23.02	29.12
Jaboatao	Formal 1	257,088	305,783	340,460	33.92	43.69
	Formal 2	33,300	39,607	44,099	1.12	1.13
	ZEIS-3	175,320	208,527	232,175	9.79	9.89
	Sub-total	465,708	553,918	616,734	44.82	54.71
Olinda		350,999	367,041	377,825	26.42	26.48
Recife	ZEIS	593,830	629,970	661,204	32.56	32.56
	Formal	761,987	816,905	844,567	85.05	85.05
	Sub-total	1,355,817	1,446,875	1,505,771	117.61	117.61
Total RMR		2,959,381	3,344,348	3,635,040	316.61	364.25

Sources:PQA

Table 2 Proposed Water Consumption and Wastewater Discharge

ELO District (LINK) (Management District of COMPESA)	Wastewater Discharge (liter/capita)			Daily Water Consumption (liter/capita)
	Daily average	Daily maximum	Hourly maximum	
Cabanga, Alto do Céu, Aurora, Dois Irmãos, Prazeres, Pau Amarelo e Olinda	160	190	285	200
Jangadinha, Ipojuca, Nossa Senhora do Ó, Camela, Ponte dos Carvalhos, Pontezinha, Cabo, Abreu e Lima, Igarassú, Cruz de Rebouças, Nova Cruz, Itamaracá, Paulista, Peixinhos e São Lourenço da Mata	125	150	225	155
Ibura, Jenipapo, Jordão, Jaboatão, Moreno, Bonança, Vera Cruz, Caetés, Itapissuma e Camaragibe, Navarro, Paratibe, Jardim Paulista, Maranguape II, Araçoiaba, Cidade Tabajara, Nossa Senhora da Luz	110	130	195	140
ZEIS and Informal Areas	80	100	150	100

Sources:PQA

Table 3 Present Pollution Loads (BOD) Generated by Population in RMR

River Basin	Population (1997)	Generated Pollution Load (kg/day)	Population with Sewerage	Load (1) (kg/day)	Population without Sewerage	Load (2) (kg/day)	Total Load (1)+(2) (kg/day)	Rate of Pollution Runoff
Beberibe	576,643	31,268	120,368	662	456,275	21,541	22,203	0.71
Botafogo	7,221	390	0	0	7,221	234	234	0.60
Capibaribe	667,933	37,209	28,208	275	639,725	24,701	24,976	0.67
Igarassu	67,966	3,670	1,297	18	66,669	2,160	2,178	0.59
Ipojyca	58,621	3,166	0	0	58,621	1,899	1,899	0.60
Jaboatao	501,382	27,075	3,008	32	498,374	20,226	20,259	0.75
Jaguaribe	8,269	447	0	0	8,269	268	268	0.60
Paratibe	98,797	5,335	21,151	228	77,646	2,535	2,764	0.52
Pirapama	84,313	4,553	11,037	119	73,276	2,374	2,493	0.55
Tejipio	493,273	26,824	13,906	75	479,367	19,585	19,660	0.73
Timbo	387,628	20,953	118,747	642	268,881	8,712	9,354	0.45
Total	2,952,046	160,889	317,722	2,052	2,634,324	104,237	106,288	0.66

Note:
1. Population number in the urban area in 1997,
2. Generated pollution load:
   Unit BOD load (54g/person/day) x population number of each river basin, which uses a converted population number for the large-scale wastewater discharges (over 500 m³/month) from public facilities etc. The converted population numbers for the river basins are as follows:
   - Capibaribe: 21,119 Beberibe: 2,393 Tejipio: 3,461 Timbo: 399
3. BOD load of population served with sewerage:
   Load (1)=served population ×54 g/person/day ×(1−Reduction rate)
4. BOD load of unserved population (population with or without septic tanks):
   - load from population with septic tank = population with septic tank×54 g/person/day ×(1−R1)
     -R1: reduction rate by septic tank is assumed as 0.4
   - load from population without septic tank :
     population without septic tank x 54 g/person/day ×(1− R2)

Table 4 Basic Data for Proposed Sewerage Systems (1/2)

Line No.	Name of Sewerage Subsystem	Population in 2020 (people)	Sewerage Area		Capacity of Existing Treatment Facilities (m^3/day)	Sewage Flow in 2020 (m^3/day)			pollution Loads	
			Sewerage Area in 2020 (ha)	Area covered by Existing System (ha)		Daily Average	Daily Max.	Hourly Max.	BOD (mg/l)	SS (mg/l)
1	Caetes	60,779	884.5	705.1	8,900	11,014	12,395	16,682	299	332
2	Peixinhos	398,839	2,548.2	963.2	36,000	57,279	66,980	95,111	370	411
3	Caixa D'agua	35,305	454.7	-	-	5,134	5,868	7,820	371	413
4	Nova Descoberta	65,506	386.9	-	-	7,138	8,456	11,849	496	551
5	Aguazinha	59,005	372.6	2.7	-	6,569	7,775	10,858	485	539
6	Dois Unidos	63,495	422.9	23.6	-	8,243	9,675	13,600	416	462
7	Ponte dos Carvalhos	24,365	131.7	-	-	3,615	4,224	6,051	364	404
8	Charnequinha	15,096	66.5	-	-	2,174	2,552	3,684	375	417
9	Camaragibe/Recife 1	61,043	954.4	80.4	-	11,254	12,722	17,022	293	325
10	Camaragibe/Recife 2	16,477	268.7	-	-	3,220	3,642	4,882	276	307
11	Camaragibe 1	24,870	446.3	89.3	-	4,450	4,952	6,464	302	335
12	Camaragibe 2	26,107	246.3	-	-	3,380	3,906	5,327	417	463
13	Cabanga	304,394	2,260.4	1,799.4	80,000	55,239	64,163	91,362	314	348
14	Cordeiro	100,048	675.3	129.2	4,416	16,319	18,995	27,034	331	368
15	Caxanga	37,326	508.9	31.3	-	6,690	7,624	10,337	301	335
16	Igarassu 2	50,251	816.7	-	-	9,690	10,906	14,595	280	311
17	Ipojuca - Sede	17,856	105.4	-	-	2,687	3,134	4,473	359	399
18	Itapissuma 1	10,679	101.7	20.8	-	1,614	1,828	2,522	357	397
19	Itapissuma 2	10,416	99.2	-	-	1,574	1,783	2,460	357	397
20	Comportas	49,970	487.1	-	-	8,275	9,545	13,265	326	362
21	Curcurana	123,636	909.9	46.2	4,975	21,280	24,678	35,051	314	349
22	Prazeres	233,403	1,547.7	71.5	1,625	32,581	38,122	53,840	387	430
23	Jaboatao 1	45,472	396.2	151.2	-	5,956	6,865	9,442	412	458
24	Jaboatao 2	56,231	803.3	-	-	9,656	10,780	14,435	314	349
25	Ibura de Cima	51,984	321.9	153.3	-	6,097	7,137	10,010	460	512
26	Jaboatao 3	36,974	528.2	-	-	6,349	7,088	9,492	314	349
27	Bonanca	5,025	114.2	-	-	1,046	1,147	1,473	259	288
28	Moreno 1	18,792	208.8	-	-	2,969	3,345	4,566	342	380
29	Moreno 2	6,435	71.5	32.6	854	1,017	1,145	1,564	342	380

Table 4 Basic Data for Proposed Sewerage Systems (2/2)

Line No.	Name of Sewerage Subsystem	Population in 2020 (people)	Sewerage Area		Capacity of Existing Treatment Facilities (m^3/day)	Sewage Flow in 2020 (m^3/day)			pollution Loads	
			Sewerage Area in 2020 (ha)	Area covered by Existing System (ha)		Daily Average	Daily Max.	Hourly Max.	BOD (mg/l)	SS (mg/l)
30	Moreno 3	3,465	38.5	-	-	547	617	842	342	380
31	Camaragibe 3	30,238	621.8	150.9	-	5,967	6,599	8,555	274	304
32	Sao Lourenco 1	45,783	921.7	298.9	-	9,619	10,737	14,115	257	286
33	Sao Lourenco 2	33,288	652.7	-	-	6,981	7,813	10,309	258	286
34	Boa Viagem	159,314	1,281.3	152.1	-	27,794	32,113	45,402	311	346
35	Imbiribeira	56,497	550.4	168.2	-	10,103	11,627	16,251	302	336
36	Jardim Sao Paulo	56,102	497.1	104.6	-	8,384	9,723	13,511	375	416
37	Ibura de Baixo	179,179	1,399.9	93.9	-	23,557	27,391	38,075	406	451
38	Ignes Andreazza	6,579	47.4	37.9	2,217	988	1,148	1,620	360	400
39	Mangueira	42,642	285.8	112.8	3,732	6,430	7,505	10,641	363	403
40	Roda de Fogo	27,810	170.8	144.6	4,752	3,892	4,564	6,477	386	429
41	Janga	316,075	2,878.7	1,105.7	34,214	59,891	68,821	97,013	285	317
42	Paulista	68,930	783.3	345.2	6,750	11,052	12,460	16,997	337	374
43	Conceicao	62,445	709.6	50.0	-	12,515	14,281	19,888	269	299
44	Apipucos	10,339	129.7	-	-	2,076	2,374	3,281	279	311
45	Curado	18,626	102.5	102.5	7,021	2,031	2,414	3,399	495	550
46	P.P. de Galinhas	3,705	49.4	-	-	621	695	936	322	358
47	Jardim Paulista	24,851	282.4	282.4	3,085	3,954	4,451	6,066	339	377
48	Mirueira	34,009	401.5	401.5	-	5,478	6,169	8,386	335	372
49	Mutirao	6,380	72.5	65.3	1,700	1,334	1,525	2,132	258	287
50	Nova Cruz	5,244	92.0	-	-	1,053	1,184	1,577	269	299
51	Parque Capibaribe	23,475	460.3	425.2	2,735	4,923	5,510	7,270	258	286
52	Parque Pirapama	32,794	172.6	51.8	3,060	4,845	5,665	8,124	366	406
53	Vila Burity	11,397	68.1	20.5	1,250	1,350	1,578	2,220	456	507
54	Vila dos Milagres	14,289	99.4	99.4	1,853	1,853	2,139	2,994	416	463
55	27 de Novembro	9,369	48.6	3.2	963	963	1,150	1,620	525	584
Total of 55 Subsystems		**3,292,602**	**29,958**	**8,516**	**210,102**	**530,710**	**611,682**	**852,970**	**336**	**374**

Source: JICA Study Team

Table 5 Rehabilitation Items of Existing Sewerage Facilities (1/2)

Line No.	Name of Sewerage System	Pumping Stations to be Rehabilitated	Sewage Treatment Stations
1	Caetes	EEJ-4(Caetes-3), EEJ-22(Caetes-I)	ETEJ-03(Caetes): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
2	Peixinhos	EEJ-14(Varadoro), EEX-1(Arruda), EEX-2(Encruzilhada), EEX-3(Rui Barbos), EEX-11(Conventional Center), EEX-12(Jao Pualo-II), EEX-13(Varadouro-II), EEX-14(COHAB),	ETEX-01(Peixinhos): Repair and replacement of mechanical parts for screen, grit chambers, primary sedimentation tanks, bio-filter, final sedimentation tanks, pumps and digesters, repair of civil and architectural structures, and replacement of filter-media.
3	Aguazinha	EEX-20(Passarinho), EEX-21(Varadouro-I), EEX-22(Canaa)	None
4	Cabanga	EEX-4(Aurora), EEX-5(J. Brasil), EEX-7(Ponte Velha), EEX-10)Henrique Dias), EEC-1(Afogsdos), EEC-2(Internacional), EEC-8(D-3), EEC-9(Jiquia), EEC-15(Abdias de Carvalhos), EEC-17(Prive da Torre)	ETEC-01(Cabanga): Repair and replacement of mechanical parts for influent pumps, screens, grit chambers, primary sedimentation tanks, digesters, etc. and repair of civil and architectural structures.
5	Cordeiro	None	ETEC-8(Villa Iputinga) to be used as another facilities, separately from the main Subsystem: Repair and replacement of machinery parts for influent pumps, etc. and civil and architectural structures.
6	Curcurana	EEC-10(Barra de Jangada), EEC-21(Costa do Sol)	ETEC-03(Barra de Jangada) and ETEC-09(Praia Grande) to be used as another facilities, separately from the main Subsystem: Repair and replacement of machinery parts for influent pumps, etc., civil and architectural structures.
7	Prazeres	EEC-16(Jardim Piedade), EEC-29(Praia Grande)	ETEC-02(Jardam Piedade) to be used as another facilities, separately from the main Subsystem: Repair and replacement of machinery parts for influent pumps, aerators, etc., civil and architectural structures and dredging of a lagoon.
8	Moreno 2	None	ETES-13(Villa Liberdade): Repair of mechanical parts, internal pipings and desludging of a septic tank.
9	Boa Viagem	EEC-6(D-18), EEC-13(D-20), EEC-19(Boa Viagem)	None
10	Imbiribeira	EEC-20(Imbiribeira)	None
11	Ignes Andreazza	None	ETES-01(Ignes Andreaza): Repair and replacement of mechanical parts for influent pumps, screens, grit chambers, a sedimentation tank, aeration tanks, aerators, etc. and repair of civil and architectural structures.
12	Mangueira	None	ETEC-10(Mangeira): Repair and replacement of mechanical parts for influent pumps, screens, grit chambers, , etc. and repair of civil and dredging of a lagoon.
13	Roda de Fogo	EEC-24(Roda de Fogo-01), EEC-25(Roda de Fogo-02), EEC-26(Roda de Fogo-03), EEC-27(Roda de Fogo-04)	ETES-07(Villa Roda de Fogo): Repair of mechanical parts, internal pipings and desludging of a septic tank.

Table 5 Rehabilitation Items of Existing Sewerage Facilities (2/2)

Line No.	Name of Sewerage System	Pumping Stations to be Rehabilitated	Sewage Treatment Stations
14	Janga	EEJ-2(Marangupe-II), EEJ-3(pedras Altas), EEJ-5(Managupe-II), EEJ-8(Bairro Nova), EEJ-X(Dona Duda), EEJ-18(Inoccop Janga)	ETEJ-01(Janga): Repair and replacement of mechanical parts for screens, grit chambers, a sedimentation tank, aeration tanks, aerators, etc. and repair of civil and architectural structures.
15	Paulista	EEJ-19(Arthur Lundgren)	ETEJ-02(Arthur Lungren): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
16	Conceicao	EEJ-17	None
17	Curado	EES-1(Curado-IV), EES-4(Curado-II),	ETES-2(Curado-IV): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
18	Jardim Paulista	EEJ-7(Paulista)	ETEJ-04(Jardim Paulista): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
19	Mutirao	EEJ-11(Engenho Marangupe), EEJ-21(EE-2)	ETEJ-06(Mutirao): Repair of mechanical parts, internal pipings and desludging of a septic tank.
20	Parque Capibaribe	EES-13(Parque Capi-II), EES-14(Parque Capi-III)	ETES-04(Capibaribe Park): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
21	Parque Pirapama	None	ETES-03(Pirapama Housing): Repair and replacement of mechanical parts for screen, flow meter, aerators, etc., and dredging of lagoons.
22	Vila Burity	EEX-16(Villa Burity-I), EEX-17(Villa Burity-X), EEX-18(Villa Burity-III)	ETEX-02 to 05(Burity Village): Repair of mechanical parts, internal pipings and desludging of a septic tank.
23	Vila dos Milagres	EEX-16(Cabo-III), EES-21(Villa dos Milagres), EES-22(Villa dos Milagres)	ETEC-10(Mangeira): Repair and replacement of mechanical parts for influent pumps, screens, grit chambers, , etc. and repair of civil and dredging of a lagoon.
24	27 de Novembro	None	ETES-05(UR-II-Ibura): Repair of mechanical parts, internal pipings and desludging of a pond.

Source: Compiled by JICA Study Team based on the results of site investigation, reviewing the data prepared by COMPESA.

