6) Prazeres System

(a) Project Site

The Prazeres System is in Jaboatao dos Guararapes. Its boundaries are as follows: to the north - Boa Viagem and Cabanga systems, to the south - Curcurana System, to the east - Atlantic Ocean, and to the west - Comportas System and the highway BR 101 / South. The boundaries with the Boa Viagem and Cabanga Systems are defined, respectively by the 4 de Outubro and Candido Ferreira avenues. The southern boundary is defined by ABDO Cabus avenue and the BR 101 / South. At the western boundary, the RFFSA railway (future surface metro) cuts through the system. Near the eastern boundary the Setubal canal bisects the system. Total area: 1,570 ha.

Occupation is mostly residential, with tall apartment buildings along the coastal strip, especially Piedade, occupied by the upper classes; to the west of the same neighborhood and in Cajueiro Seco, there are lower buildings, occupied by the middle class, housing estates and single family homes. The area of this system is heavily commercial, mainly in the neighborhood of Prazeres. There is also a shopping center – Shopping Guararapes, with shops and services, as well as shopping arcades, mainly in the Piedade neighborhood, where there are also good hotels between Beira Mar Avenue and Bernardo Vieira de Melo Avenue. Within this system is the Administrative Center of the Jaboatão dos Guararapes Council, near Barreto de Menezes avenue. At the seaside there are various bars and restaurants. Expansion should take place vertically as in the neighborhood of Piedade.

As regards topography, this system can be divided into two areas with different characteristics. The one beyond the Dr. Júlio Maranhao Avenue presents levels varying from 8m to 80m, making it a very irregular area. The other area, located before this one, despite having levels, which vary from 2.0 m to 12.0 m, has predominantly flat topography. This occurs mainly between the Copacabana Avenue and the Setubal Canal to the south, and close to the Olho d Agua lagoon where the levels vary between 2.0 and 3.5 m. During the rainy season, this region presents serious flood problems due to the deficient drainage system, insufficient land reclamation for occupation, and the silting of the Olho d Agua lagoon.

In terms of sanitary conditions, the area is very deficient. Only the housing estates Dom Helder Camara and Jardim Piedade have a SES, consisting of a collection network, pump station and treatment plant. In apartment buildings and individual dwellings, occupied by the high and middle classes, with higher incomes, the treatment system is composed of a septic tank and porous pipes. In low-income areas, sewage produced in individual dwellings is conveyed to pits called soakaways. In areas where absorption of wastewater by the soil is difficult, it is very common to use small soakaways just for toilet wastes. The rest of the

wastewater produced is directed to culverts or channels for rainwater drainage which discharge into the Olho d Agua lagoon and into the sea (the beach at Piedade). The maintenance of these septic tanks is precarious, even those of the higher income population. In areas near the lagoon, drainage is deficient.

There are two tourist attractions in this system worth drawing attention to: one is the coastline and the other is the Historic National Park of Guararapes, with its church, Nossa Senhora dos Prazeres. Part of the Olho d'Água lagoon is also in this park.

(b) Planning Context

This system is composed of UEs 16, 18, 19 and 21 in Jaboatão, defined by the Plan of Sewerage and Stormwater Drainage Management of the RMR and by the PQA – Program of Water Quality of the RMR. UE 20, which belonged to the Curcurana system, was partly incorporated into UE 21 in order to facilitate the geographic delimitation between the Curcurana and Prazeres systems. Part of UEs 15 and 17, belonging to the Boa Viagem system, was also incorporated into the Prazeres system.

(c) Wastewater Flow and Pollution Load

•	Served population in 2020	233,400	persons
•	Sewerage area in 2020:	1,570	ha (100%)
	1. New construction area	1,542	ha (98.2%)
	1. Area covered by existing system	28	ha (1.8%)
•	Wastewater Flow in 2020:		
	2. Daily Average	32,677	m^3/day
	3. Daily Max	38,218	m^3/day
	4. Hourly Max	53,936	m^3/day
•	Pollution Load in 2020		
	1. BOD	12,604	kg/day
	2. SS	14,004	kg/day

The Computation table for Wastewater flow in Prazeres System is shown in Table A.4-6.

(d) Main Facility Layout

The Sewerage Plan of the Prazeres System is shown in Fig 4.2-7.

- Trunk sewers

In the layout of principal collectors, major traffic routes were avoided, such as, for example, Bernardo Vieira de Melo Avenue and Copacabana Avenue. However, in this last one, in the stretch between the limit with the Boa Viagem system and Shopping Guararapes (Barreto de Menezes avenue), two collectors were included, one on each side of the avenue since this avenue runs alongside the Setúbal canal, and in order to receive the contributions from UEs 18 and 19. The diameters of these collectors vary from 150mm to 400mm. This system will have one crossing at the Setúbal canal (through a pressure pipe), four crossings under the railway, and one crossing under the highway BR 101/South, with a diameter of 1,500mm, to reach the proposed treatment station.

The Computation table for Design of the gravity and Pressure flow sewer in Prazeres System is shown in Table A.4-23.

The longitudinal profile of proposed sewer to the Prazeres System is planned and compiled in the Data Book.

- Pumping stations

The pumping stations EEC-16 and EEC-21, in the Housing Estates Dom Helder Camara and Jardim Piedade respectively, will be used to elevate part of the UE 21 sewage. Besides these two pumping stations, another five were proposed. They are distributed as follows: two in the neighborhood of Piedade (UE 18 and 21); two in the neighborhood of Cajueiro Seco, close to the Setubal canal (UE 19); and one in the neighborhood of Prazeres (UE 16). The UE 18 pump will be of the dry-well and wet-well type, proposed to avoid deepening the collector network by approximately 6.0m.

- Sewage Facilities and Receiving Body

The service area of the Prazeres sewerage system covers the coastal area to the north of the Olho d Agua lagoon. The PQA, however, proposed the site for the sewage treatment facilities station near the river mouth of the Jaboatao River, a few kilometers to the south of the lagoon. This is because the PQA avoided discharging treated sewage into the Olho d Agua lagoon. The site is owned by the city of Jaboatao and within a planned industrial zone. The site has adequate land for the construction of large facilities that are easy to be built and require a minimal level of maintenance. The treated water is planned to be discharged into the Jaboatao River.

7) Curcurana System

(a) Project Site

The Curcurana System is in Jaboatao dos Guararapes. Its boundaries are as follows: the Prazeres System to the north, the estuary of the Jaboatao river to the south, the Atlantic Ocean to the east, and the Comportas System to the west. The northern and western boundaries, respectively, are defined by ABDO Cabus Avenue and the BR 101/South highway. At the western boundary the system is cut by the railway - RFFSA - and by the highway, BR 101/South. The total area of the System is 1,160 ha.

Occupation is mostly residential. This type of occupation predominates with tall residential condominiums situated along the coast, particularly in the neighborhood of Candeias, an upper class area, but, to the west of this neighborhood and in Barra de Jangada, there are smaller buildings, occupied by the middle class population, as well as housing estates. In other areas, there are single family dwellings and large land subdivisions. The low class is located predominantly near the Olho d Agua Lagoon (João de Deus, Vila Sotave, Pau Seco, Areial) and the District of Pontezinha.

In the area of this system there is local commerce, principally in the district of Pontezinha. The coastal strip, in particular the beach at Candeias used to have many shacks, which functioned as bars, but these were removed by the local authority. At present, the bars and restaurants on the coast are on the blocks behind the beach. There are various subdivisions in Curcurana, constituting the space available for expansion.