Table 6 Project Evaluation by River Basin

River Basin	Generated BOD Load (kg/day)	Basic Conditions				Urgency Based on the total pollution loads in the basin		Technical Evaluation Based on the reduced amount of BOD kg/day ~~and~~		Economic Evaluation Based on the value of EIRR for the river basin		Financial Evaluation Based on the value of FIRR for the river basin		Social Environmental Impact Based on Served population (Served population in poverty area)		Evaluation as a whole	
	Percentage (%) of the total Load	Area (ha)	Population In 2020	Reduction of BOD Load (kg/day) by Master Plan	Construction cost (1000 R$)												
Capibaribe	43,839 (22.2 %)	9,265	790,709	41,815	161,999	Very large	A	Very large	A	14.4%	A	6.9%	A	757,620 (185,568)	A	Very effective	A
Beberibe	34,209 (17.4 %)	4,586	640,041	29,814	94,099	Large	B+	Large	B+	18.9%	A	7.4%	A	622,150 (332,152)	A	Very Effective	A
Jaboatão	35,139 (17.8 %)	5,445	650,726	35,139	149,743	Very large	A	Very large	A	13.0%	A	4.7%	B	650,726 (187,095)	A	Very effective	A
Tejipio	30,366 (15.4 %)	4,629	561,128	29,366	104,871	Large	B	Large	B	11.2%	B	5.8%	A	542,596 (179,475)	A	Effective	B+
Timbo	25,874 (13.1 %)	5,077	478,766	24,088	71,209	Large	B	Large	B	18.7%	A	8.3%	A	445,679 (Non)	C	Effective	B
Other six river basins	27,681 (14.0 %)	7,423	51,259	14,786	53,599	Less	C	Small	C	3.7%	C	7.2%	A	273,831 (902)	C	Less effective	C
Whole Basins (M/P)	197,108 (100 %)	36,425	3,633,960	178,438	634,520	Very large	A	Very large	A	14.4%	A	6.1%	A	3,292,602 (885.192)	A	Very effective	A

Evaluation criteria

Evaluation Item	A	B	C
Technical evaluation	Above 10,000kg/day	10,000~5,000 kg/day	Below 5,000 kg/
Economic evaluation	Above 12%	12% - 10%	Below 10%
Financial evaluation	Above 5%	5% - 2%	Below 2%
Social environmental evaluation	Very high	High	Low

Table 7 Basic Data for Priority Projects

System	River Basin	BOD load generated in the River Basin (kg/day) (Ratio (%) of the total BOD load in the RMR)	Basic Conditions: Area (ha)	Basic Conditions: Population in 2020.	Basic Conditions: BOD load (kg/day)	Basic Conditions: Construction cost (1000R$)	Urgency (Based on the river basin and location.)		Technical Evaluation (Based on the reduction amount of BOD load kg/day, and reduction rate (%) of the total load from the basin)		Social Environmental Impact (Based on the served population in the system and the served population in the poverty areas.)		Impacts by Construction		Evaluation as a whole	
Conceição	Timbo	25,874 (13.1%)	710	62,445	3,372	23,779	Urgent	B	Reduction amount of BOD: 3,035 kg/day, Reduction rate:14%	C	Served population: 62,445 Served population in poverty area: No data.	C	No significant impacts expected	B	Effective	B
Janga	Timbo	25,874 (13.1%)	2,879	316,075	17,078	63,443	Very urgent	A	Reduction amount of BOD: 15,370 kg/day, Reduction rate: 71%	A	Served population: 316,075 Served population in poverty area: No data.	A	No significant impacts are expected.	A	Very effective	A
Cabanga	Capibaribe	43,839 (22.2%)	2,260	304,394	17,319	40,836	Very urgent	A	Reduction amount of BOD: 15,587 kg/day, Reduction rate: 41%	A	Served population: 304,394, Served population in poverty areas: 67,116 (22%)	A	No significant impacts expected.	A	Very effective	A
Boa Viagem	Tejipio	30,366 (15.4%)	1,281	159,314	8,649	49,936	Very urgent	A	Reduction amount of BOD: 7,784 kg/day, Reduction rate:29%	B	Served population: 159,314, Served population in poverty area:32,952 (21%)	A	Some impacts to the housing area nearby.	C	Very effective	A-
Cordeiro	Capibaribe	43,839 (22.2%)	675	100,048	5,403	23,026	Urgent	B	Reduction amount of BOD: 4,862 kg/day, Reduction rate: 13%	C	Served population: 100,048 Served population in poverty areas: 29,215 (29%)	B+	Some impacts to the surrounding poverty area nearby.	C	Effective	B+
Prazeres	Jaboatao	35,139 (17.8%)	1,548	233,403	12,604	60,185	Very Urgent	A	Reduction amount of BOD: 11,343 kg/day, Reduction rate: 36%	A	Served population: 233,403, Served population in poverty areas:104,196 (44%)	A	Impacts unknown	B	Effective	B
Curcurana	Jaboatao	35,139 (17.8%)	910	123,636	6,676	35,720	Urgent	B	Reduction amount of BOD: 6,008 kg/day, Reduction rate:19%	B	Served population: 123,636, Served population in poverty area:19,135 (15%)	B-	No significant impacts expected.	A	Effective	B-

Evaluation criteria

Evaluation Item	A	B	C
Technical evaluation	Above 10,000 kg/day	10,000～5,000 kg/day	Below 5,000 kg/
Social environmental evaluation	Very high	High	Low

Table 8 Trunk Sewer and Branch Sewer for the Seven Sewerage Systems (1/2)

(A) Gravity Flow

Unit: m

Diameter of Pipe(mm)	Material	Conceicao	Janga	Cabanga	Boa Viagem	Cordeiro	Prazeres	Curcurana	Total (m)
ϕ 300	PVC	580	2,002	1,645	4985	1,625	3,885	2,030	16,752
ϕ 400	PVC	2,040	7,065	835	2865	4,845	3,990	1,510	23,150
ϕ 500	RC	3060	1250		1880	920	1490	1495	10,095
ϕ 600	RC		370		1915	850	1240	785	5,160
ϕ 700	RC	780	1248		1040	300	230	2280	5,878
ϕ 800	RC				2835	100	680	1435	5,050
ϕ 1000	RC					40	835	925	1,800
ϕ 1200	RC				330		925	20	1,275
ϕ 1500	RC						600		600
Total		6,460	11,935	2,480	15850	8,680	13,875	10,480	69,760

(B) Pressure Flow

Diameter of Pipe(mm)	Material	Conceicao	Janga	Cabanga	Boa Viagem	Cordeiro	Prazeres	Curcurana	Total (m)
ϕ 100	PVC	245		250					495
ϕ 150	PVC		300	1055	780			455	2,590
ϕ 200	PVC	720		465	750			1515	3450
ϕ 250	PVC		1020	435				1770	3225
ϕ 300	PVC	690				1360	750	2190	4990
ϕ 350	CIP			1200	440				1640
ϕ 400	CIP		3300				500		3800
ϕ 450	CIP					745		1515	2260
ϕ 500	CIP		2180	3350			3515		9045
ϕ 600	CIP		2800		2550				5350
ϕ 700	CIP		7200				2680		9880
Total		1655	16800	6755	4520	2105	7445	7445	46725

Table 8 Trunk Sewer and Branch Sewer for the Seven Sewerage Systems (2/2)

(C) Rehabilitation (Replacement)

Diameter of Pipe(mm)	Material	Conceicao	Janga	Cabanga	Boa Viagem	Cordeiro	Prazeres	Curcurana	Total (m)
ϕ 200	PVC		425						425
ϕ 300	PVC		3190						3190
ϕ 350	CIP						1760		1760
ϕ 500	CIP			630					630
ϕ 800	CIP			210					210
ϕ 1000	CIP			890					890
ϕ 1200	CIP			1095					1095
ϕ 1500	CIP			385					385
Total			3615	3210	0	0	1760	0	8585

(D) Branch and Collector Sewers

Diameter of Pipe (mm)		Total (m)
Side walk	150 PVC	251,842
	200PVC	83,948
	250PVC	83,949
	Sub total	419,739
Branch	150PVC	979,391
Total		1,399,130

Table 9 Number of Pumping Station in each Sewerage System

Sewerage System	Quantities					
	Manhole Type P/S	Simplified Type(I) P/S	Simplified Type(II) P/S	Standard Type(I) P/S	Standard Type(II) P/S	Total
Conceicao	3	1	0	0	0	4
Janga	2	2	1	0	0	5
Cabanga	6	0	0	0	0	6
Boa Viagem	2	1	0	1	1	5
Cordeiro	3	2	1	0	0	6
Prazeres	2	0	2	0	1	5
Curcurana	11	0	1	0	0	12
Total	29	6	5	1	2	43

P/S : Pumping Station

Table 10 Overall Evaluation of Priority Projects

System	River Basin	Generated BOD Load in the River Basin (kg/day) (Ratio (%) of the total pollution load in the RMR)	Basic Conditions: Area (ha)	Basic Conditions: Population in 2020.	Basic Conditions: BOD load (kg/day)	Basic Conditions: Construction cost (1000R$)	Urgency: Based on the river basin and location.		Technical Evaluation: Based on the reduction amount of BOD load (kg/day), and reduction rate (%) of the total BOD load from the basin.		Economic Evaluation: Based on the value of EIRR for the Sewerage System.		Financial Evaluation: Based on the value of FIRR for the Sewerage System.		Social Environmental impact: Based on the number of serviced population, and the served population in the poverty areas.		Impacts by Construction		Evaluation as a whole	
Conceição	Timbo	25,874 (13.1%)	853	62,440	3,372	16,135	Urgent	B	Reduction amount of BOD: 3,035 kg/day, Reduction rate:11.7%	C	12.6%	A	3.1%	B	Served population: 62,445 Served population in poverty area: No data.	C	Impacts unknown, but no significant impacts expected	B	Effective	B —
Janga	Timbo	25,874 (13.1%)	3,954	322,450	17,423	58,683	Very urgent	A	Reduction amount of BOD: 15,681 kg/day, Reduction rate: 60.6%	A	12.8%	A	9.9%	A	Served population: 322,450 Served population in poverty area: No data.	A	No significant impacts expected.	A	Very effective	A
Cabanga	Capibaribe	43,839 (22.2%)	2,671	306,690	17,443	39,765	Very urgent	A	Reduction amount of BOD: 15,699 kg/day, Reduction rate: 35.8%	A	15.5%	A	15.0%	A	Served population: 306,690, Served population in poverty areas: 72,869 (24%)	A	No significant impacts expected.	A	Very effective	A
Boa Viagem	Tejipio	30,366 (15.4%)	1,203	157,010	8,525	27,919	Very urgent	A	Reduction amount of BOD: 7,673 kg/day, Reduction rate:25.2%	B	11.7%	B	4.1%	B	Served population: 157,010, Served population in poverty area:34,008 (22%)	A	Some impacts to the housing area nearby.	C	Effective	B+
Cordeiro	Capibaribe	43,839 (22.2%)	1,054	109,230	5,898	21,056	Urgent	B	Reduction amount of BOD: 5,508 kg/day, Reduction rate: 12.1%	C	10.8%	B	6.6%	A	Served population: 109,230 Served population in poverty areas: 29,215 (29%)	B +	Some impacts to the surrounding poverty area nearby.	C	Effective	B+
Prazeres	Jaboatao	35,139 (17.8%)	1,570	233,400	12,604	36,500	Very Urgent	A	Reduction amount of BOD: 11,344 kg/day, Reduction rate: 32.3%	A	14.1%	A	4.9%	B	Served population: 233,403, Served population in poverty areas:138,204 (60%)	A	Impacts Unknown, but no significant impacts expected	B	Very effective	A —
Curcurana	Jaboatao	35,139 (17.8%)	1,160	150,160	8,108	26,362	Urgent	B	Reduction amount of BOD: 7,297 kg/day, Reduction rate:20.8%	B	14.5%	A	7.2%	A	Served population: 150,160, Served population in poverty area:48,011 (32%)	B -	No significant impacts expected.	A	Very effective	A-

Evaluation Criteria

Evaluation Item	A	B	C
Technical evaluation (Reduction amount of BOD)	Above 10,000 kg/day	10,000～5,000 kg/day	Below 5,000 kg/
Economic evaluation	Above 12.0 %	12.0 %～10.0%	Below 10.0 %
Financial evaluation	Above 5.0 %	5.0 %～2.0 %	Below 2.0 %
Social environmental evaluation	Very high	High	Low