As regards topography, although the levels vary from 25.1 m to 0.2 m, the land is relatively flat, especially in the areas which include the neighborhoods of Candeias and Barra de Jangada (7.0 m to 4.5 m) and in the areas near the Olho d'Água lagoon, such as Curcurana, João de Deus and Vila Sotave (2.0 m to 0.2 m).

Sanitary conditions are very precarious. The area has very little sewerage. Only the INOCOOP housing estate in Barra de Jangada has a SES, with a network of collectors, pump station and treatment plant. In the isolated buildings and houses, occupied by the high and middle classes, in a higher income bracket, the treatment systems consist of septic tanks with porous pipes. In low-income areas, the wastewater produced in isolated houses is carried to simple soakaways. In areas where absorption of wastewater by the soil is difficult, it is very common to use small soakaways just for toilet wastes. The rest of the wastewater produced in the house is directed to rainwater ditches or culverts leading to the Olho d Agua lagoon. The maintenance of these systems is precarious, even those which serve the high-income residents. In the areas near the lagoon there is a drainage deficit or an absence of drainage.

Although almost undeveloped for tourism, the region where this system is located has potential, both because of the presence of the Olho d Agua lagoon and the estuary of the Jaboatao river, mainly for the practice of water sports and for the beauty of the mangroves there.

(b) Planning Context

This system is made up of the UEs 20, 22, 23 and 24 of Jaboatão, defined in the master plan. UE 24 belongs to the Comportas system but as it drains into the Olho d'Água lagoon, it is included here.

To facilitate the geographic delineation of the system and reduce the contribution of UE 20 to the system, due to the increase from UE 24, UE 20 is divided between the Curcurana System and the Prazeres System.

The decision not to increase the size of the ETE at Curcurana is because there are areas of environmental preservation here.

(c) Wastewater Flow and Pollution Load

•	Served population in 2020	150,160	persons
•	Sewerage area in 2020:	1,160	ha (100%)
	1. New construction area	1,122	ha (96.7%)
	2. Area covered by existing system	38	ha (3.3%)
•	Wastewater Flow in 2020:		
	1. Daily Average	24,795	m^3/day
	2. Daily Max	28,762	m^3/day
	3. Hourly Max	40,638	m^3/day
•	Pollution Load in 2020		
	1. BOD	8,108	kg/day
	2. SS	9,009	kg/day

The Computation table for Wastewater flow in Curcurana System is shown in Table A.4-8.

(d) Main Facility Layout

The Sewerage Plan of the Curcurana System is shown in Fig 4.2-8.

- Trunk sewers

In the layout of principal collectors, the major traffic routes were avoided, such as, for example, Bernardo Vieira de Melo Avenue and Ulisses Motarroyas Avenue, popularly known as "the three lanes".

The collector is planned along the Curcurana road, with diameters from 600mm to 1200mm, to transport the contributions from all the UEs to the treatment plant.

The Computation tables for Design of the gravity and Pressure flow sewer in Curucurana System are shown in Tables A.4-24 and A.4-25.

The longitudinal profile of proposed sewer to the Curcurana system is planned and compiled in the Data Book.

- Pumping stations

12 pumping stations are proposed in this sewerage system.

4 are in the neighborhoods of Candeias and Barra de Jangada (UE 22), 3 in Curcurana (UE 23) 2 in Pontezinha, 1 in Pau Seca and 2 in the Nossa Senhora das Graças subdivision.

- Sewage Treatment Facilities and Receiving Body

The service area of the Curcurana system covers the coastal area to the south of Olho d Agua lagoon that also corresponds to the area on the left bank of the Jaboatao River. The service area includes the neighborhood of the lagoon which the city of Jaboatao plans to develop as a lakeside resort. The site for the construction of the sewage treatment facilities was designated as an environmental protection area (Z4-10) and construction work is strictly restricted. The city of Jaboatao, however, gave a favorable consideration to the application and agreed to the use of the site for the construction of a sewage treatment facilities because the project is aimed at the improvement of the aquatic environment in the vicinity.

In the PQA the treated sewage was planned to go to the drainage canal of Olho d Agua lagoon. In this study, however, it is planned to be discharged into the Jaboatao River to avoid the reverse flow of sewage into the canal caused by high tides.

4.2 Sewage Collection Facility Plan

(1) Preliminary Design of Collection Facilities

1) Trunk Sewers

General sewer alignments of the seven sewerage systems are shown in Figs. 4.2-1 to 4.2-8. All trunk sewers are planned based on the design criteria, as stated in the former section. Two types of flow system, gravity and pressure flow system, will be applied for these 7 sewerage systems.

Total length of trunk sewers and force mains in the project area are 69,760 m and 46,725 m, respectively. Summary of bill of quantities of trunk sewers is shown in Table A.4-26, and breakdowns of the bill of quantities of trunk sewers are shown in Tables A.4-27 to A.4-33.

2) Branch and Collector Sewers

Total length of branch and collector sewers in the project area is summarized as follows,

- Collector Sewers : 419,700 m (Ø 150, Ø 200, Ø 250 mm)
- Branch Sewers : 979,400 m (Ø 150 mm)

Total length of branch and collector sewers is approximately 1,400,000 m. Summary of bill of quantities of branch and collector sewers is shown in Table A.4-34 and breakdown of bill of quantities of branch and collector sewers is shown in Table A.4-35.

3) Pumping Station

The pumping stations are planned based on design criteria, which are summarized in Table A.4-36, and explained as follows:

(a) Type of pumping station

a) Standard Type Pumping Station

The Standard type pumping station is to have a relatively large sewage flow volume and a high pumping capacity. It is composed of the following facilities:

- Screen

  The function of a screen is to remove garbage and large obstacles manually or automatically from the inflow sewage for protection of the pump equipment.

- Grit Chamber

  The function of a grit chamber is to allow settling grit from the inflow sewage to settle in the chamber before the well pit to protect pump impellers. The space of a grit chamber is to be designed for the following conditions:

  - Surface loading: 1800 m^3/m^2/Sec
  - Detention time: 30 to 60 seconds
  - Velocity of flow through chamber: 0.3 m

- Wet-well

  The capacity of a wet-well should be sufficient for the pump to operate continuously for at least ten minutes.

- Dry-well

  There are pumps and related facilities in a dry-well. The space of the dry-well should be sufficient for the easy removal of pumps, motors and other auxiliary equipment. A drawing of the standard type pumping station is shown in Fig.A.4-36 and A.4-37 and bill of quantities of pumping stations is shown in Table A.4-37.

b) Simplified Type Pumping Station

The simplified type pumping station included of a basket and a grit pit. Drawings of the simplified type are shown in Fig.A.4-38 and A.4-39 and bill of quantities of pumping stations is shown in Table A.4-37.

c) Manhole Type Pumping Station

The manhole type pumping station is similar to the simplified type pumping station, but has no grit pit. The size of the manhole type pumping station is planned for two sets of pumps. A basket for the garbage inflow is to be provided to protect pumps. A drawing of the manhole type of pumping station is shown in Fig.A.4-40 and bill of quantities of pumping stations is shown in Table A.4-37.

d) Selection of pump type

A centrifugal vertical type of pump is applied for the standard type pumping station and a submersible type of pump is applied for both the simplified type and the manhole type.

Specification of all pumps and motors, which have sufficient function to lift up designed sewerage flow, is shown in Table A.4-38 to A.4-44.

e) Control System

Unmanned operation system except the standard pumping station should be recommended. Therefore establishment of control system, which will be notified the trouble of pump and another equipment, should be considered. Control system has the functions the followings,

- Observation with trouble alarms of pumps
- Remote control at the central control room located in the STF
- No inter-telephone communication between central control room and pumping station

f) Required space for each type of pumping station

Pumping station space planning should consider the following aspects;

- Ease of maintenance
- Prevention of odor problems
- Provision of a parking lot for maintenance
- Screenings/grit disposal area
-

The space required for each type of pumping station is approximately as follows:

Type of Pumping Station	Required Space (m^2)
Manhole type pumping station	80
Simplified type pumping station (1)	170
Simplified type pumping station (2)	190
Standard type pumping station (1)	560
Standard type pumping station (2)	650

Required area for land acquisition of all pumping stations in the project area is shown in Table A.4-45.