FIGURES

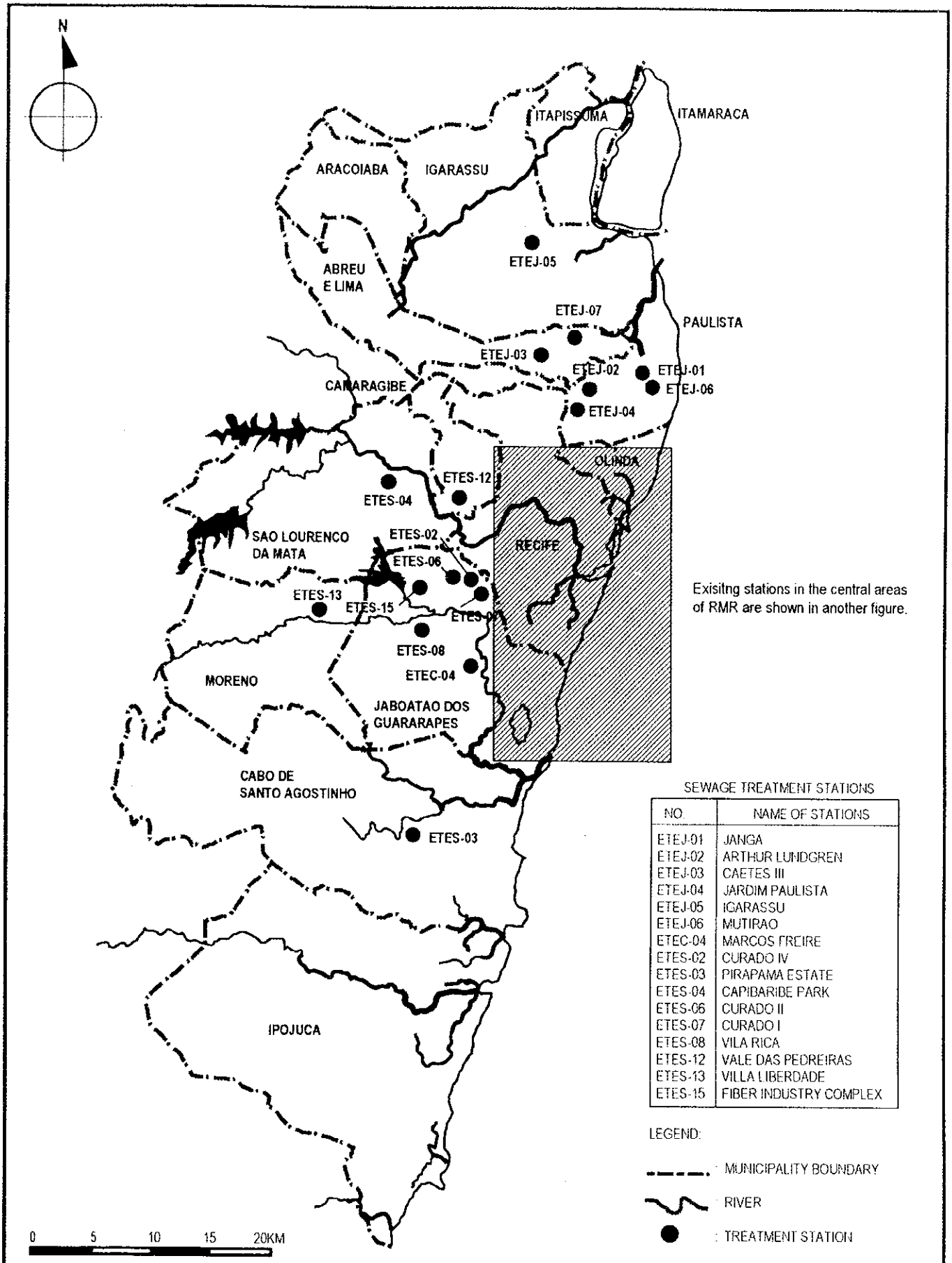


Fig.1 **Locations of Existing Sewerage Systems in Entire RMR**

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

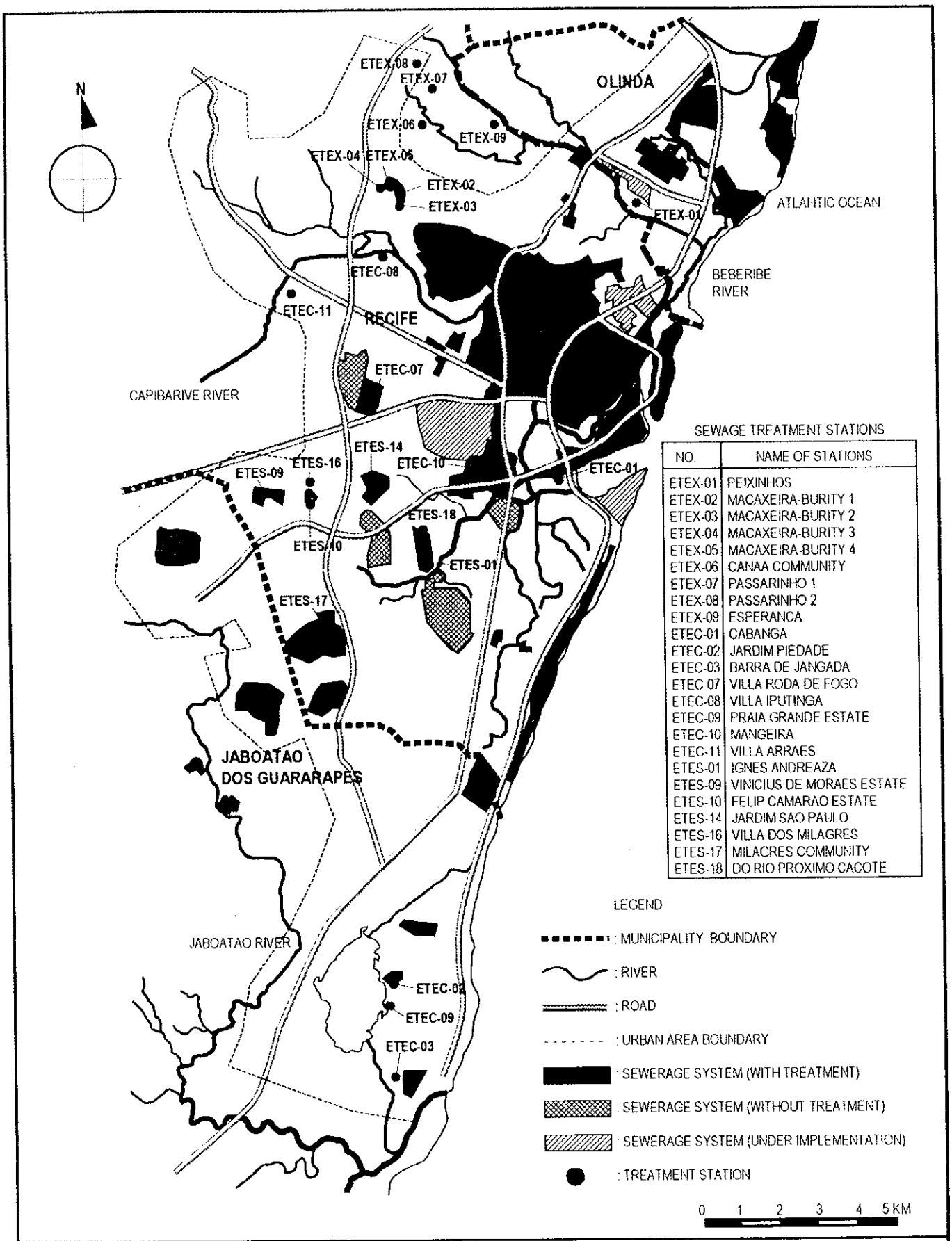


Fig.2 **Locations of Existing Sewerage Systems in Central Area of RMR**

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

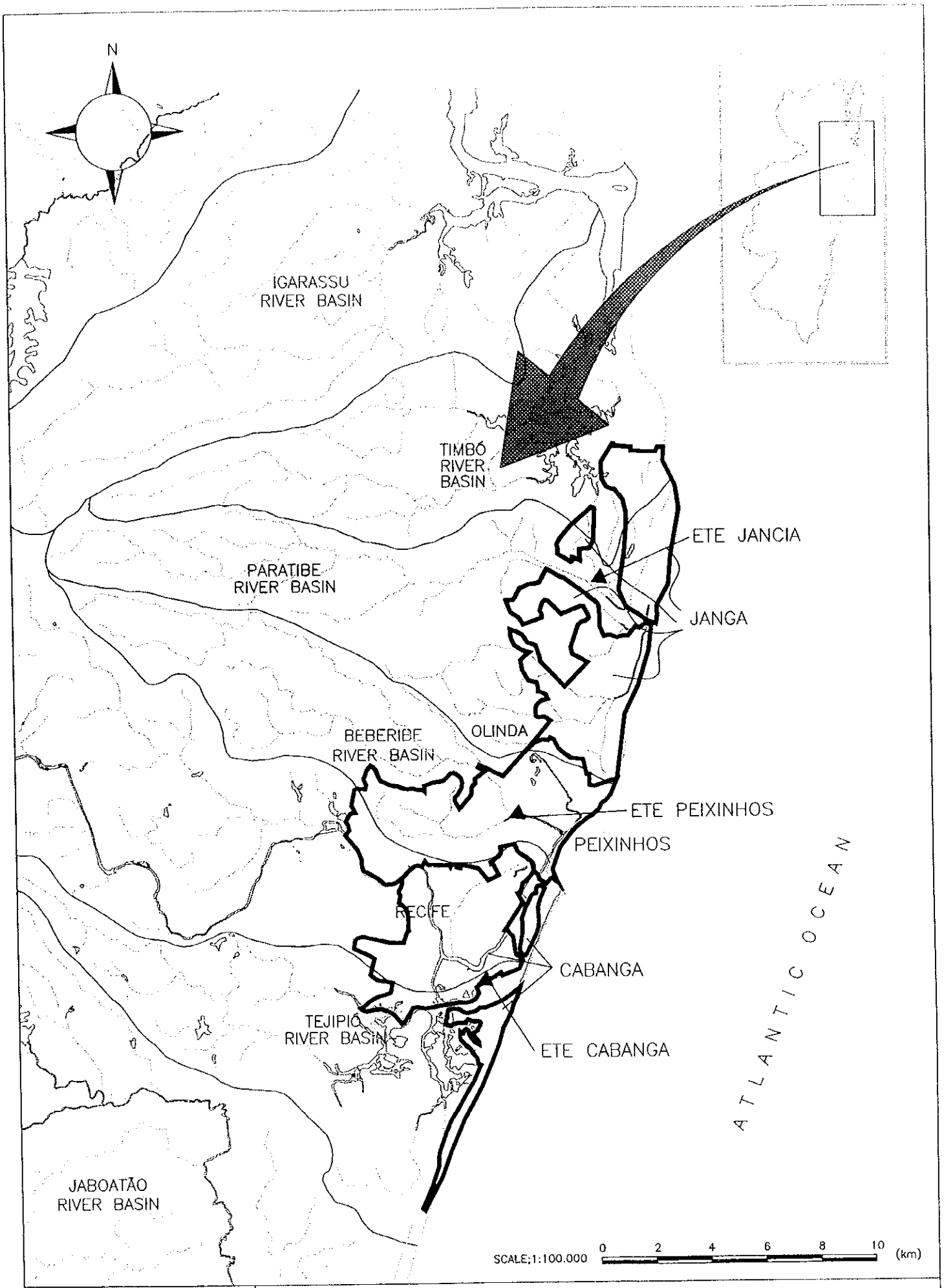


Fig.3	Location of Major Treatment Stations (Janga, Peixinhos and Cabanga Systems)

THE STUDY ON STORMWATER DRAINAGE AND WASTEWATER MANAGEMENT PLAN FOR RMR

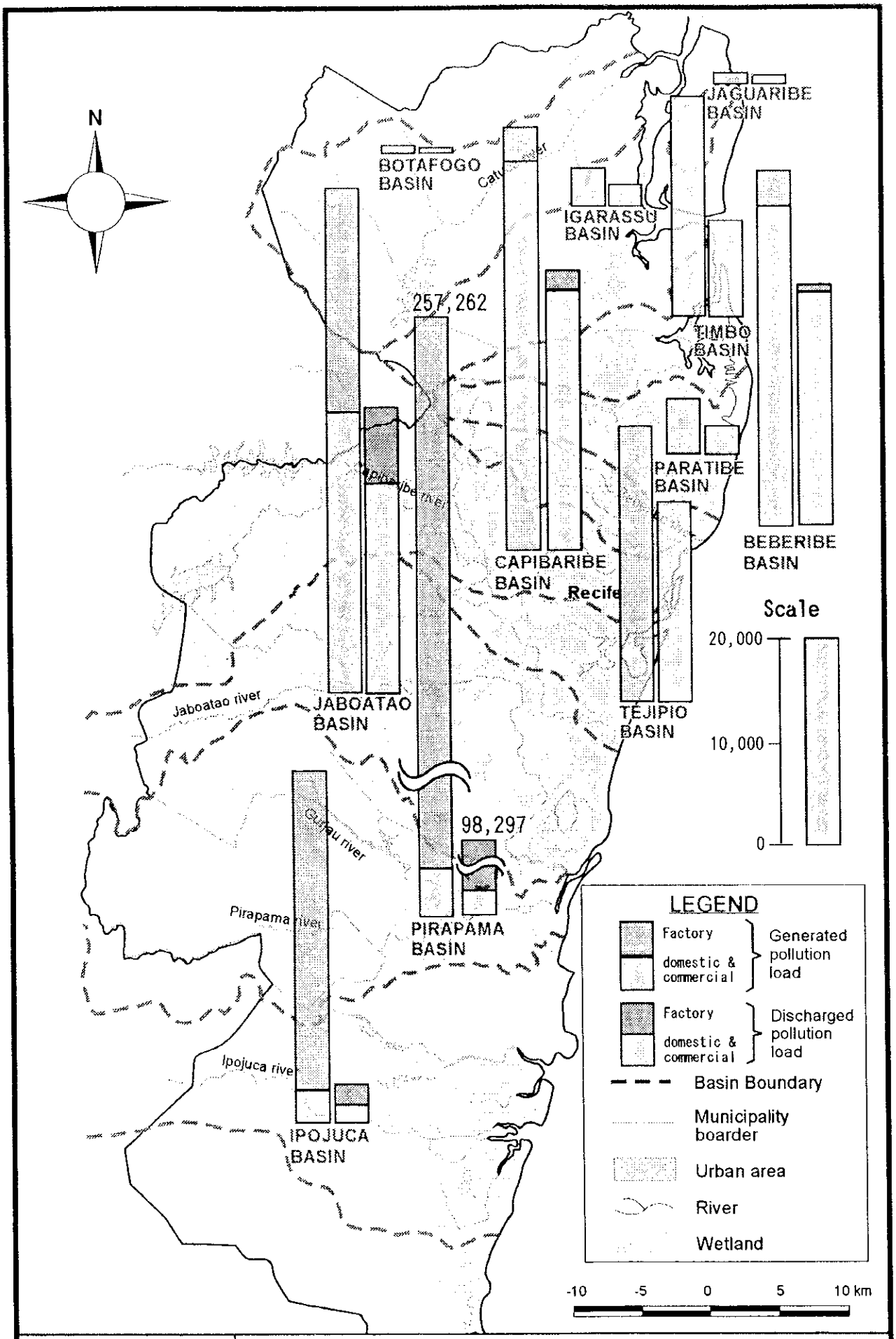
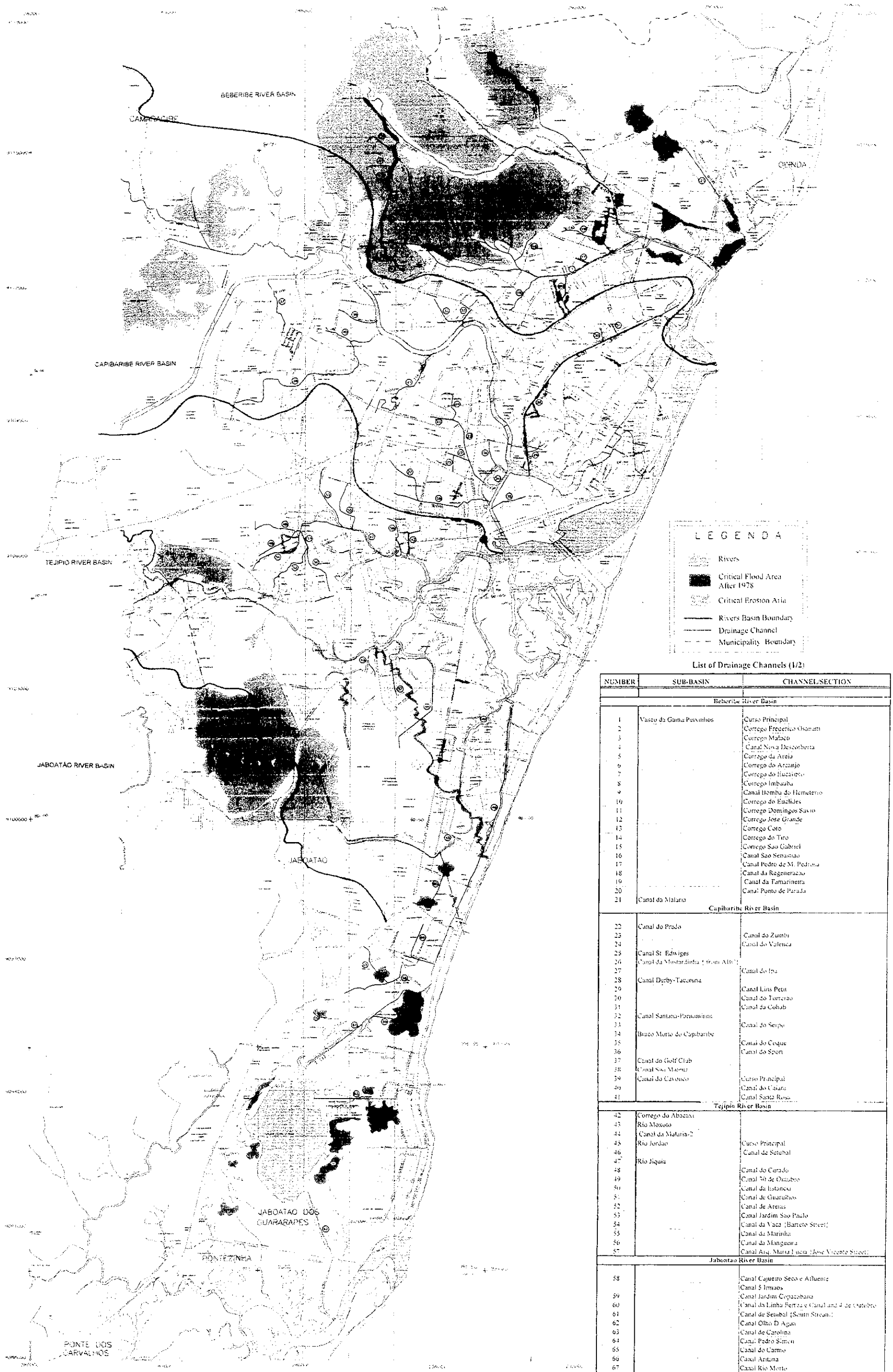


Fig.4	Present Distribution of Pollution Load in the RMR

THE STUDY ON STORMWATER DRAINAGE AND WASTEWATER MANAGEMENT PLAN FOR RMR



List of Drainage Channels (1/2)

NUMBER	SUB-BASIN	CHANNEL/SECTION
	Beberibe River Basin	
1	Vasco da Gama-Peixinhos	Curso Principal
2		Corrego Frederico Osanam
3		Corrego Malaco
4		Canal Nova Descoberta
5		Corrego da Areia
6		Corrego do Arcanjo
7		Corrego do Bucaxixo
8		Corrego Imbauba
9		Canal Bomba do Hemeterio
10		Corrego do Euclides
11		Corrego Domingos Savio
12		Corrego Jose Grande
13		Corrego Coto
14		Corrego do Tiro
15		Corrego Sao Gabriel
16		Canal Sao Sebastiao
17		Canal Pedro de M. Pedrosa
18		Canal da Regeneracao
19		Canal da Tamarineira
20		Canal Ponto de Parada
21	Canal da Malaria	
	Capibaribe River Basin	
22	Canal do Prado	
23		Canal do Zumbi
24		Canal do Valenca
25	Canal St. Ediviges	
26	Canal da Mustardinha (from Alto)	
27		Canal do Ipa
28	Canal Derby-Tacoruna	
29		Canal Lins Petit
30		Canal do Torreao
31		Canal da Cohab
32	Canal Santana-Parnamirim	
33		Canal do Serpo
34	Braco Morto do Capibaribe	
35		Canal do Coque
36		Canal do Sport
37	Canal do Golf Club	
38	Canal Sao Marcos	
39	Canal do Cavouco	Curso Principal
40		Canal do Caiara
41		Canal Santa Rosa
	Tejipio River Basin	
42	Corrego do Abacaxi	
43	Rio Moxoto	
44	Canal da Malaria-2	
45	Rio Jordao	Curso Principal
46		Canal de Setubal
47	Rio Jiquia	
48		Canal do Cerado
49		Canal 30 de Outubro
50		Canal da Estancia
51		Canal de Guarulhos
52		Canal de Areias
53		Canal Jardim Sao Paulo
54		Canal da Vaca (Barreto Street)
55		Canal da Marinha
56		Canal da Mangueira
57		Canal Ang. Maria Lucia (Jose Vicente Street)
	Jaboatao River Basin	
58		Canal Cajueiro Seco e Afluente
		Canal 5 Irmaos
59		Canal Jardim Copacabana
60		Canal da Linha Ferrea e Canal and 4 de Outubro
61		Canal de Setubal (South Stream)
62		Canal Olho D'Agua
63		Canal de Carolina
64		Canal Pedro Simon
65		Canal do Carmo
66		Canal Aritana
67		Canal Rio Morto
68		Canal Bulrans
69		Canal do Matadouro

Fig.5 Flood Area (after 1978)