(2) Rehabilitation of Existing Sewer Networks

1) Pumping Station

(a) Flow Diagram of Existing Sewerage System

All the pumping stations and sewer pipes connected to the Janga and Cabanga sewage treatment facilities have been investigated based on the data provided by COMPESA and the

GME. Also other independent small systems maintained by the GME have been investigated. The sewage flow diagrams of the Janga system and the Cabanga system were prepared after the field investigation and are shown in Figs. 4.3-7 and 4.3-8, respectively.

(b) Field Survey of Existing Pumping Stations

The Study Team together with COMPESA staff carried out the investigation and data collection to clarify the present condition of the existing pumping stations for a rehabilitation plan. The existing pumping stations are grouped into seven systems in accordance with the priority projects. The results of the investigation are summarized as follows:

a) Specifications of pumps and motors

The following items have been investigated and are shown in Table A.4-46.
Pump: Flow rate (m^3/hr) and Total Head (m)
Motor: Output (HP), Pole, Phase, Voltage and Frequency (Hz)
Almost all the specifications have been investigated on site because they are not available in COMPESA, because the data has not been updated since equipment was repaired, modified and replaced. The flow rate of the pumps and output of the motors are shown in m3/hr and HP respectively, being the units used in Brazil.

b) Equipment manufacturers of pumps, motors and distribution boards

Equipment manufacturers of pumps, motors and electrical panels are shown in Table A.4-47.

c) Ancillary equipment

The following items have been checked and shown in Table A.4-48.

- Bar screen
- Grit chamber
- Pumping house

d) Valves and Gates

Current situation of and rehabilitation requirement for valves and gates of existing pumping stations is shown in Table A.4-48. The current situation is summarized as follows:

Current Situation of Valves and Gates

Remarks		Quantity and (%)					
		Valves		Check Valves		Gates	
Good in use		53	(28)	27	(28)	3	(14)
Rehabilitation	To be repaired	0	(0)	0	(0)	0	(0)
	To be replaced	137	(72)	69	(72)	18	(86)
	Sub-Total	136	(72)	69	(72)	18	(86)
Total		190	(100)	96	(100)	21	(100)

2) Rehabilitation Required for Existing Pumping Stations

Based on the field survey results, the existing pump facilities to be required rehabilitation are listed as follows:

- Pumps and motors:81 of 97 (Table A.4-50)
- Electrical panels: 32 of 38 (Table A.4-50)
- Valves: 137 of 190 (Table A.4-49)
- Check valves: 69 of 96 (Table A.4-49)
- Gates 18 of 21 (Table A.4-49)
- Bar screens: 27 of 34 (Table A.4-51)
- Grit chambers 1 of 1 (Table A.4-51)
- Pumping house 22 of 24 (Table A.4-51)

The rehabilitation works are including repair, replacement and new installation.

Table A.2-1 Present O and M Organization of COMPESA (1/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
PRESIDENT			PR	Direct the Company according to its purpose and	●			1			1	1	3
	Cabinet		GAB	Assist the Administrative Council, Directors and	●			2					2
	Permanent Bidding Committee		CPL	Organise the purchase of material and contacting of	●				3	3	1	11	18
	Auditor		AUD	Report on economic/financial administrative and operational situation	●			1		2		3	6
	Juridical Advisory		AJU	Represent and advise the Company judicially	●			2		6		8	16
	Social Communication Advisory		ACS	Direct the public relations policy of the Company	●							8	8
	Planning Advisory		APL	Formulate and coordinate organisational and financial planning	●			4	1	4	1	3	13
Sub-Total								**10**	**4**	**15**	**3**	**34**	**66**
Consigned Staff								**10**	**0**	**0**	**0**	**0**	**10**
COMPESA Staff								**0**	**4**	**15**	**3**	**34**	**56**
MANAGEMENT DIRECTORATE			DG	Direct the administrative activities of the Company	●			1				3	4
	Planning and Management Advisory Office		APG	Formulate and carry out administrative policy	●			2		4		2	8
	Economic Manager		GEC	Planning and control of general accountancy	●						3	1	4
		Accounting Division	DCT	Classification and accountancy of administrative	●						7	1	8
		Budget and Cost Division	DGO	Program and control of forecasts and supply of	●					2	4	3	9
	Financial Manager		GFI	Planning and control of financial management	●						1	3	4
		Financial Management Division	DGF	Execution of short, medium and long-term financial	●						3	6	9
		Treasury Division	DTS	Activities connected with receipts and payments	●						5	5	10
		Finance Control Division	DCF	Administration of contracts with external funding	●							5	5

Table A.2-1 Present O and M Organization of COMPESA (2/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
	Human Resources Manager		GRH	Plan, formulate and control human resources activities	●							3	3
		Personnel Registration and Payment Division	DRP	Control of information and payment of personnel	●					3		16	19
		Trainning Division	DTN	Staff recruitment and training	●						6	7	13
		Security and Medical Division	DSM	Program and carry out activities connected with	●				2	4	10	4	20
		Social Assistance Division	DAS	Program and carry out activities of social and psychological support to staff	●				1		7	4	12
	Procurement Mannager		GSU	Plan and coordinate administration of materials, transport, patrimony and	●			4		1		2	7
		Material and Patrimony Division	DMP	Control of patrimony and stock	●						3	35	38
		General Services Division	DSG	Maintenance of premises and general services	●						2	386	388
		Transport Division	DTR	Administration and control of transport services	●							56	56
		Chemical Products Control Division	DPQ	Acquisition and control of chemicals for treatment	●						1	11	12
Sub-Total								**7**	**3**	**14**	**52**	**553**	**629**
Consigned Staff								**7**	**0**	**0**	**0**	**345**	**352**
COMPESA Staff								**0**	**3**	**14**	**52**	**208**	**277**
TECHNICAL DIRECTORATE			DT	Direct technical planning, projects and expansion works of water and wastewater drainage systems. Technical support to operations and	●			1			5	2	8
	Technical Planning Advisory Office		APT	Coordinate studies on alternatives for control, maintenance and expansion o water supply and drainage	●				12	5	6	8	31
	Quality Control Manager		GQL	Control activities of technical support to operations, including quality control.	●					1	1	4	6
		Laboratory Control Division	DCL	Technical support to regional laboratories. Control of water quality standards.	●				2	5	12	5	24
		Treatment Control Division	DCN	Technical support to water and sewage treatment.	●				4	1	3		8

Table A.2-1 Present O and M Organization of COMPESA (3/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
	Operational Control Manager		GCO	Control activities and coordinate studies connected with operational information.	●				2		3	1	6
		Quality Control Division	DCQ	Water distribution and leakage research. Macro-	●				3	1	25	13	42
		Operational Control Division	DCO	Maintenance of operational information system.	●				2		13	2	17
	Production Manager		GPR	Control production from large-scale catchments and participate in distribution and maintenance planning		●			4		4	128	136
		South Production Division	DPS	Operate respective production units. Undertake studies for improvement of production processes.		●							
		Botafogo Production Division	DPB			●							
		Alto do Céu Production Division	DPC			●							
		Tapacurá Production Division	DPT			●			2	3	31	74	110
	Maintenance Manager		GMN	Preventive and corrective maintenance of production units in RMR and in the	●						2	42	44
		Electric Maintenance Division	DME	Maintenance of electrical systems in RMR and interior. Studies for improvement of equipment and maintenance	●				2	3	11	20	36
		Mechanic Maintenance Division	DMM	Maintenance of mechanical systems in RMR and interior. Studies for improvement of equipment and maintenance	●				3	1	9	7	20
		Wells Maintenance Division	DMS	Maintenance of wells with other divisions of GMN		●			2	1	5	9	17
	Expansion Manager		GEX	Control activities of projects for expansion of services	●			3	1			1	5
		Projects Division	DPJ	Preparation of projects for subsystems	●				9	6	2	27	44
		Civil Works Division	DOB	Coordinate activities related to civil works including disappropriations	●				14	3	13	4	34
Sub-Total								**4**	**62**	**30**	**145**	**347**	**588**
Consigned Staff								**4**	**0**	**0**	**0**	**154**	**158**
COMPESA Staff								**0**	**62**	**30**	**145**	**193**	**330**

Table A.2-1 Present O and M Organization of COMPESA (4/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
COMMERCIAL DIRECTORATE			DC	Direct planning and control of commercial area	●			2			1	2	5
	Commercial Planning Adovisory Office		APC	Formulate commercial policy and tariff system. Control commercial activities	●					3	1	2	6
	Recurrence Commettee		CRR		●								0
	Commercial Registry & Invoice Management		GCF	Coordination of control of activities connected with consumer records.	●							5	5
		Registration Support Division	DIC	Technical support for updating of records	●							28	28
		Invoice Control Division	DFT	Local and regional support to activities in invoicing process	●							12	12
	Micro-Measurement Manager		GMI	Control of work connected with micro-measurement and connections to buildings	●				1			3	4
		Micro-measurement and Building Connection Division	DMI	Technical support to activities including expansion and maintenance of water	●							2	2
		Watermeter Maintenance Division	DMH	Programming and execution of activities of checking and maintenance of water meters.	●						5	9	14
	Commercial and Rate Collecting Manager		GCC	Coordination of customer services, sales and promotion and rate collecting activities	●			1			2	21	24
		Charging Division	DCB	Program and conduct charging activities	●							8	8
		Division	DAR	Control of rate collection	●						1	20	21
		Customer Service Division	DAC	Program and conduct customer services activities	●						1	31	32
	Data Processing Manager		GPD	Plan and coordinate data processing activities	●						1	10	11
		Development and Maintenance Division	DDM	Implement data processing systems	●						16	6	22
		Processing & Support Division	DSP	Handling of data processed. Maintenance of hardware and software.	●						7	19	26
Sub-Total								**3**	**1**	**3**	**35**	**178**	**220**
Consigned Staff								**3**	**0**	**0**	**0**	**10**	**13**
COMPESA Staff								**0**	**1**	**3**	**35**	**168**	**207**

Table A.2-1 Present O and M Organization of COMPESA (5/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
OPERATION DIRECTOR			DO	Direct activities of operational planning and administration of services	●				1	5	8	8	22
	Operational Planning Advisory Office		APO	Promote procedures for the rationalization of water supply and drainage services	●				8		3	4	15
	Arcoverde Regional Manager		GRA	Plan and coordinate the administration of services of water supply and drainage in area under its jurisdiction	●								
	Afogados da Ingazeira Regional Manager		GRI		●								
	Belo Jardim Regional Manager		GRB		●								
	Carpina Regional Manager		GRC		●								
	Caruaru Regional Manager		GRU		●								
	Garanhuns Regional Manager		GRG		●								
	Jaboatão Regional Manager		GRJ		●								
	Olinda Regional Manager		GRD		●								
	Petrolina Regional Manager		GRP		●								
	Recife Regional Manager		GRR		●								
	Salgueiro Regiuona Manager		GRS		●								
	Telhada Regional Manager		GRE		●								
	Vitória de Santo Antão Regional Manager		GRV		●			79	18	35	94	1562	1788
		Adm./Financial Sub-Manager	SBA	Control activities related to human resources, material, patrimony, and general and financial services, locally and		●							
		Commercial Sub-Manager	SBC	Control the operation, maintenance and expansion o regional systems		●							
		Technical Sub-Manager	SBT	Control local and regional commercial services		●							

Table A.2-1 Present O and M Organization of COMPESA (6/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
		Support Sub-Manager	SBP	Control systems operations at at Arcoverde, Afogados da Ingazeira, Belo Jardim, Salgueiro, Serra Talhada and Vitória de Santo Antão. Control activities of human resources, material, patrimony, general and financial services at Carpina,		●							
	Regional Office		ELO			●							
		Barreiros				●							
		Cabo				●							
		Camaragibe				●							
		Ipojuca				●							
		Jaboatão				●							
		Jordão				●							
		N.Sra.do Ó				●							
		Pte. Carvalhos				●							
		Prezeres				●							
		S.Lourenço da Mata				●							
		Sirinhaém				●							
		Tamandaré				●							
		Abreu e Lima		Program and execute commercial, operational, financial and administrative activities autonomously or otherwise		●							
		Caetés				●							
		Igarassu				●							
		Itamaracá				●							
		Itapissuma				●							
		Olinda				●							
		Pau Amarelo				●							
		Paulista				●							
		Peixinhos				●							
		Pontas de Pedra				●							
		Aurora				●							
		Alto do Céu				●							
		Cabanga				●							
		Dois Irmãos				●							
		Fernando de Noronha				●							
		Ibura				●							
		Jangadinha				●							
		Jenipapo				●			19	25	69	1894	2007
							●		3		3	9	15

Table A.2-1 Present O and M Organization of COMPESA (7/7)

Organization				Main Function	Field			Number of Employees					
					Common	Water Supply	Sewerage	Managers	Engineers	Other Professionals	Technicians	Others	Total
	Metoropolitan Sewerage Manager		GME	Coordinate maintenance activities at pumping stations and treatment plants			●					27	
		Adm./Financial Sub-Manager	SBA/ GME	Coordinate activities related to admin. of personnel, material, patrimony and			●						
		Technical Sub-Manager	SBT/ GME	Prepare norms for O/M of ETEs. Control activities and submit reports			●						
		Operation and Maintenance Sub-Manager	SBE/ GME	Apply norms and execute O/M services at pumping stations and treatment plants			●						
		Cabanga Sewerage Division	DEC	Program and carry out maintenance activities in sewerage. New connections.			●						
		Peixinhos Sewerage Division	DEX				●						
		Janga Sewerabe Division	DEJ				●						
		South Sewerage Division	DES				●		6	3	14	196	211
	Regional Office						●						
		Caruaru Sewerage Division	DEU	Program and carry out maintenance and sewerage expansion activities			●						
		Petorolina Sewerage Division	DEP				●			1		9	10
Sub-Total								**79**	**55**	**69**	**191**	**3709**	**4103**
Consigned Staff								**79**	**33**	**0**	**43**	**1298**	**1453**
COMPESA Staff								**0**	**22**	**69**	**148**	**2411**	**2650**
Total								**103**	**125**	**131**	**426**	**4821**	**5606**
Consigned Staff								**103**	**33**	**0**	**43**	**1807**	**1986**
COMPESA Staff								**0**	**92**	**131**	**383**	**3014**	**3520**