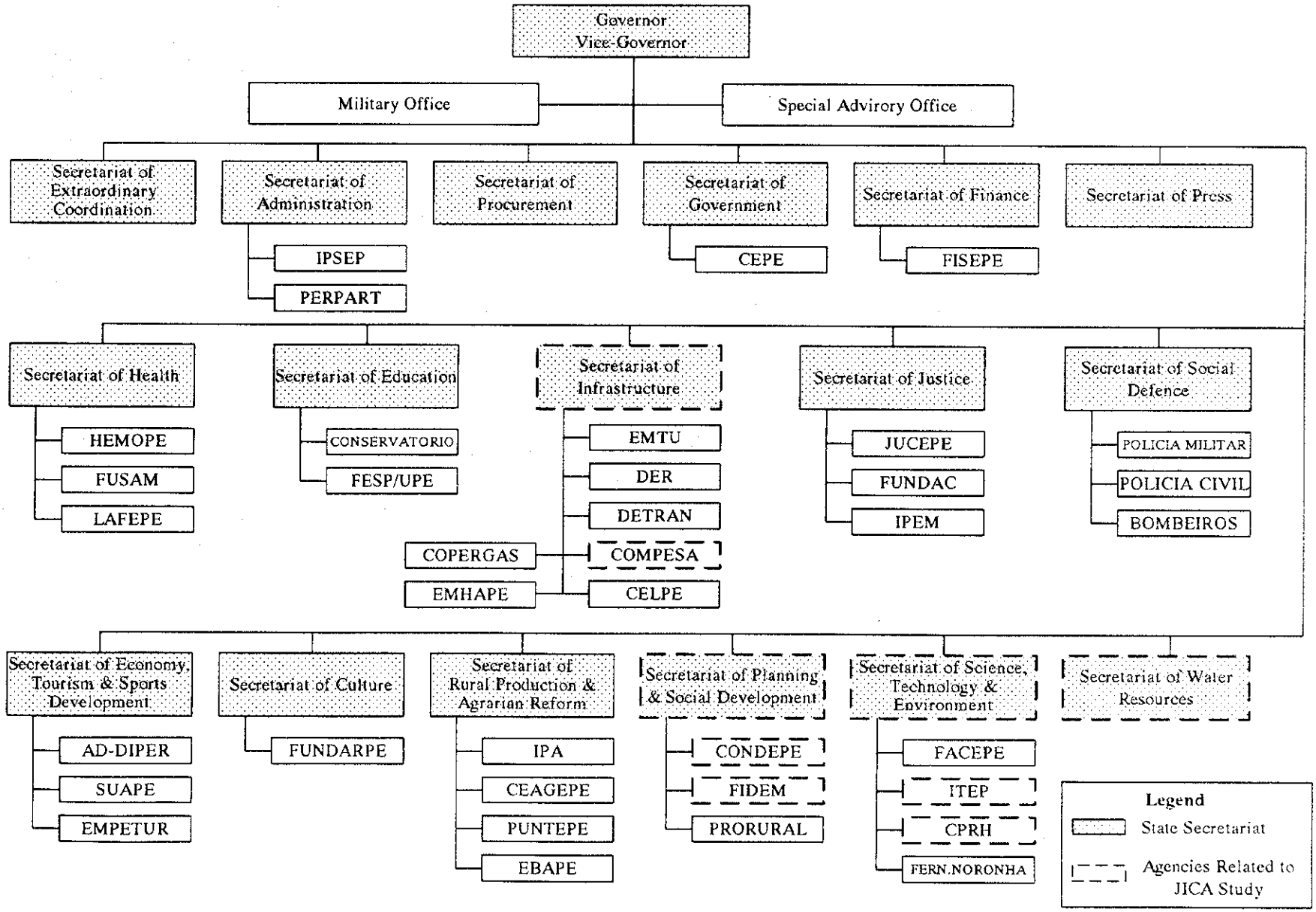


Fig.6 **Organizational Diagram of Pernambuco State Government**

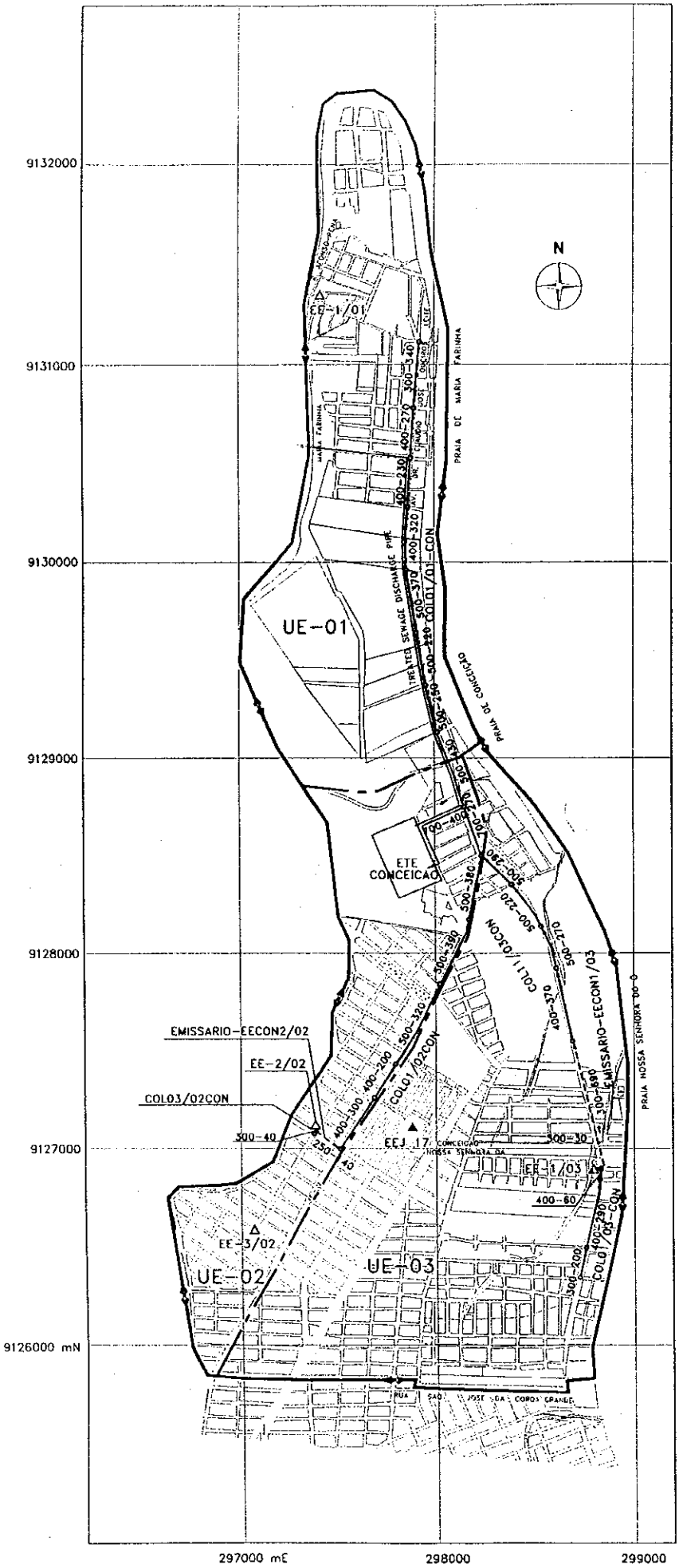
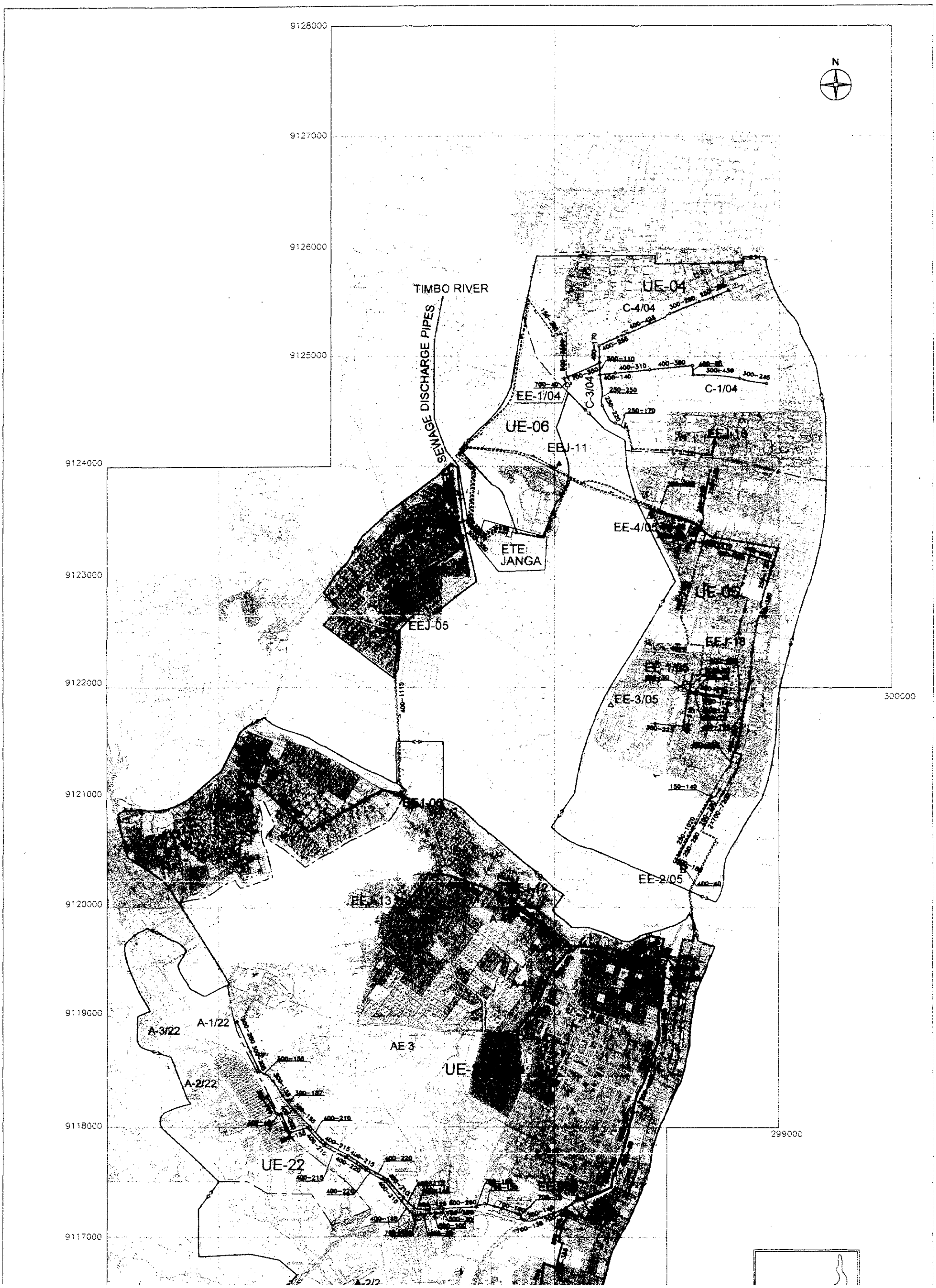


Fig.7	Layout Plan of Conceicao System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR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9127000
9126000
9125000
9124000
9123000
9122000
9121000
9120000
9119000
9118000
9117000
300000
299000
TIMBO RIVER
SEWAGE DISCHARGE PIPES
UE-04
C-4/04
C-1/04
C-3/04
EE-1/04
UE-06
EEJ-11
EEJ-18
EE-4/05
ETE JANGA
UE-05
EEJ-05
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A-3/22
A-1/22
A-2/22
AE 3
UE-22

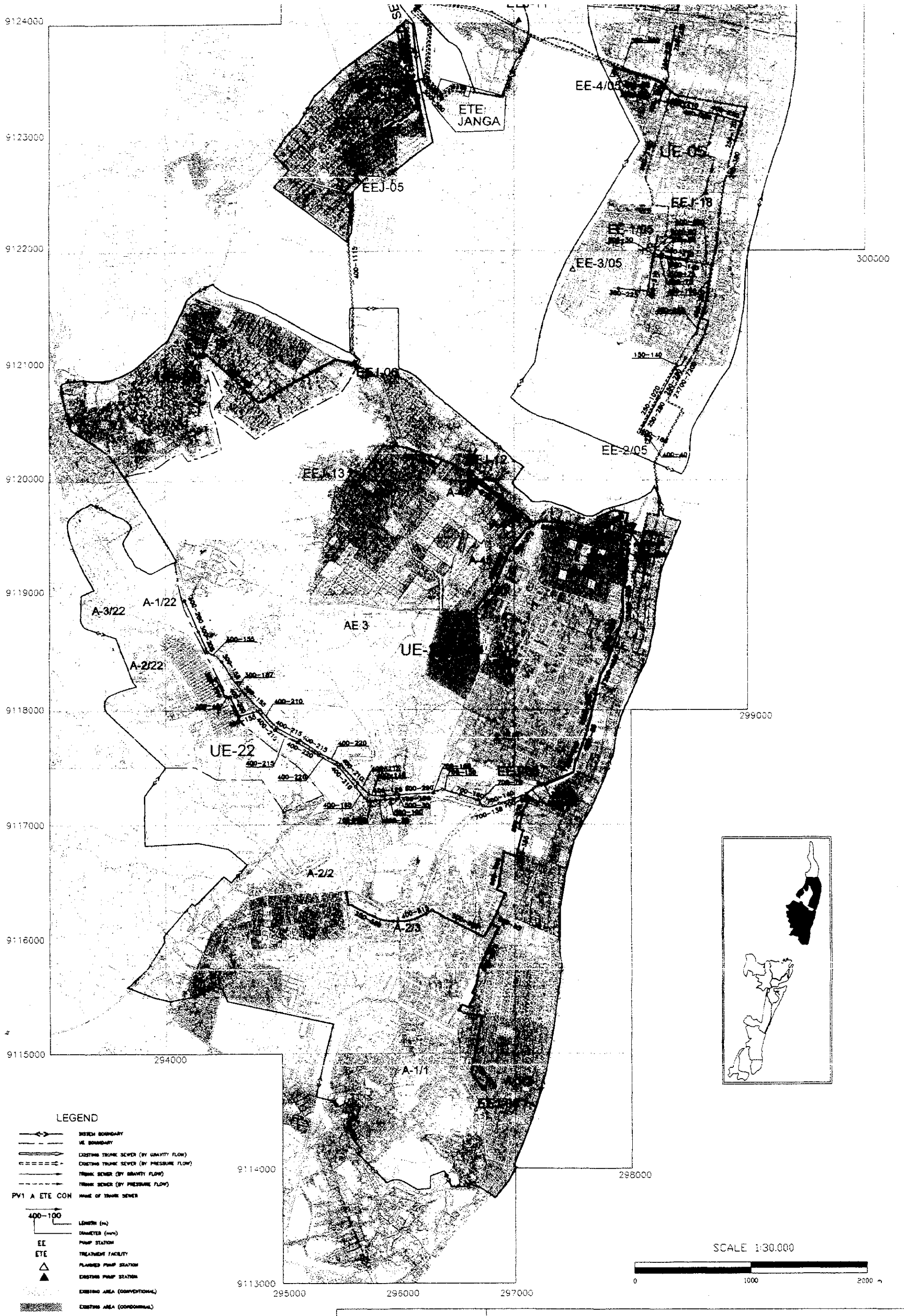
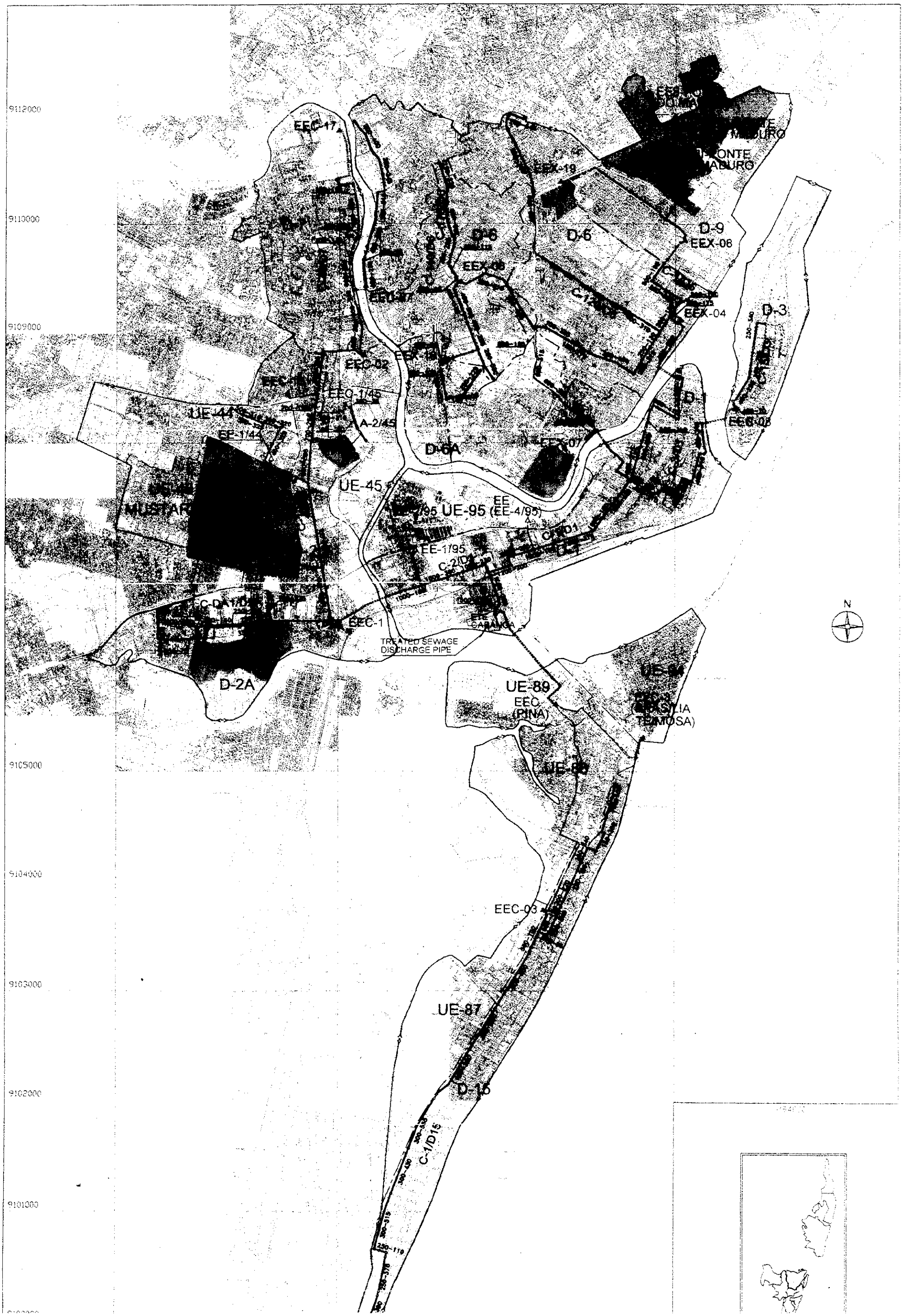