Sources:COMPESA

Table A.2-2 List of Major O&M Equipment Owned by GME

	GME／SBT		GME／SBE		GME／DEC		GME／DEX		GME／DEJ		GME／DES		Total	
	In operation	Need repair	In operation	Need repair	In operation	Need repair	In operation	Need repair	In operation	Need repair	In operation	Need repair	In operation	Need repair
Traction Television													0	0
Automatic Television													0	0
High-velocity Jet Truck													0	0
Tank Truck					1		1				1		3	0
Sludge Lifter Truck					2	1	3	1	3	1	2	1	10	4
High-aspiration Truck					2	4	2	1	4		3	1	11	6
Pickup High-velocity													0	0
Engine Generater						1	1			2	1		2	3
Car					2	1	1		2	1	2		7	2
Truck(2t under)					2	1	1	2	1		1		5	3
Truck(2~4t)					1		1		1				3	0
Truck(4t more)							1		1				2	0
Weld Machine					1								1	0
Submerged Motor Pump(Diameter 50					1		1		1				3	0
Submerged Motor Pump(Diameter							1		1				2	0
Oil Jack					1								1	0
Field Gas Leak Detector													0	0
Field Current Meter							1		1				2	0
Field Voltage Meter							1		1				2	0
Switch Board Test													0	0
Noise Level Meter													0	0
Frequency Meter													0	0
													0	0
													0	0

Sources:COMPESA

Table A.2-3 Ongoing Projects in the RMR (1/2)

Municipality	Project	Status	Project Cost
CABO DE SANTO AGOSTINHO	Elaboration and extension of SES project	1	R$ 2,000,000.00
	SES implantation in Ponte dos Carvalhos	1	R$ 3,960,000.00
CAMARAGIBE	SES implantation	1	R$ 3,672,000.00
IPOJUCA	SES implantation in São Miguel Neighborhood	1	R$ 360,000.00
JABOATÃO DOS GUARARAPES	Elaboration of conception studies, basic and executive projects of SES Piedade, Candeias and Barra de Jangada.	1	R$ 1,000,000.00
	SES implantation in Guararapes Historical Park	1	R$ 3,328,000.00
MORENO	SES Implantation in Vila João Paulo II (KFW).	1	R$ 830,000.00
	Revision of basic SES project in Basins A and B. (KFW)	6	R$ 14.800,00
	Technical and legal support for the preparation of the SES project in Moreno (KFW)	4	R$ 34,231.25
	International consultancy services	4	R$ 933,914.67
OLINDA	Project revision and SES implantation in Olinda's Seashore	1	R$ 24,960,000.00
	Implantation of sewers in some segments of Marcos Freire and Getúlio Vargas Avenues in Bairro Novo	1	R$ 246,564.00
PAULISTA	JARDIM PAULISTA - Construction of sewer at Rua 93.	1	R$ 17,200.00
	PAULISTA - SES extension	1	R$ 2,000,000.00
RECIFE	PINA - Complementation of SES works in Brasília Teimosa and the D15 connection to Cabanga ETE.	3	R$ 600,000.00
	MANGUEIRA - Completion of SES sewages connections	3	R$ 500,000.00
	CAMPO GRANDE - SES completion	2	R$ 25,000.00
	TORREÃO - Project elaboration for SES completion	1	R$ 25,000.00
	AREIAS - Completion of SES Vila Cardeal Silva	1	R$ 600,000.00
	ENGENHO DO MEIO - Construction of 352m of collector in PVC DN 200mm in the streets Carneiro Mariz, D. João Moura and W.Falcão	1	R$ 61,413.64
	TEJIPIÓ - SES implatation of Tejipió basin (PROEST)	1	R$ 52,080,000.00
	IPUTINGA - Elaboration of a project for a SES construction in Conj. Residencial Ipiranga	2	R$ 25,000.00
	BOA VIAGEM - Implantation of sewers in the streets Júlio Ferreira and Félix de Brito Melo	1	R$ 3,700.00

Table A.2-3 Ongoing Projects in the RMR (2/2)

Municipality	Project	Status	Project Cost
RECIFE (contd.)	BOA VISTA - Implantation of a 300m collector in Epaminondas de Melo street	6	R$ 184,446.45
	IMBIRIBEIRA - Re-routing collectors and introduction of DN 1,200mm piping in the streets Sebastião and Luxemburgo (Sítio Grande)	6	R$ 130,173.91
	IMBIRIBEIRA - Preparation of conceptual studies, basic and executive SES projects (PROEST-1). (Ucs 74 to 78).	4	R$ 527,186.65
	IPUTINGA - Preparation of a project for a wastewate drainage system with pumping station for the existing treatment in Vila São João (project being developed b DPJ team).	6	R$ 0.00
	PAISSANDU - Construction of a wastewater drainag system in Epaminondas de Melo street	6	R$ 227,852.12
	PINA - Provision of collectors in Pina and conclusion of SES in Brasília Teimosa.	5	R$ 3,889,516.81
	PINA - Additions to works of SES in Brasília Teimos and connection of D15 to the Cabanga ETE (Waters of Pernambuco)	4	R$ 2,793,595.42
	RECIFE - Services of diagnosis, inspection, topographical surveying, cleaning, repair and registration of collector pipes in Old Recife (PPA)	4	R$ 786,418.08
	CABANGA - Restoration of Cabanga ETE	6	R$ 123,318.70
	ENGENHO DO MEIO - Preparation of project for extension of SES.	5	R$ 75,143.00

* Status :

1: in Speculation

2: in Planning

3: about to be implemented

Table A.3-1 Per-capita Water Consumption by Municipality

Municipality	Consumption Unit with Watermeter (1)	Population (2)	Average Monthly Water Consumption (m^3) (3)	Water Consumption by Consumption Unit (m^3/C.U..month)	Per-capita Water Consumption (liter/cap/day) (5)
Abreu e Lima	2,524	11,106	38,883	15	117
Araçoiaba	486	2,284	8,305	17	121
Cabo	8,940	41,125	128,472	14	104
Camaragibe	79	368	912	12	83
Igarassu	2,738	12,869	44,726	16	116
Ipojuca	2,245	10,552	37,399	17	118
Itamaracá	693	3,119	15,362	22	164
Itapissuma	922	4,149	16,396	18	132
Jaboatão	43,488	186,997	836,857	19	149
Moreno	6,659	28,634	92,311	14	107
Olinda	31,115	136,906	614,350	20	150
Paulista	13,324	57,293	210,720	16	123
Recife	138,735	582,689	2,666,153	19	153
São Lourenço	43	198	379	9	64
RMR	251,991	1,078,288	4,711,225	19	146

(1) Residential C.U. with hydrometers of real measurement

(2) Population corresponding to residential Consumption Unit

(3) Real average consumption monthly measured.

(4) Monthly average consumption by Consumption Unit (3)/(1)

(5) Daily consumption per capita

*C.U. : Consumption Unit

Table A.3-2 Breakdown of Per-capita Water Consumption by LINK (1/2)

LINK	Consumption Unit with Watermeter	Inhabitants per Consumption Unit	Population	Average Monthly Water Consumption (m3)	Water Consumption per Consumption	Per-capita Water Consumption (liter/day)	Municipality
Cabanga	32,249	4.2	135,446	712,071	22	175	RECIFE
Alto do Céu	21,974	4.2	92,291	411,988	19	149	
Aurora	32,531	4.2	136,630	625,174	19	153	
Dois Irmãos	29,738	4.2	124,900	568,022	19	152	
Ibura	4,121	4.2	17,307	58,347	14	112	
Jenipapo	3,024	4.2	12,701	42,028	14	110	
Jordão	981	4.2	4,118	14,892	15	121	
Jangadinha	14,118	4.2	59,296	233,631	17	131	
TOTAL	**138,735**		**582,689**	**2,666,153**	**19**	**153**	
Ibura	2,971	4.3	12,777	42,073	14	110	JABOATÃO
Jordão	491	4.3	2,113	7,465	15	118	
Jangadinha	6,396	4.3	27,502	105,842	17	128	
Prazeres	26,581	4.3	114,298	577,499	22	168	
Jaboatão	7,048	4.3	30,306	103,978	15	114	
TOTAL	**43,488**		**186,997**	**836,857**	**19**	**149**	
Moreno	5,362	4.3	23,057	76,707	14	111	MORENO
Bonança	1,297	4.3	5,577	15,604	14	93	
TOTAL	**6,659**		**28,634**	**92,311**	**14**	**107**	
Ipojuca	824	4.7	3,873	12,305	15	106	IPOJUCA
Nossa Senhora do Ó	757	4.7	3,558	13,624	18	128	
Camela	664	4.7	3,121	11,470	17	123	
TOTAL	**2,245**		**10,552**	**37,399**	**17**	**118**	
Ponte dos Carvalhos	2,198	4.6	10,111	33,231	15	110	CABO
Pontezinha	986	4.6	4,536	15,896	16	117	
Cabo	5,756	4.6	26,478	79,345	14	100	
TOTAL	**8,940**		**41,125**	**128,472**	**14**	**104**	
Abreu e Lima	2,524	4.4	11,106	38,883	15	117	ABREU E LIMA
Caetés	0	4.4	0	0			
TOTAL	**2,524**		**11,106**	**38,883**	**15**	**117**	
Igarassu	813	4.7	3,821	13,086	16	114	IGARASSU
Cruz de Rebouças	1,878	4.7	8,827	30,303	16	114	
Nova Cruz	47	4.7	221	1,337	28	202	
TOTAL	**2,738**		**12,869**	**44,726**	**16**	**116**	
Camaragibe	32	4.6	147	320	10	72	CAMARAGIBE
Vera Cruz	47	4.7	221	592	13	89	
TOTAL	**79**		**368**	**912**	**12**	**83**	

Table A.3-2 Breakdown of Per-capita Water Consumption by LINK (2/2)

LINK	Consumption Unit with Watermeter	Inhabitants per Consumption Unit	Population	Average Monthly Water Consumption (m3)	Water Consumption per Consumption	Per-capita Water Consumption (liter/day)	Municipality
Itamaracá	693	4.5	3,119	15,362	22	164	ITAMARACÁ
TOTAL	**693**		**3,119**	**15,362**	**22**	**164**	
Paulista	8,237	4.3	35,419	123,475	15	116	PAULISTA
Pau Amarelo	941	4.3	4,046	25,603	27	211	
Navarro	268	4.3	1,152	4,335	16	125	
Paratibe	756	4.3	3,251	9,900	13	102	
Jardim Paulista	2,292	4.3	9,856	35,945	16	122	
Maranquape II	830	4.3	3,569	11,462	14	107	
TOTAL	**13,324**		**57,293**	**210,720**	**16**	**123**	
Araçoiaba	486	4.7	2,284	8,305	17	121	ARAÇOIABA
TOTAL	**486**		**2,284**	**8,305**	**17**	**121**	
Olinda	23,256	4.4	102,326	488,039	21	159	OLINDA
Cidade Tabajara	229	4.4	1,008	4,371	19	145	
Peixinhos	7,630	4.4	33,572	121,940	16	121	
TOTAL	**31,115**		**136,906**	**614,350**	**20**	**150**	
Itapissuma	922	4.5	4,149	16,396	18	132	ITAPISSUMA
TOTAL	**922**		**4,149**	**16,396**	**18**	**132**	
São Lourenço da Mata	33	4.6	152	272	8	60	SÃO LOURENÇO
Nossa Senhora da	10	4.6	46	107	11	78	
TOTAL	**43**		**198**	**379**	**9**	**64**	
TOTAL GERAL	**251,991**		**1,078,288**	**4,711,225**	**19**	**146**	**RMR**

Table 3-3 Average Monthly Water Consumption by LINK. (1/2)

LINK	* Total Consumption Unit with Watermeter	Average Monthly Water Consumption (m3)	Water Consumption per Consumption Unit (m3/c.u. month)	Municipality
Cabanga	37,662	903,551	24	RECIFE
Alto do Céu	23,297	452,249	19	
Aurora	40,431	938,831	23	
Dois Irmãos	31,905	695,091	22	
Ibura	4,294	62,170	14	
Jenipapo	3,149	47,198	15	
Jordão	1,030	16,725	16	
Jangadinha	14,759	284,965	19	
TOTAL	**156,528**	**3,400,780**	**22**	
Ibura	3,096	44,831	14	JABOATÃO
Jordão	517	8,383	16	
Jangadinha	6,687	129,098	19	
Prazeres	28,393	691,933	24	
Jaboatão	7,476	118,106	16	
TOTAL	**46,168**	**992,351**	**21**	
Moreno	5,545	81,386	15	MORENO
Bonança	1,349	16,853	12	
TOTAL	**6,894**	**98,239**	**14**	
Ipojuca	888	16,563	19	IPOJUCA
Nossa Senhora do	848	16,475	19	
Camela	703	13,285	19	
TOTAL	**2,439**	**46,323**	**19**	
Ponte dos Carvalho	2,260	39,054	17	CABO
Pontezinha	1,021	17,412	17	
Cabo	6,224	286,964	46	
TOTAL	**9,505**	**343,430**	**36**	
Abreu e Lima	2,691	43,785	16	ABREU E LIMA
Caetés	0	0		
TOTAL	**2,691**	**43,785**	**16**	
Igarassu	918	18,405	20	IGARASSU
Cruz de Rebouças	2,016	34,143	17	
Nova Cruz	52	1,688	32	
TOTAL	**2,986**	**54,236**	**18**	

Table 3-3 Average Monthly Water Consumption by LINK. (2/2)

LINK	* Total Consumption Unit with Watermeter	Average Monthly Water Consumption (m3)	Consumption per Consumption Unit (m3/c.u. month)	Municipality
TOTAL	**88**	**1,218**	**14**	
Itamaracá	767	1,723	22	ITAMARACÁ
TOTAL	**767**	**1,723**	**22**	
Paulista	8,584	136,196	16	PAULISTA
Pau Amarelo	1,019	26,675	26	
Navarro	282	4,484	16	
Paratibe	793	10,920	14	
Jardim Paulista	2,425	38,711	16	
Maranguape II	847	11,794	14	
TOTAL	**13,950**	**228,780**	**16**	
Araçoiaba	511	7,427	15	ARAÇOIABA
TOTAL	**511**	**7,427**	**15**	
Olinda	24,354	519,444	21	OLINDA
Cidade Tabajara	245	4,732	19	
Peixinhos	8,042	136,749	17	
TOTAL	**32,641**	**660,924**	**20**	
Itapissuma	980	19,227	20	ITAPISSUMA
TOTAL	**980**	**19,227**	**20**	
São Lourenço da	1,926	30,226	16	SÃO LOURENÇO
Nossa Senhora da	1,313	115	9	
TOTAL	**3,239**	**30,341**	**16**	
TOTAL	**279,387**	**5,944,292**	**21**	

Note * : Total Consumption Unit; Consumption Unit in the residential area and the commercial are