Fig.8 Layout Plan of Janga System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR


9112000
9110000
9109000
9105000
9104000
9103000
9102000
9101000
EEC-17
EEX-19
D-6
D-5
D-9
EEX-06
EEX-08
EEX-04
D-3
EEC-02
EEC-1/45
UE-44
EE-1/44
A-2/45
D-6A
EEC-08
UE-45
UE-95 (EE-4/95)
EE-1/95
C-2/D1
EEC-1
TREATED SEWAGE
DISCHARGE PIPE
D-2A
UE-89
EEC
(PINA)
EEC-3
(MASSIA
TEMOSA)
EEC-03
UE-87
D-15
C-1/D15
N

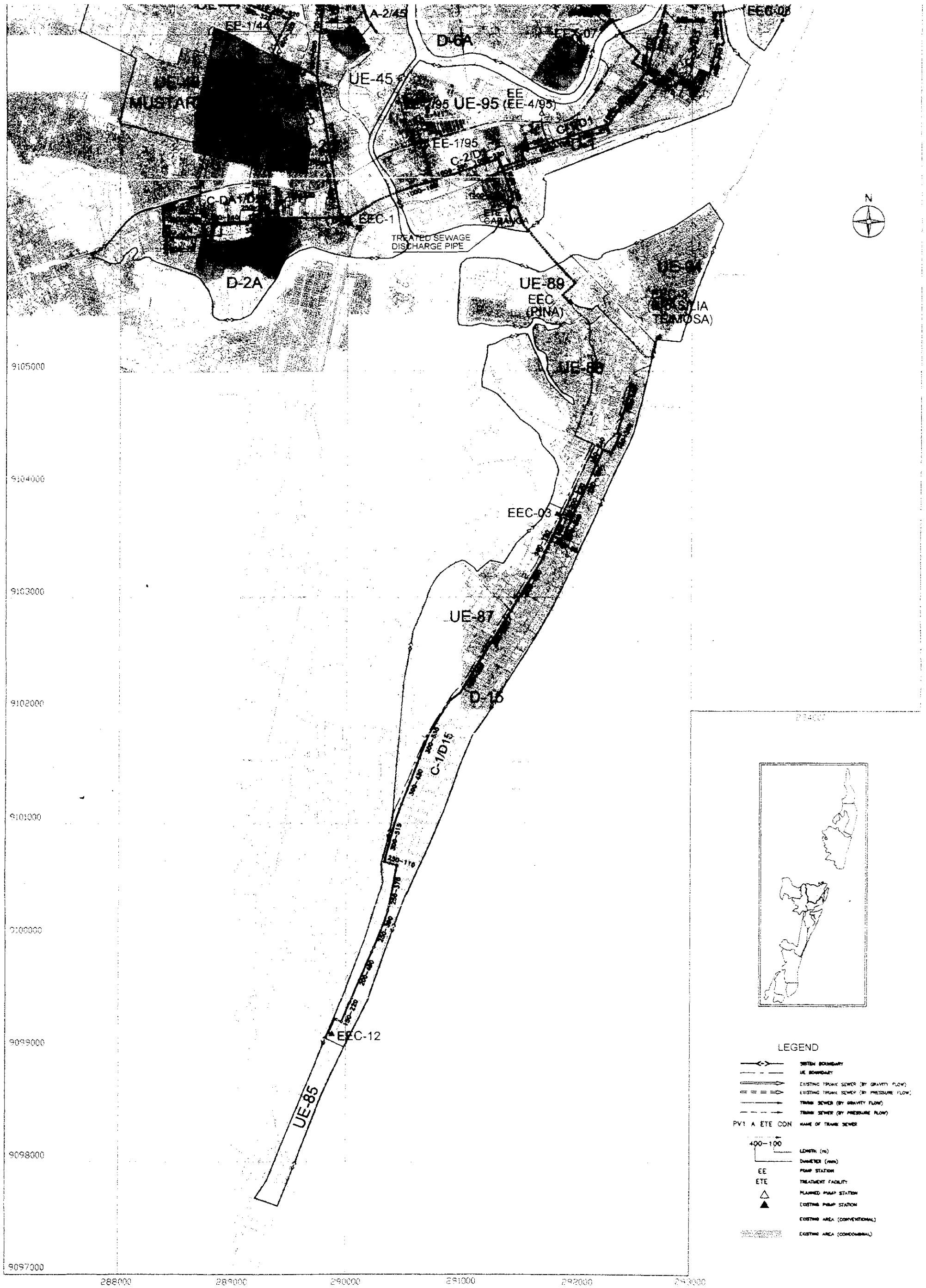
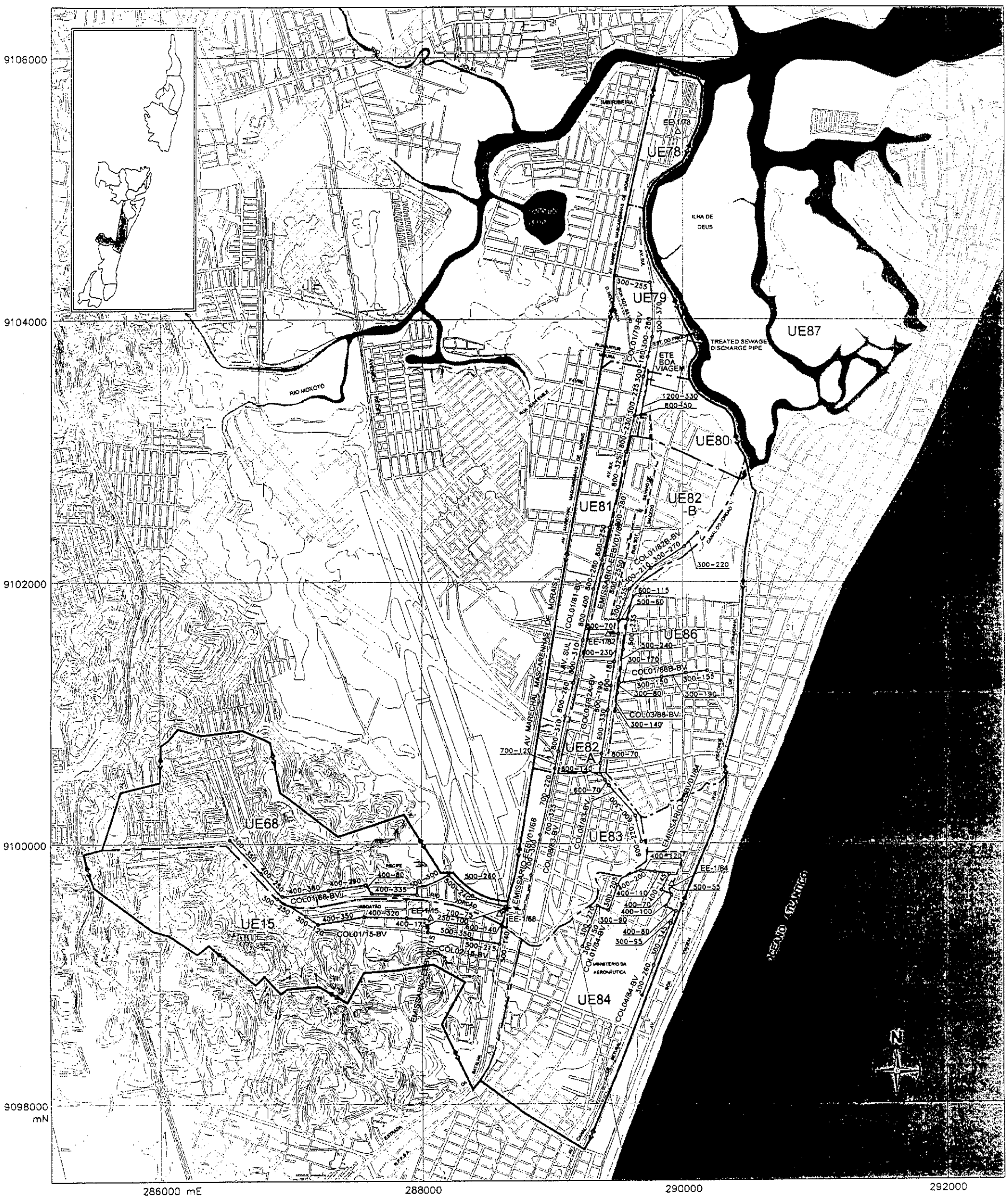


Fig.9 Layout Plan of Cabanga System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR



LEGEND

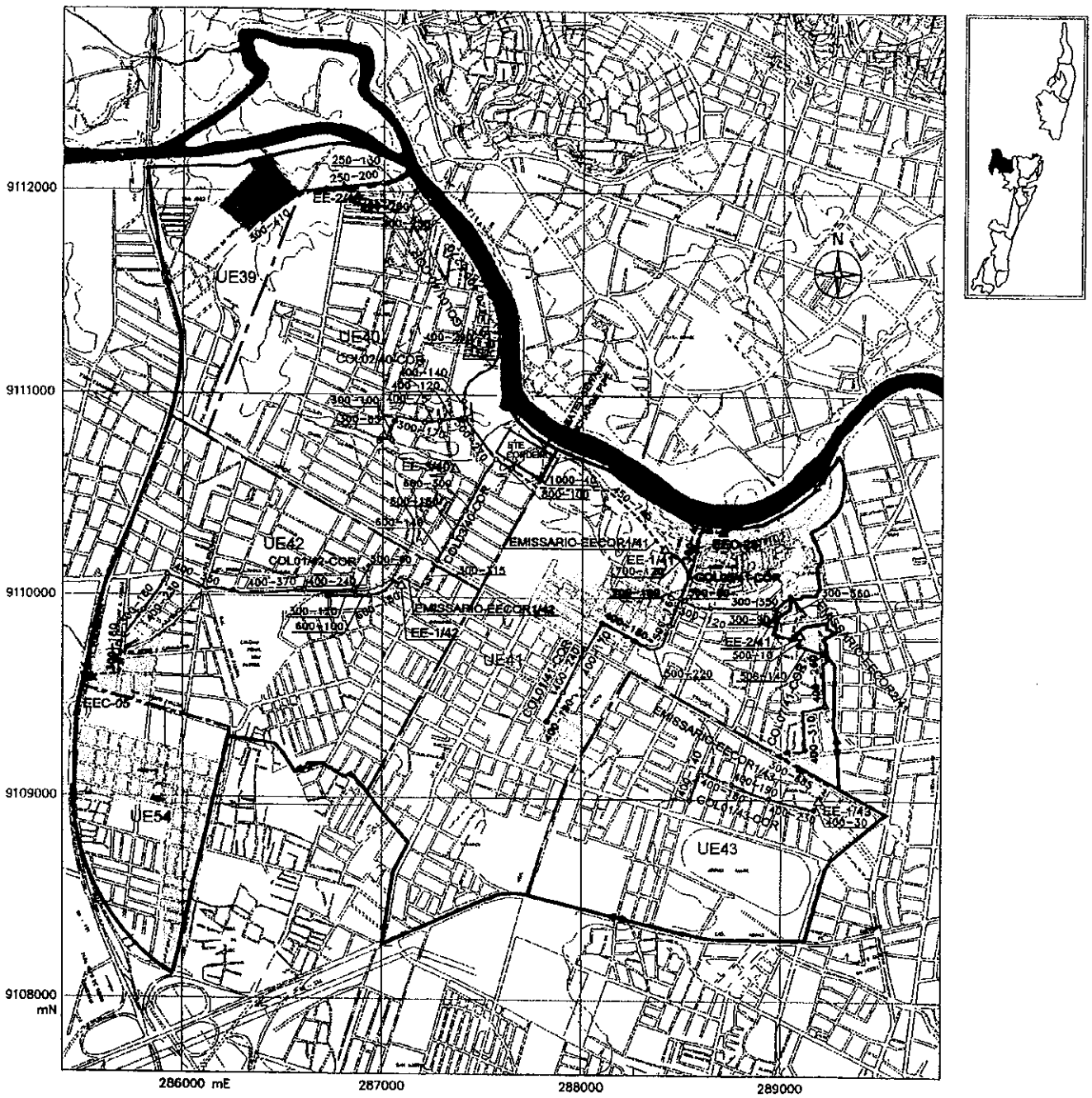
- SISTEM BOUNDARY
- UE BOUNDARY
- TRUNK SEWER (BY GRAVITY FLOW)
- TRUNK SEWER (BY PRESSURE FLOW)
- COL01/81-BV — NAME OF TRANK SEWER
- 400-100 — LENGTH (m); DIAMETER (mm)
- EE — PUMP STATION
- ETE — TREATMENT FACILITY
- △ — PLANNED PUMP STATION
- ▲ — EXISTING PUMP STATION

SCALE 1:30.000

0 1000 2000 m

Fig.10	Layout Plan of Boa Viagem System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR



LEGEND

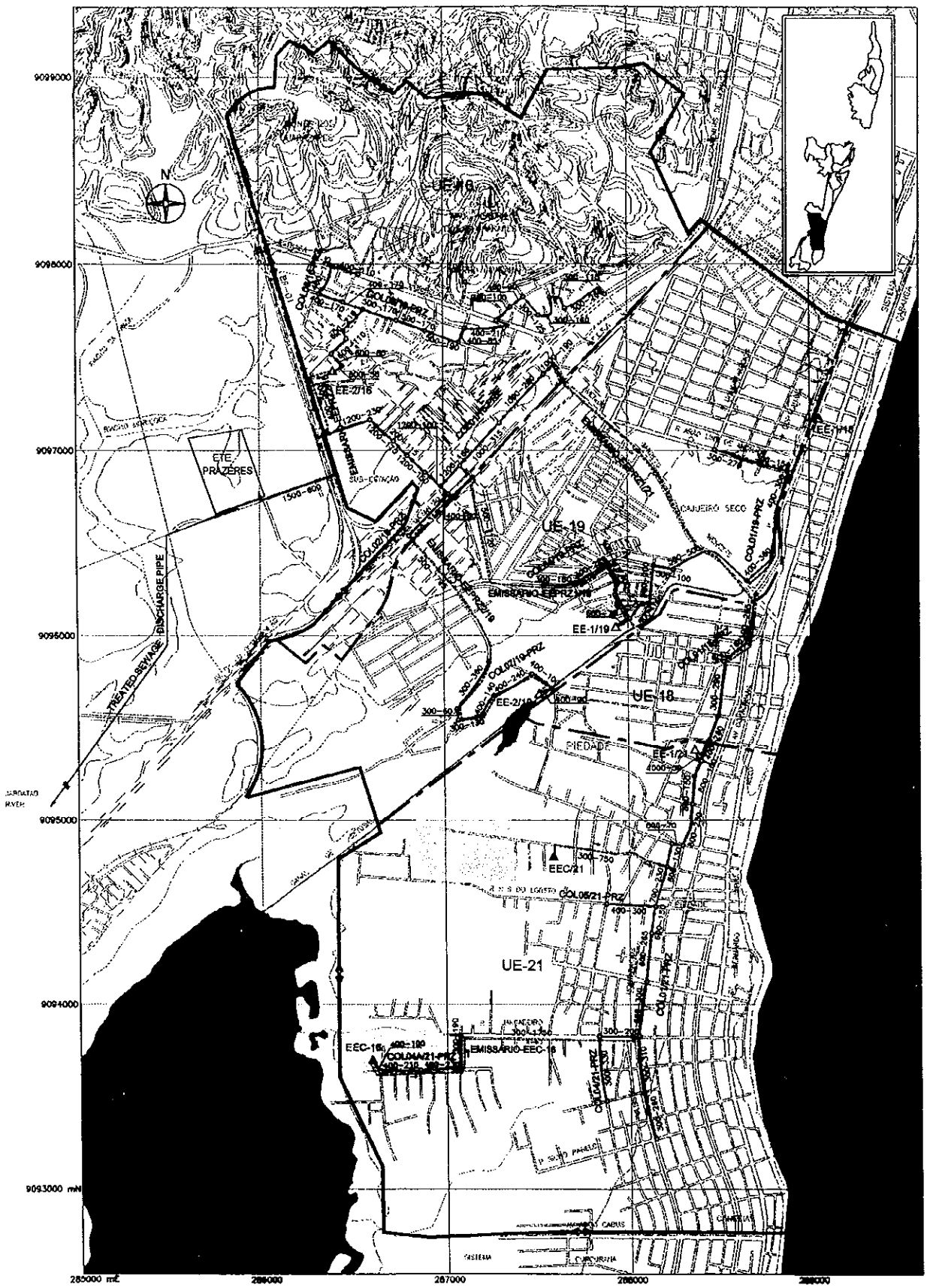
- SYSTEM BOUNDARY
- UE BOUNDARY
- TRUNK SEWER (BY GRAVITY FLOW)
- TRUNK SEWER (BY PRESSURE FLOW)
- COL01/40-COR — NAME OF TRUNK SEWER
- 400–100 — LENGTH (m); DIAMETER (mm)
- EE — PUMP STATION
- ETE — TREATMENT FACILITY
- △ PLANNED PUMP STATION
- ▲ EXISTING PUMP STATION
- EXISTING AREA (CONVENTIONAL)
- EXISTING AREA (CONDOMINIAL)