Table A.3-4 Proposed Average Monthly Water Consumption by LINK

Municipality	LINK	Average Monthly Water Consumption (m^3/c.u. month)		
		Residential Area	Residential and Commercial Area	Proposed Average Monthly Water Consumption
RECIFE	Cabanga	22	24	26
	Alto do Céu	19	19	26
	Aurora	19	23	26
	Dois Irmãos	19	22	26
	Ibura	14	14	18
	Jenipapo	14	15	18
	Jordão	15	16	18
	Jangadinha	17	19	20
JABOATÃO	Ibura	14	14	18
	Jordão	15	16	18
	Jangadinha	17	19	20
	Prazeres	22	24	26
	Jaboatão	15	16	18
MORENO	Moreno	14	15	18
	Bonança	14	12 (*)	18
IPOJUCA	Ipojuca	15	19	20
	Nossa Senhora do Ó	18	19	20
	Camela	17	19	20
CABO	Ponte dos Carvalhos	15	17	20
	Pontezinha	16	17	20
	Cabo	14	46 (**)	20
ABREU E LIMA	Abreu e Lima	15	16	20
	Caetés	-	-	18
IGARASSU	Igarassu	16	20	20
	Cruz de Rebouças	16	17	20
	Nova Cruz	28 (*)	32 (*)	20
CAMARAGIBE	Camaragibe	10	10 (*)	18
	Vera Cruz	13	16	18
ITAMARACÁ	Itamaracá	22 (*)	22 (*)	20
PAULISTA	Paulista	15	16	20
	Pau Amarelo	27	26	26
	Navarro	16	16	18
	Paratibe	13	14	18
	Jardim Paulista	16	16	18
	Maranquape II	14	14	18
ARAÇOIABA	Araçoiaba	17	15 (*)	18
OLINDA	Olinda	21	21	26
	Cidade Tabajara	19	19	18
	Peixinhos	16	17	20
ITAPISSUMA	Itapissuma	18	20 (*)	18
SÃO LOURENÇO DA MATA	São Lourenço da Mata	8	16	20
	Nossa Senhora da Luz	11	0	18

(*) Inconsistent data (**) Existence of major consumers

TableA.3-5 Details of Water Consumption by Major Consumers (1/2)

Municipality	Major Consumers	Monthly Water Consumption (m^3/month)	Daily Water Consumption (m^3/day)	Name of UE*
Abreu e Lima	Industria Reunidas Renda	1,046	35	1
	Total	**1,046**	**35**	
Olinda	PMPE Batalhão D. Coelho Olinda	1,060	35	23
	CSU Olinda / Fusam	801	27	20
	EMTU PE - 15	977	33	7
	Escola Renato Fonseca	1,428	48	8
	Total	**4,266**	**142**	
Recife	Mercado da Encruzilhada / CSURB	1,659	55	D14
	Palácio das Princesas / PMPE.	3,610	120	D1
	Praça da Republica	1,094	36	D1
	EBCT – Sede	978	33	D1
	Condomínio do Edifício Brasília	1,216	41	D1
	Secretaria da Fazenda - Sede	2,164	72	D1
	Caixa Econômica Federal	1,065	36	D4
	PAM – Centro (PCR)	1,327	44	D1
	Mercado São José / CSURB	1,375	46	D1
	Shopping Popular	1,950	65	D1
	FUNDARPE – Casa da Cultura	1,074	36	D1
	COMPESA - escritório local	2,425	81	27
	7º Departamento de Suprimento	1,829	61	D2
	Unidade Mista Prof. B. Filho	1,889	63	D2
	SOUZA CRUZ S/A	4,263	142	D2
	JUMBO SUPERBOX	1,031	34	87
	Escritório Wilson Campos	4,474	149	D15
	Internacional Lucsim Hotel	2,009	67	D15
	Recife Palace Hotel	5,459	182	D15
	Shopping 2 - cinema	2,917	97	87
	Bompreço S/A	1,171	39	87
	Sudene – Sede	6,000	200	38
	UFPE – Reitoria	3,064	102	38
	Hospital Clinicas	17,251	575	38
	Hospital Correia Picanço	910	30	D8
	Maternidade Barros Lima	5,621	187	D8
	Escola Municipal Prof. N. Pereira	883	29	D8
	RFFSA Parque Diesel	2,093	70	D1
	CBTU STU/REC – sede	1,499	50	D2
	Presídio Anibal Bruno	9,604	320	55
	Porto do Recife Reservatório 1	5,535	185	D3
	Companhia Pilar	5,000	167	D3

* UE: Sewerage Unit

TableA.3-5 Details of Water Consumption by Major Consumers (2/2)

Municipality	Major Consumers	Monthly Water Consumption (m^3/month)	Daily Water Consumption (m^3/day)	Name of UE*
	Superintendência da Receita Federal	1,083	36	D3
	Prefeitura da Cidade do Recife - Sede	2,285	76	D3
	Tribunal Regional do Trabalho	1,604	53	D9
	Tribunal Regional Federal 5ª. Região	2,174	72	D3
	Caixa Econômica Federal	1,044	35	D3
	Portobras - Reservatório	3,216	107	D3
	PMPE Colégio Militar	1,171	39	D7
	IPSEP – Sede	527	18	D7
	Hospital Geral João XXIII	1,543	51	D2
	Centro Hospitalar Albert Sabin	1,390	46	D2
	COMPESA – Rua da Aurora	510	17	D5
	Escola Rochael de Medeiro	1,173	39	D5
	Edifício Circulo Católico	1,716	57	D4
	Hospital Geral do Exército	1,813	60	D5
	Banco Nordeste do Brasil	1,763	59	D5
	Juizado Privativo de Menores	1,752	58	D5
	TELPE – Boa Vista	2,326	78	D5
	CELPE – Sede	1,935	65	D5
	Universidade de Pernambuco	1,423	47	D9
	Departamento de Transporte - Oficina	3,222	107	D5
	SENAI Santo Amaro	1,422	47	D9
	CEPE – Companhia Editora PE	745	25	D9
	ETEPAM	1,629	54	D14
	HEMOPE - Sede	3,457	115	D7
	PMPE - Hospital Maternidade	906	30	D6A
	Comando Geral da PMPE	1,686	56	D6A
	Condomínio Shopping Tacaruna	3,700	123	97
	Hospital Santo Amaro	2,602	87	D9
	CELPE Centro Operacional Bongi	2,495	83	48
	CHESF	910	30	48
	Total	**155,661**	**5,189**	
RMR Toral		**160,973**	**5,366**	