SCALE 1:30.000

0 — 1000 m

Fig.11	Layout Plan of Cordeiro System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR



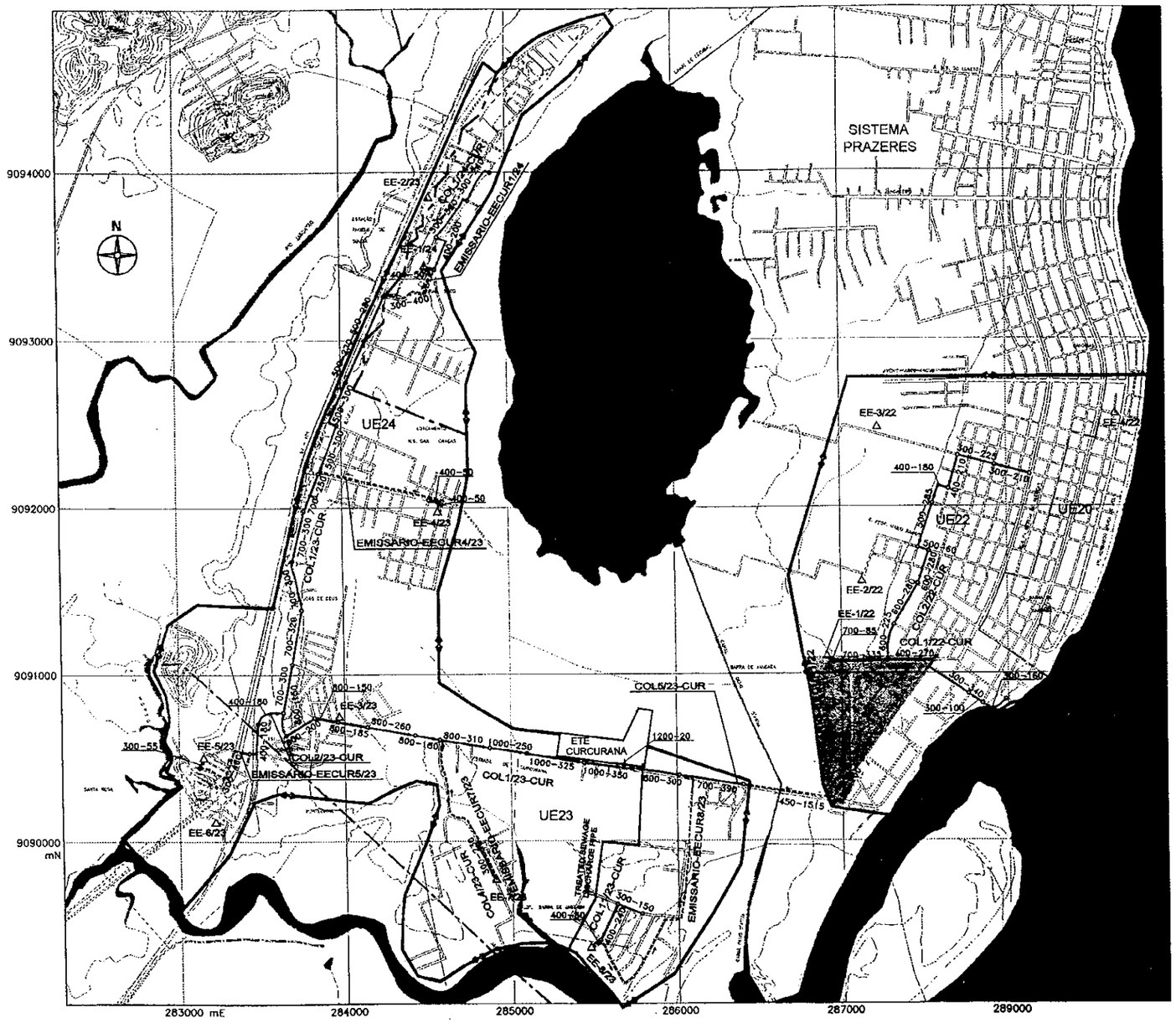
LEGEND

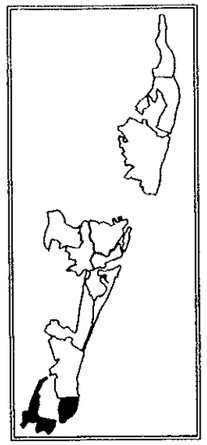
- SERVICE BOUNDARY
- UE BOUNDARY
- TRUNK SEWER (BY GRAVITY FLOW)
- TRUNK SEWER (BY PRESSURE FLOW)
- COL01/16-PRZ — NAME OF TRUNK SEWER
- 400-100 — LENGTH (m) / DIAMETER (mm)
- EE — PUMP STATION
- ETE — TREATMENT FACILITY
- △ — PLANNED PUMP STATION
- ▲ — EXISTING PUMP STATION
- EXISTING AREA (CONDOMINIAL)
- EXISTING AREA (CONDOMINIAL)

SCALE 1:30,000

0 500 1000 m

Fig.12	Layout Plan of Prazeres System
THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR	





LEGEND

- SISTEM BOUNDARY
- UE BOUNDARY
- TRUNK SEWER (BY GRAVITY FLOW)
- TRUNK SEWER (BY PRESSURE FLOW)
- COL1/24-CUR — NAME OF TRANK SEWER
- 400-100 — LENGTH (m); DIAMETER (mm)
- EE — PUMP STATION
- ETE — TREATMENT FACILITY
- PLANNED PUMP STATION
- EXISTING PUMP STATION
- EXISTING AREA (CONVENTIONAL)
- EXISTING AREA (CONDOMINIAL)

SCALE 1:30.000

0 500 1000 m

Fig.13	Layout Plan of Curcurana System

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

Fig.14 **Flow Diagram of Existing Janga Sewerage System**

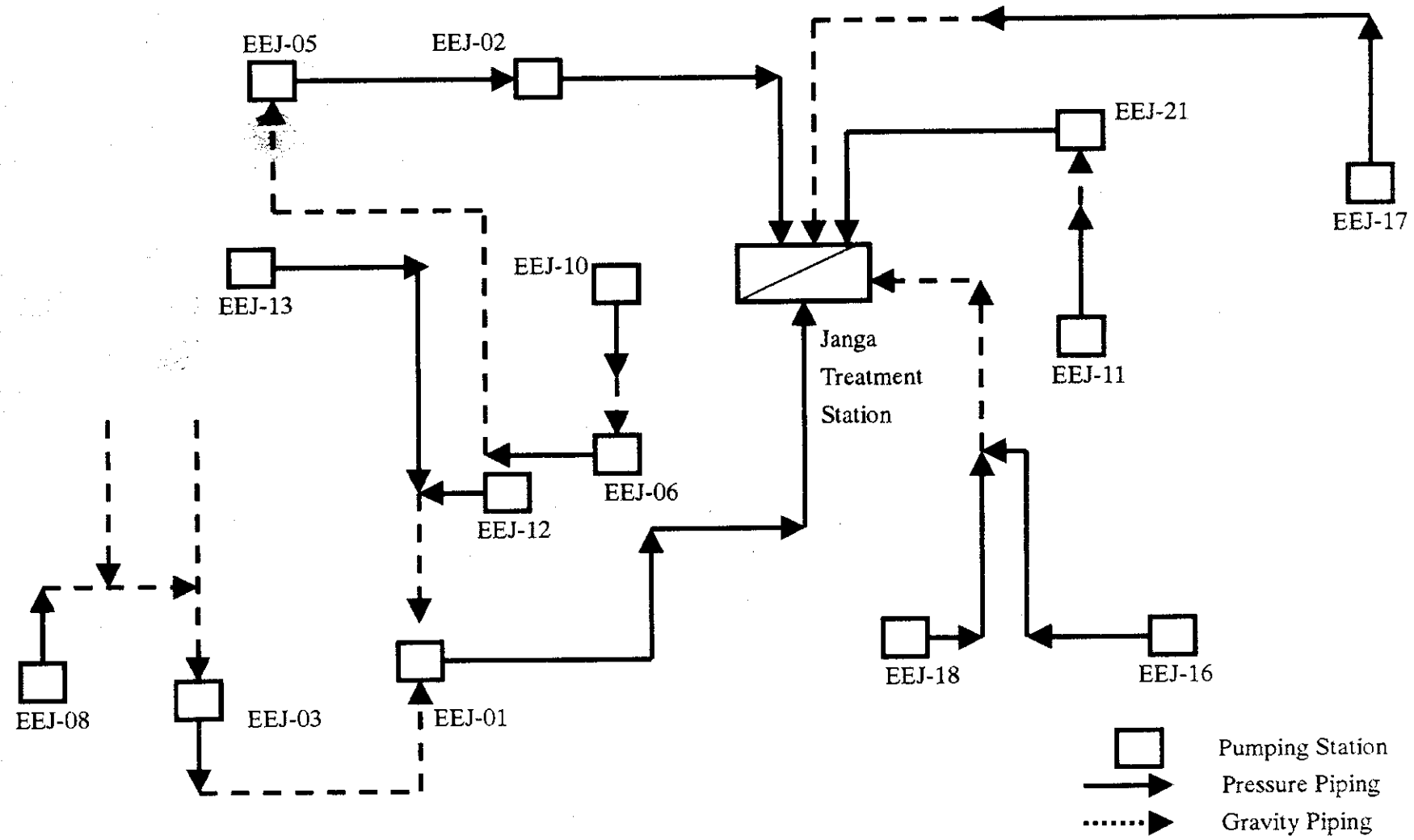
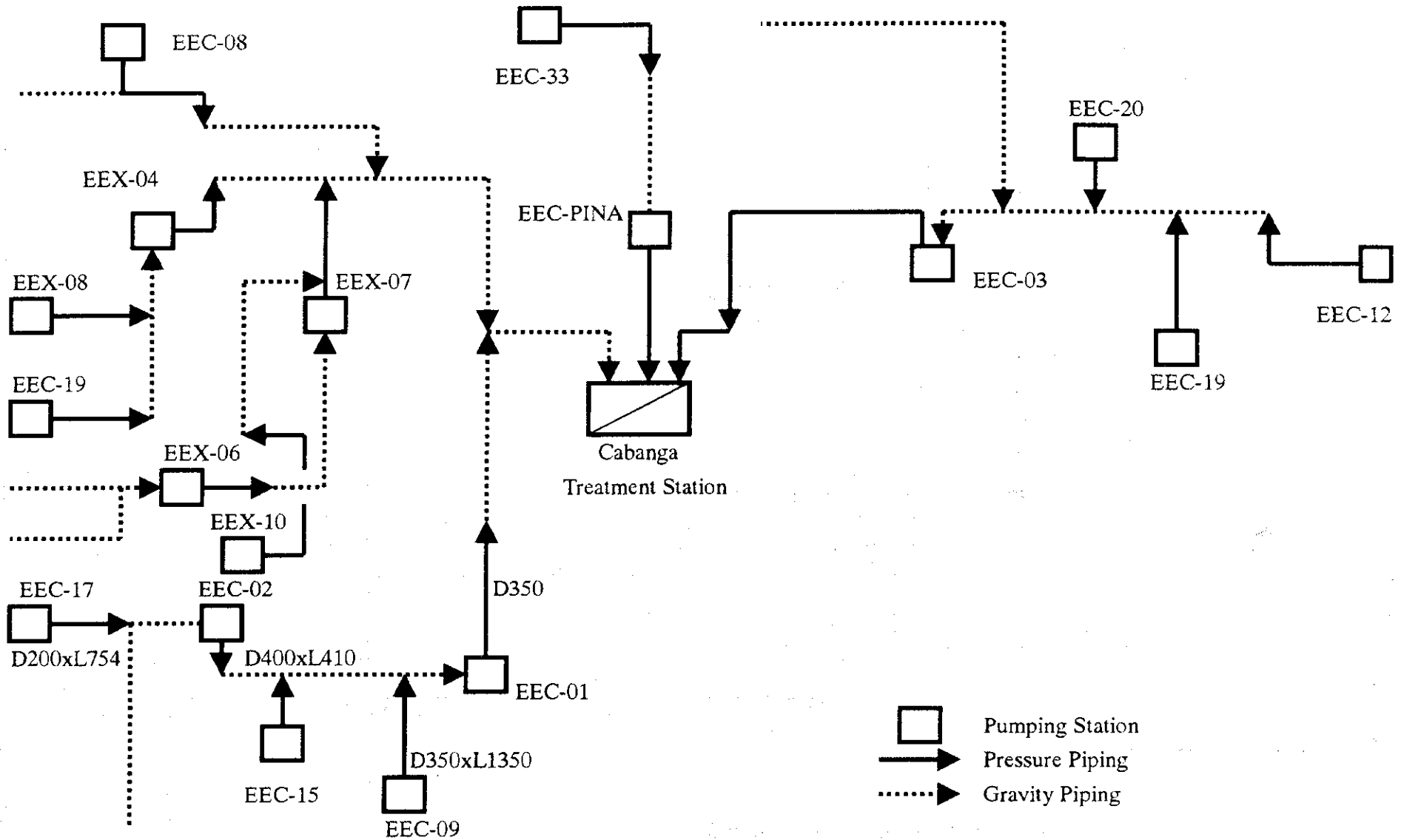
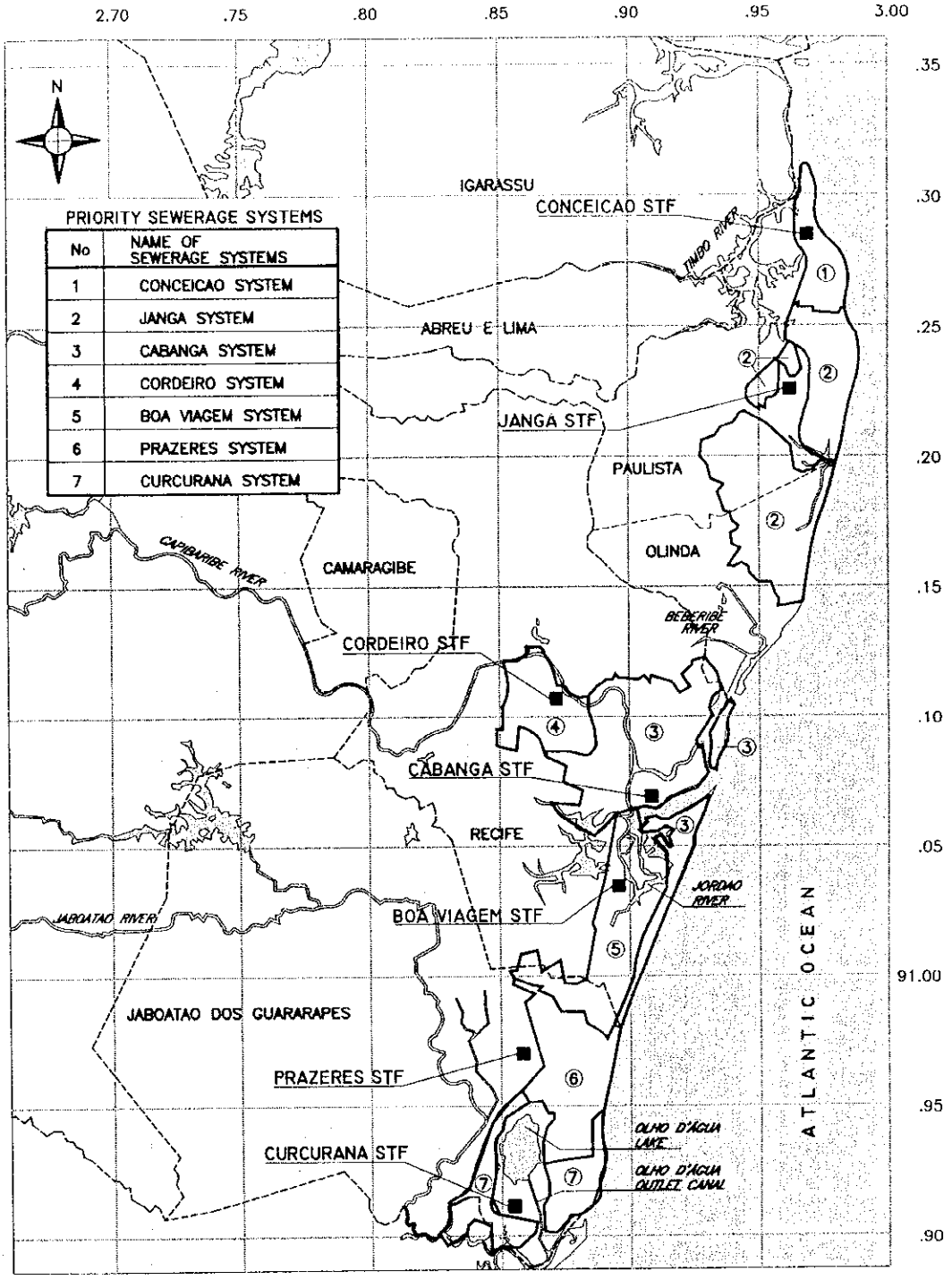


Fig.15 **Flow Diagram of Existing Cabanga Sewerage System**





L E G E N D :

SEWERAGE AREA BOUNDARY

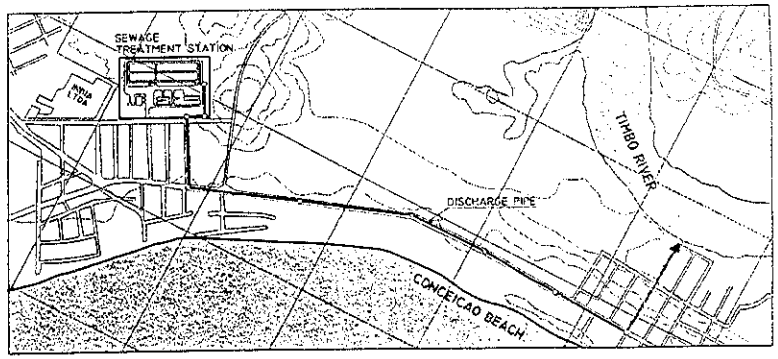
MUNICIPALITY BOUNDARY

STFs

SCALE 0 2 4 6 8 10 (KM)

Fig.16 **Location of Priority Sewage Treatment Facilities**

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR



TREATED SEWAGE DISCHARGE PIPE

SCALE: 1/20,000

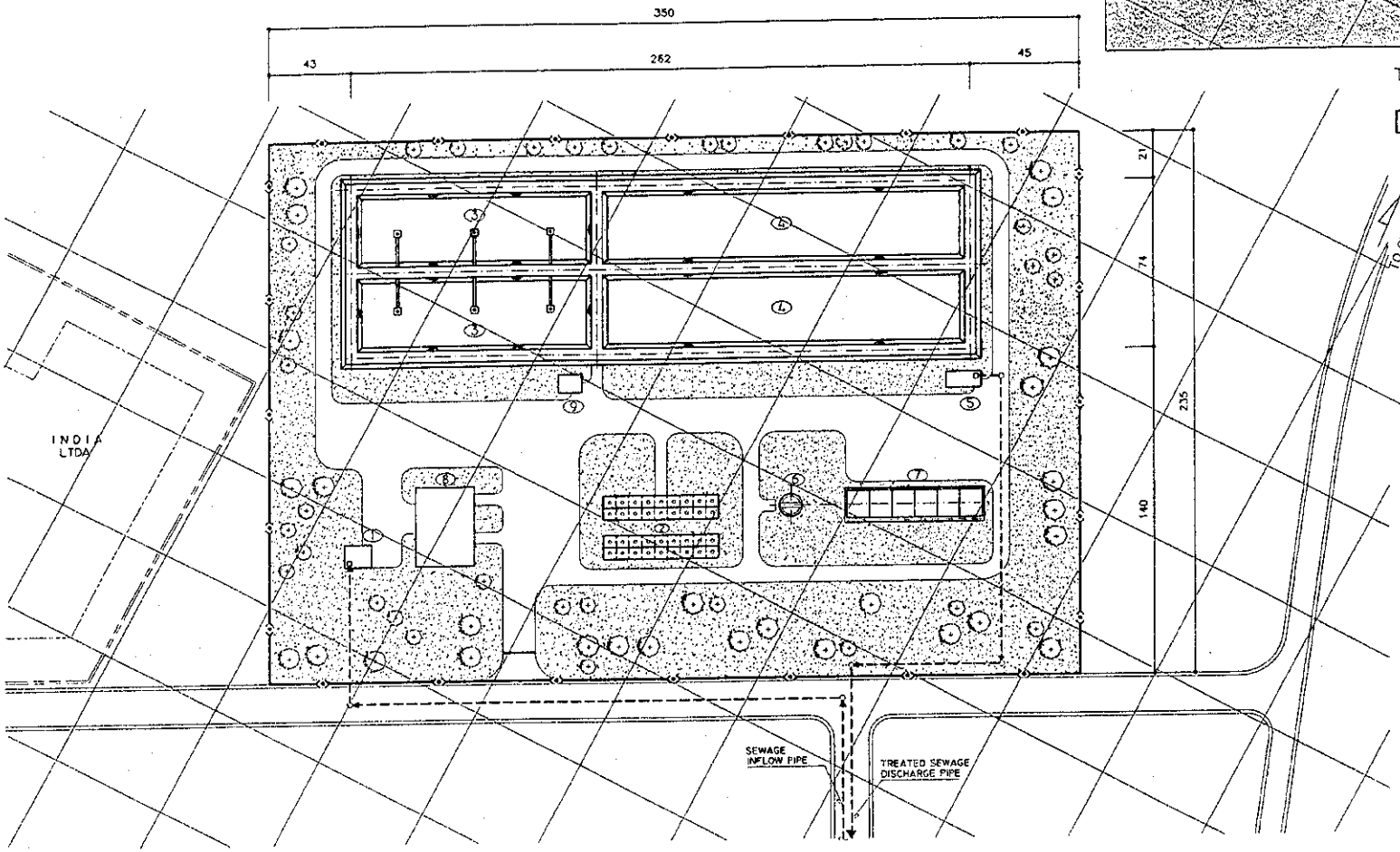


TABLE OF FACILITIES

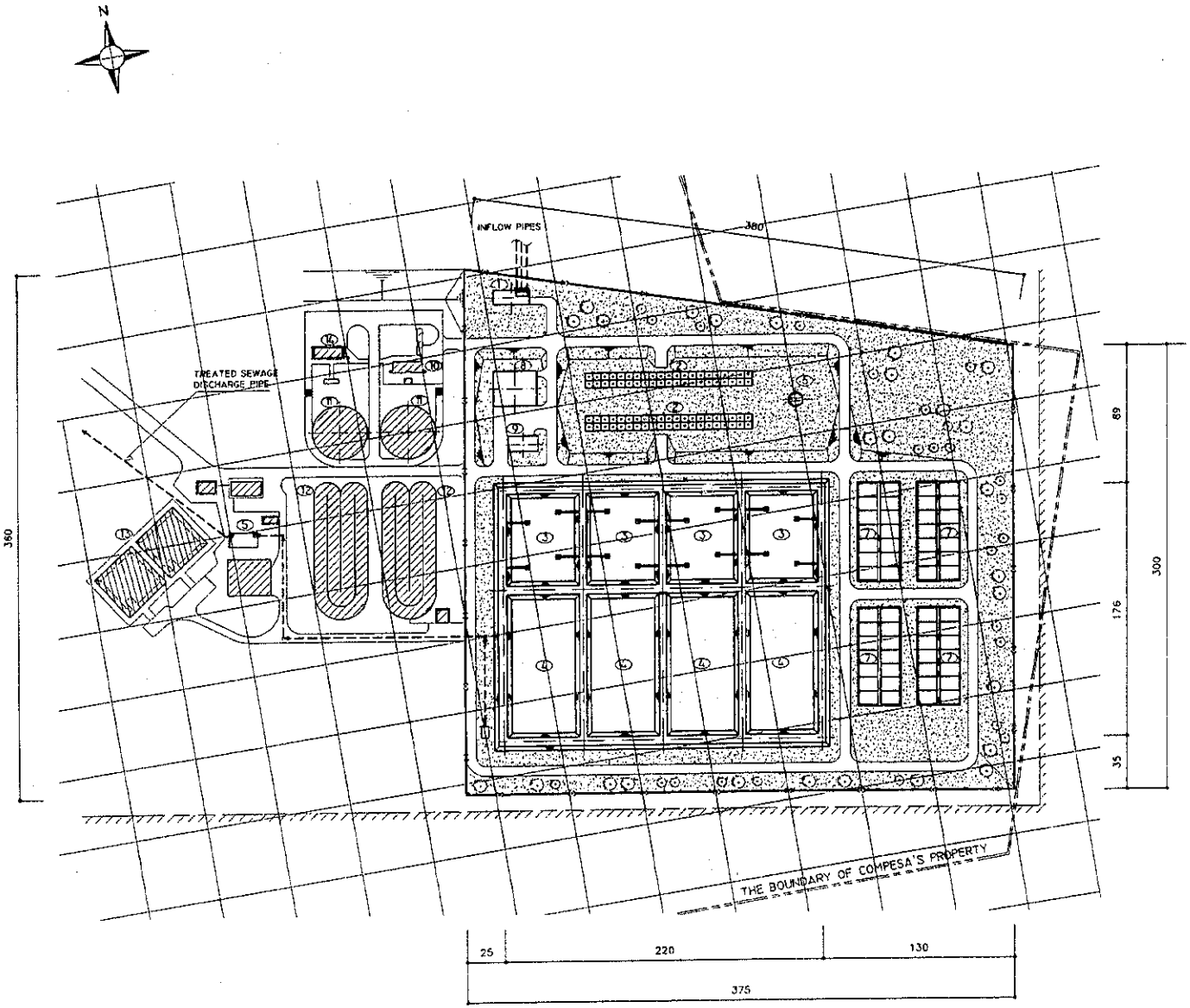
NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	AERATED LAGOONS
4	POLISHING PONDS
5	DISINFECTION TANK
6	SLUDGE THICKENER
7	SLUDGE DRYING BEDS
8	ADMINISTRATION BUILDING
9	ELECTRICAL ROOM

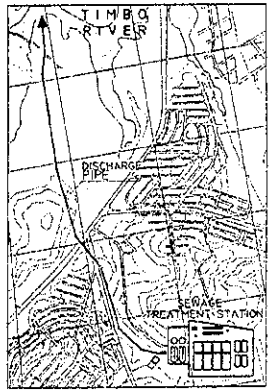
REMARKS:
(1) THE UNIT OF COORDINATE IS 50M.
(2) THE UNIT OF DIMENSIONS IS "METER".

SCALE: 1/2,000

Fig.17	Conceicao Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR





TREATED SEWAGE DISCHARGE PIPES

SCALE: 1/30,000

TABLE OF FACILITIES

NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	AERATED LAGOONS
4	POLISHING PONDS
5	DISINFECTION TANK
6	SLUDGE THICKENER
7	SLUDGE DRYING BEDS
8	ADMINISTRATION BUILDING
9	ELECTRICAL ROOM
10	GRIT CHAMBERS (EXISTING)
11	SEDIMENTATION TANKS (EXISTING)
12	OXIDATION DITCHES (EXISTING)
13	SLUDGE LAGOON (EXISTING)
14	ADMINISTRATION ROOM (EXISTING)

REMARKS:
(1) THE UNIT OF COORDINATE IS 50M.
(2) THE UNIT OF DIMENSIONS IS "METER".
(3) THE FACILITIES MARKED BY HATCHING ARE EXISTING ONES.

SCALE: 1/3,000

Fig.18 Janga Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

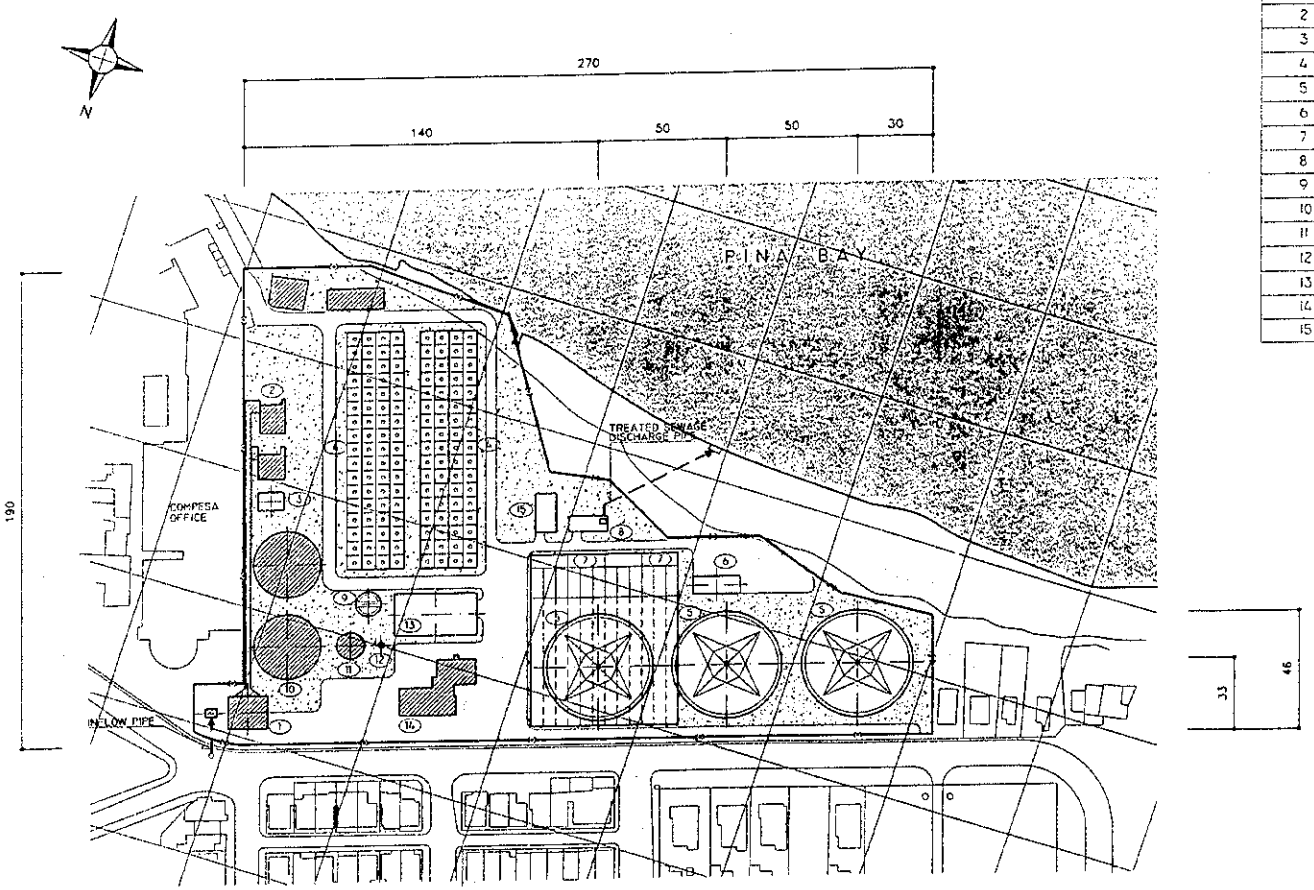


TABLE OF FACILITIES

NUMBER	NAME
1	INFLUENT WELL AND INFLUENT PUMPS (EXISTING)
2	GRIT CHAMBERS
3	TRANSFER PUMPS
4	RAFA REACTORS
5	BIO-FILTERS
6	RECIRCULATION PUMPS
7	SEDIMENTATION TANKS
8	DISINFECTION TANK
9	SLUDGE THICKENER
10	SLUDGE DIGESTERS (EXISTING)
11	GAS HOLDER (EXISTING)
12	BIO-GAS BURNER
13	DEHYDRATION ROOM AND CONTROL ROOM
14	ADMINISTRATION ROOM (EXISTING)
15	ELECTRICAL ROOM

REMARKS:
(1) THE UNIT OF COORDINATE IS 50M.
(2) THE UNIT OF DIMENSIONS IS "METER".
(3) THE FACILITIES MARKED BY HATCHING ARE EXISTING ONES.

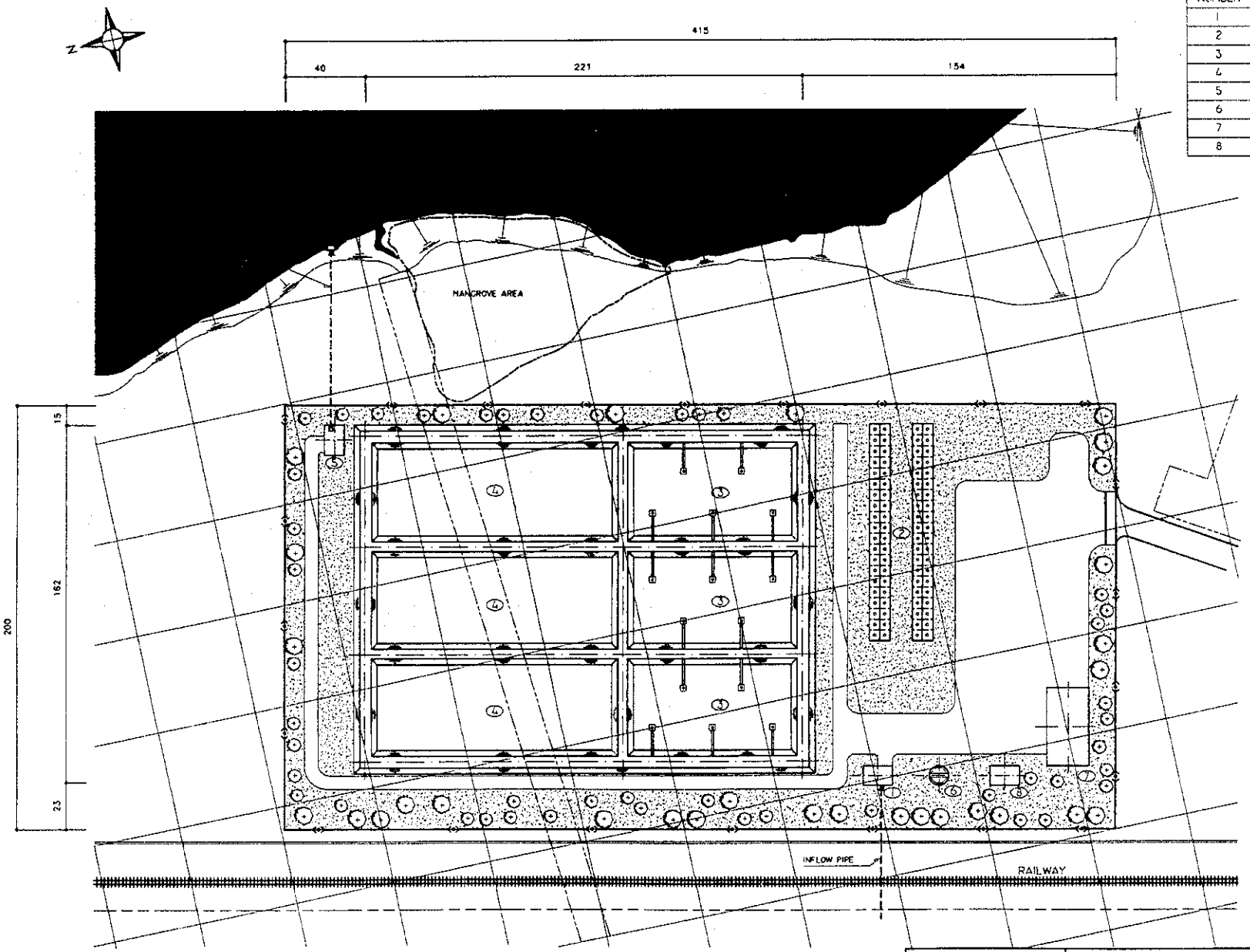
SCALE: 1/2,000

Fig.19 Cabanga Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

TABLE OF FACILITIES

NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	AERATED LAGOONS
4	POLISHING PONDS
5	DISINFECTION TANK
6	SLUDGE THICKENER
7	ADMINISTRATION BUILDING
8	ELECTRICAL ROOM



REMARKS:
(1) THE UNIT OF COORDINATE IS 50m.
(2) THE UNIT OF DIMENSIONS IS "METER".

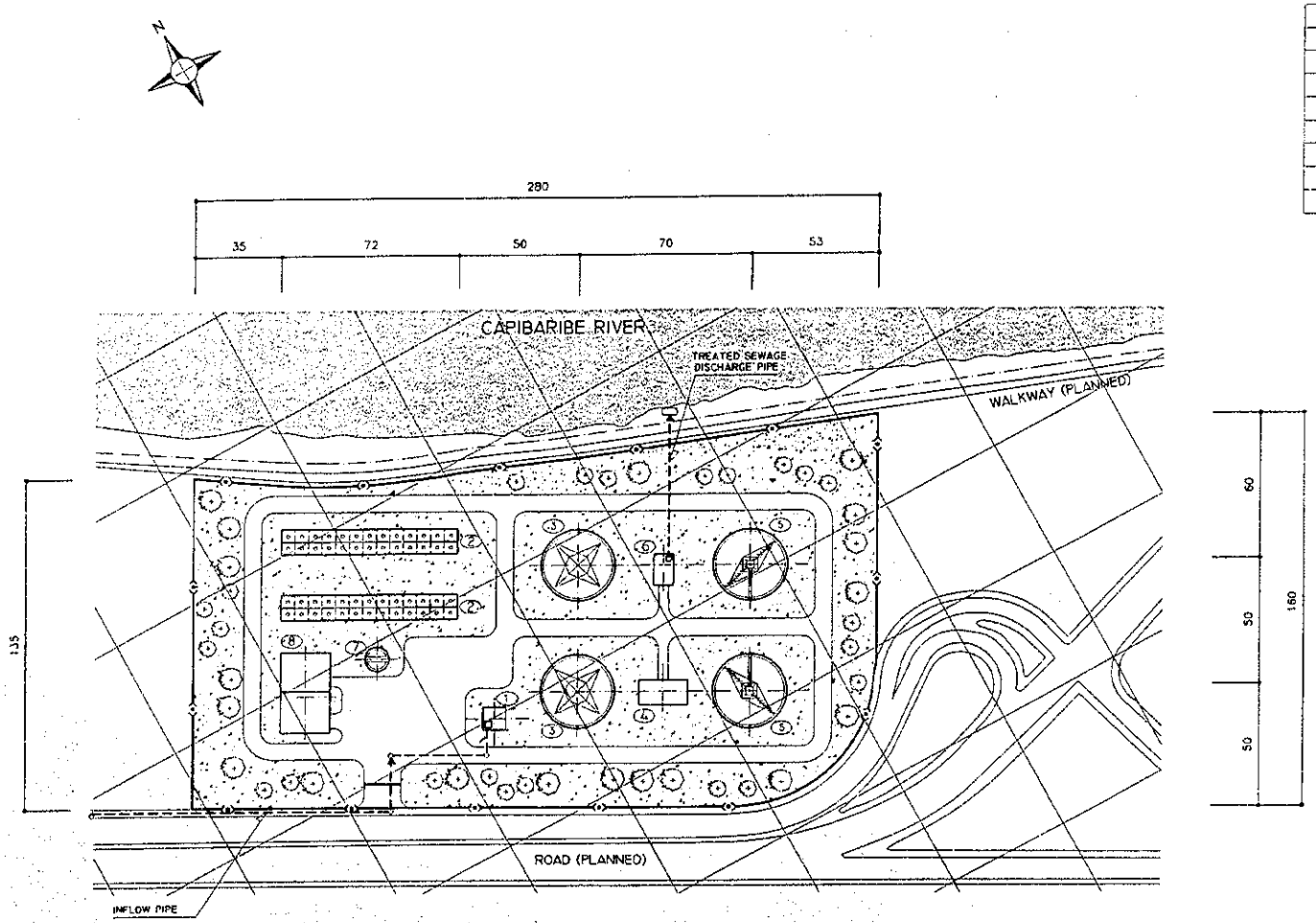
SCALE: 1/2,000

Fig.20 Boa Viagem Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR

TABLE OF FACILITIES

NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	BIO-FILTERS
4	TRANSFER TANK
5	SEDIMENTATION TANKS
6	DISINFECTION TANK
7	SLUDGE THICKENER
8	ADMINISTRATION BUILDING

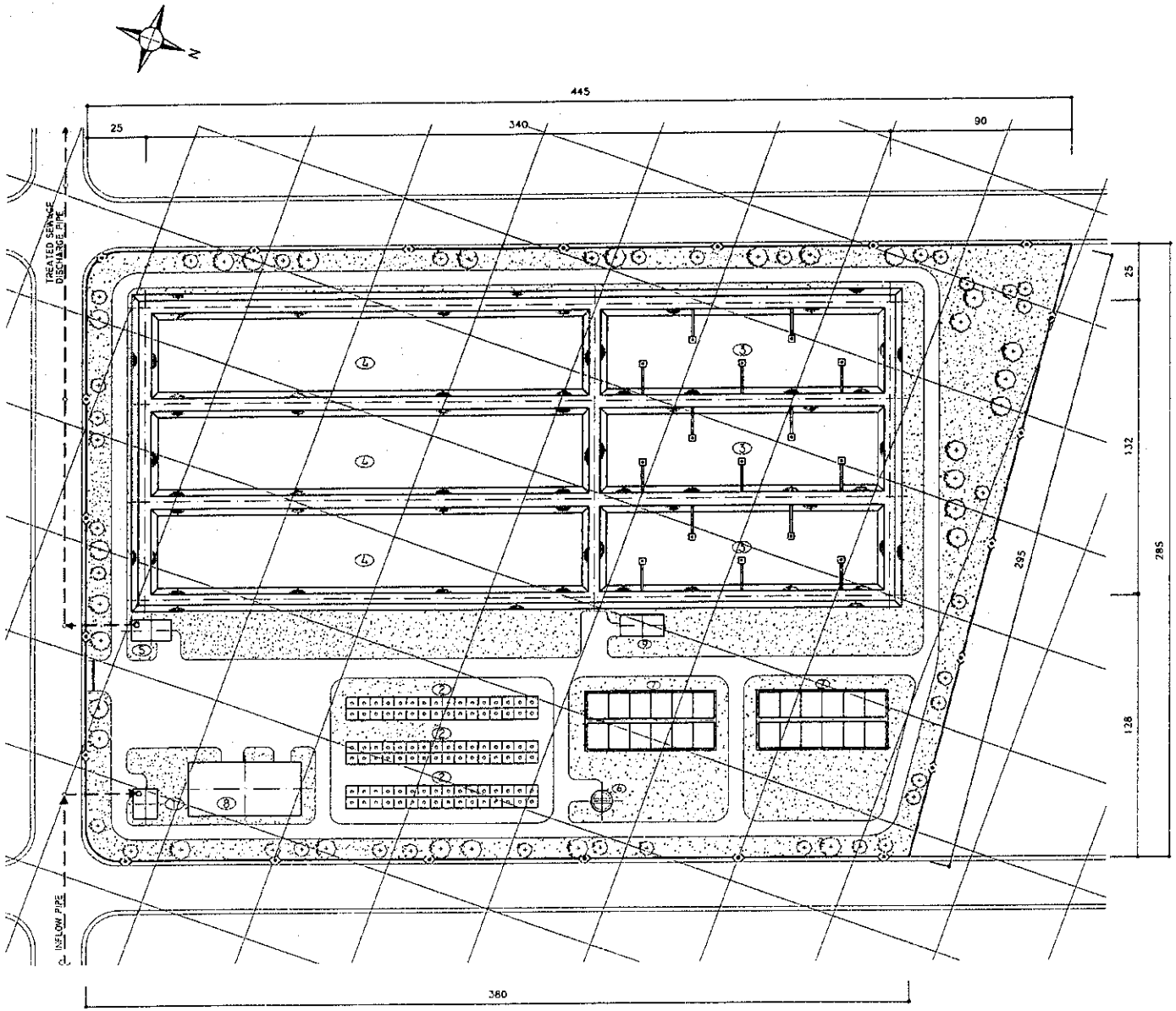


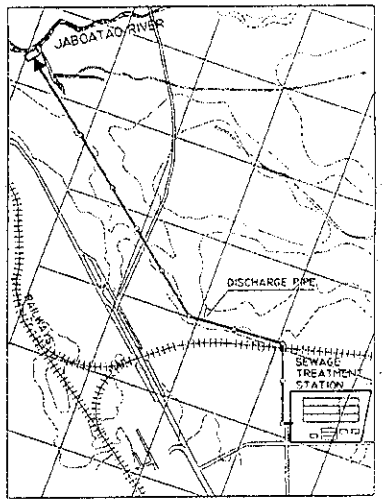
REMARKS:
(1) THE UNIT OF COORDINATE IS 50M.
(2) THE UNIT OF DIMENSIONS IS "METER".

SCALE: 1/2,000

Fig.21	Cordeiro Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR





TREATED SEWAGE DISCHARGE PIPE

SCALE: 1/30,000

TABLE OF FACILITIES

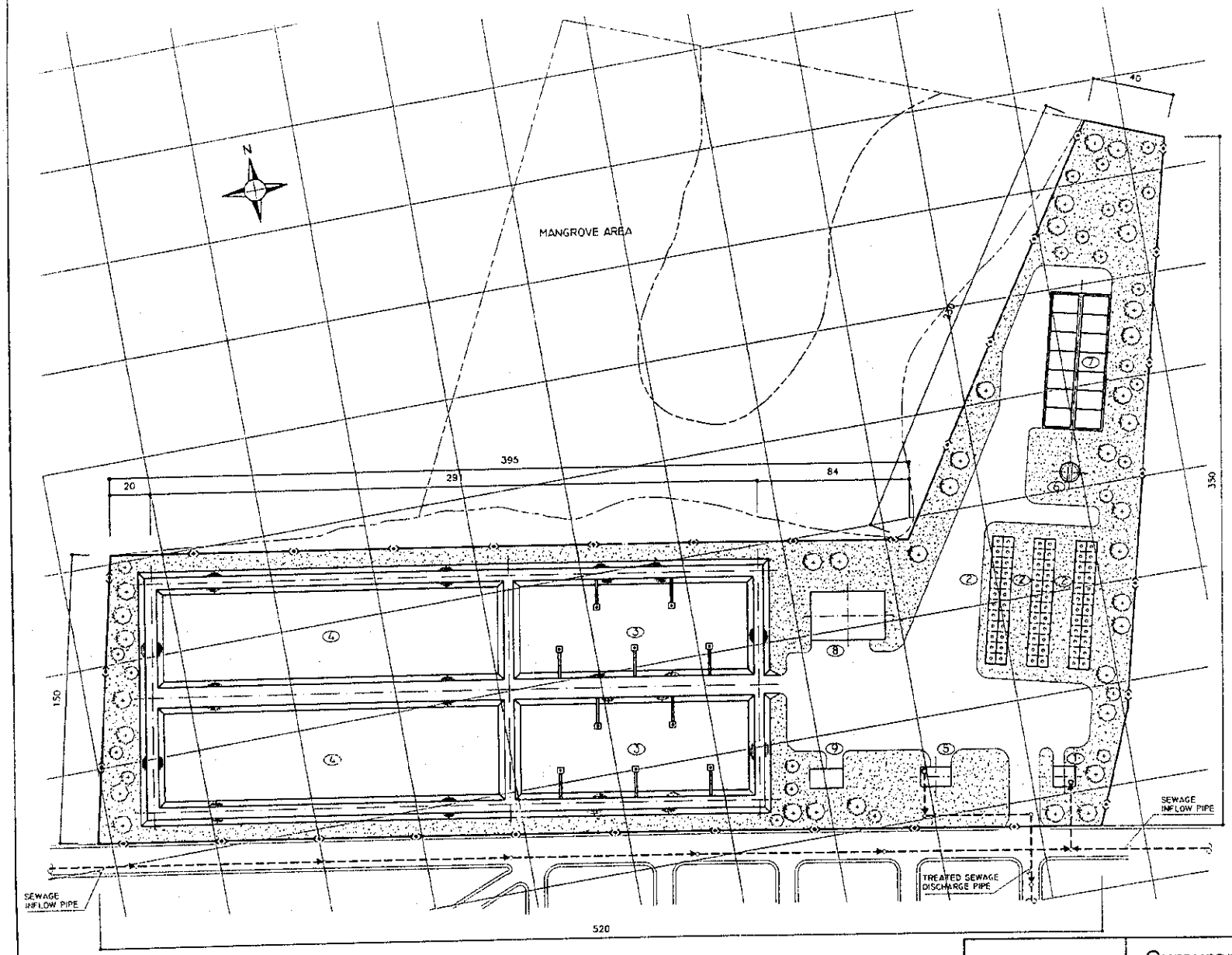
NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	AERATED LAGOONS
4	POLISHING PONDS
5	DISINFECTION TANK
6	SLUDGE THICKENER
7	SLUDGE DRYING BEDS
8	ADMINISTRATION BUILDING
9	ELECTRICAL ROOM

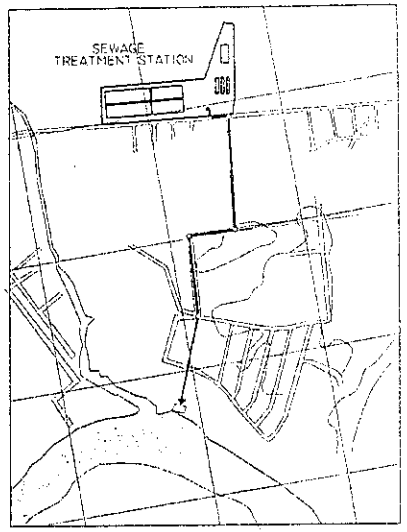
REMARKS:
(1) THE UNIT OF COORDINATE IS 50M.
(2) THE UNIT OF DIMENSIONS IS "METER".

SCALE: 1/2,000

Fig.22 Prazeres Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR





TREATED SEWAGE DISCHARGE PIPE

SCALE: 1/20,000

TABLE OF FACILITIES

NUMBER	NAME
1	GRIT CHAMBERS AND INFLUENT WELL
2	RAFA REACTORS
3	AERATED LAGOONS
4	POLISHING PONDS
5	DISINFECTION TANK
6	SLUDGE THICKENER
7	SLUDGE DRYING BEDS
8	ADMINISTRATION BUILDING
9	ELECTRICAL ROOM

SCALE: 1/2,000

Fig.23 Curcurana Sewage Treatment Facilities Layout Plan

THE STUDY ON STORMWATER DRAINAGE AND SEWERAGE MANAGEMENT PLAN FOR RMR