* UE: Sewerage Unit

Table A.3-6 Microorganism Removal by Various Sewage Treatment Methods

Name of Microorganism	Location of Sample	Sewage Treatment Methods					
		Primary settling tank	Trickling filter process (Primary settling tank,Final sedimentation tank,Sludge digestion,Sludge-drying bed)	Activated sludge process (Primary settling tank,Final sedimentation tank,Sludge digestion,Sludge-drying bed)	Oxidation ditch process (Final sedimentation tank,Sludge-drying bed)	Stabilization lagoon process (3 pond, all minimum time = 25 days)	Septic tank
Intestines virus	Inflow	10^3~10^5/l	10^3~10^5/l	10^3~10^5/l	10^3~10^5/l	10^3~10^5/l	0~10^9/l
	Outflow	10^3~10^5/l	10^2~10^4/l	10~10^4/l	10~10^4/l	0~10^8/l	0~10^8/l
	Removal rate	0-30%	90-95%	90-99%	90-99%	99.9-100%	50%
Salumonellas	Inflow	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	0~10^9/l
	Outflow	10^2~10^3/l	10^2~10^3/l	10~10^3/l	10~10^3/l	0~1/l	0~10^8/l
	Removal rate	50-90%	90-95%	90-99%	90-99%	99.9-100%	50-90%
Dysentery bacillus	Inflow	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	10^3~10^4/l	0~10^9/l
	Outflow	10^2~10^3/l	10^2~10^3/l	10~10^3/l	10~10^3/l	0~1/l	0~10^8/l
	Removal rate	50-90%	90-95%	90-99%	90-99%	99.9-100%	50-90%
Colon bacillus	Inflow	10^6~10^8/l	10^6~10^8/l	10^6~10^8/l	10^6~10^8/l	10^6~10^8/l	10^7~10^9/l
	Outflow	10^5~10^7/l	10^5~10^7/l	10^4~10^7/l	10^4~10^7/l	10~10^4/l	10^6~10^8/l
	Removal rate	50-90%	90-95%	90-99%	90-99%	99.99~99.9999%	50-90%
Cholera bacillus	Inflow	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	0~10^9/l
	Outflow	1~10^2/l	1~10^2/l	0.1~10^2/l	0.1~10^2/l	0/l	0~10^8/l
	Removal rate	50-90%	90-95%	90-99%	90-99%	100%	50-90%
Leptospira	Inflow	only a few.	only a few.	only a few.	only a few.	only a few.	only a few.
	Outflow	only a few.	only a few.	only a few.	only a few.	0/l	0/l
	Removal rate	0%	0%	0%	0%	100%	100%
Entamoeba histolytica	Inflow	10~10^4/l	10~10^3/l	10~10^4/l	10~10^4/l	10~10^4/l	0~10^5/l
	Outflow	5~10^4/l	5~10^3/l	5~10^3/l	5~10^3/l	0/l	0~10^5/l
	Removal rate	10-50%	50%	50%	50%	100%	0%
Dochmius duodenalis	Inflow	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	0~10^4/l
	Outflow	10~10^2/l	10~10^2/l	10~10^2/l	10~10^2/l	0/l	0~10^3/l
	Removal rate	50%	50-90%	50-90%	50-90%	100%	50-90%
Ascaris egg	Inflow	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	10~10^3/l	0~10^4/l
	Outflow	5~10^2/l	0~10^2/l	0~10^2/l	0~10^2/l	0/l	0~10^3/l
	Removal rate	30-80%	70-100%	70-100%	70-100%	100%	50-90%
Schistosome egg	Inflow	1~100/l	1~100/l	1~100/l	1~100/l	1~100/l	1~100/l
	Outflow	1~10/l	1~10/l	1~10/l	1~10/l	0/l	1~10/l
	Removal rate	80%	50-90%	50-99%	50-99%	100%	50-90%
Taenia egg	Inflow	1~100/l	1~100/l	1~100/l	1~100/l	1~100/l	0~103/l
	Outflow	0.1~50/l	0.1~50/l	0.1~50/l	0.1~50/l	0/l	0~500/l
	Removal rate	50-90%	50-95%	50-95%	50%	100%	50-90%

Sources: Water hygiene(Mr.Mitsumi Kaneko) Japan

Table A.3-7 Sludge Generation Projection by Municipalities

(Unit: Wet-ton/day)

Municipalities	Years		
	2010	2015	2020
Abreu E Lima	3.7	3.7	3.7
Cabo	0.0	3.4	4.3
Camaragibe	3.7	5.2	8.5
Igarassu	3.0	3.0	3.3
Ipojuca	0.0	0.0	1.3
Itapissuma	0.0	0.0	1.3
Jaboatao	33.6	37.0	37.0
Moreno	0.0	0.0	2.0
Olinda	3.5	3.5	3.5
Paulista	26.9	30.8	30.8
Recife	146.9	152.2	154.8
Sao Lourenco	2.7	4.2	6.2
Total	224.0	243.0	256.7

Remarks:

1) The sludge quantities are calculated based on the results of the JICA Master Plan Study.

2) The water content of sludge is assumed as 80 % or 60 % corresponden with final sludge treatment methods to be applied for respective systems.

Table A.3-8 List of Agricultural Land in the RMR

Municipal	Sweet potato	Sugar cane	Bean	Cassava	Corn	Banana	Coconut	Orange	Papaya	Mango	Passion fruit	Total (ha)
Abreu e Lima	0	50	180	200	200	130	120	7	85	0	0	972
Araçoiaba	0	0	0	0	0	0	0	0	0	0	0	0
Cabo	0	19,440	70	210	80	135	108	9	0	150	20	20,222
Camaragibe	0	40	200	180	200	8	27	0	0	0	0	655
Igarassu	0	10,200	120	200	0	150	2,200	0	15	0	0	12,885
Ipojuca	10	0	40	170	20	100	700	0	0	13	0	1,053
Itamaracá	0	12,250	80	30	0	10	1,120	0	15	0	0	13,505
Itapissuma	0	2,000	0	100	0	0	500	0	0	0	0	2,600
Jaboatão	20	8,000	20	2,000	20	90	50	10	0	0	0	10,210
Moreno	0	17,000	20	195	30	150	10	8	0	0	0	17,413
Olinda	0	0	10	350	10	5	50	0	0	0	0	425
Paulista	0	0	40	400	0	5	5	0	0	0	0	450
Recife	0	0	0	0	0	0	0	0	0	0	0	0
São Lourenço	0	4,800	400	200	200	50	30	10	0	0	0	5,690
RMR	30	73,780	1,180	4,235	760	833	4,920	44	115	163	20	86,080

Sources:EBAPE

Table A.4-1 Computation Table for Wastewater Flow in Conceicao System

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
PA01	110	67.30	4,514	497	587	880		0	0	291	291	291	787	878	1171
	160	217.70	14,590	2334	2772	4158		0	0	940	940	940	3275	3713	5099
Sub-Total		**285.00**	**19,105**	**2,831**	**3,359**	**5,039**	**0**	**0**	**0**	**1,231**	**1,231**	**1,231**	**4,062**	**4,590**	**6,270**
PA02	110	112.40	6,310	694	820	1230		0	0	486	486	486	1180	1306	1716
	160	63.60	3,564	570	677	1016		0	0	275	275	275	845	952	1290
Sub-Total		**176.00**	**9,874**	**1,264**	**1,497**	**2,246**	**0**	**0**	**0**	**760**	**760**	**760**	**2,025**	**2,258**	**3,006**
PA03	160	392.00	33,466	5355	6359	9538		0	0	1693	1693	1693	7048	8052	11231
Sub-Total		**392.00**	**33,466**	**5,355**	**6,359**	**9,538**	**0**	**0**	**0**	**1,693**	**1,693**	**1,693**	**7,048**	**8,052**	**11,231**
Total	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	110	180	10,824	1,191	1,407	2,111	0	0	0	776	776	776	1,967	2,183	2,887
	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	160	673	51,621	8,259	9,808	14,712	0	0	0	2,909	2,909	2,909	11,168	12,717	17,621
	Total	**853**	**62,445**	**9,450**	**11,215**	**16,823**	**0**	**0**	**0**	**3,685**	**3,685**	**3,685**	**13,135**	**14,900**	**20,508**

Table A.4-2 Computation Table for Wastewater Flow in Janga System

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
OL22	110	285	6,787	747	882	1,324		0	0	1,231	1,231	1,231	1,978	2,114	2,555
	125	72	1,564	196	235	352		0	0	311	311	311	507	546	663
	160	0	13	2	2	4		0	0	0	0	0	2	2	4
Sub-Total		**357**	**8,364**	**944**	**1,119**	**1,679**	**0**	**0**	**0**	**1,542**	**1,542**	**1,542**	**2,486**	**2,662**	**3,221**
OL23	110	261	13,861	1,525	1,802	2,703		0	0	981	981	981	2,505	2,783	3,683
	125	99	5,634	704	845	1,268		0	0	372	372	372	1,076	1,217	1,639
	160	1,582	137,561	22,010	26,137	39,205	28	34	50	5,944	5,944	5,944	27,982	32,114	45,200
Sub-Total		**1,942**	**157,055**	**24,239**	**28,784**	**43,175**	**28**	**34**	**50**	**7,296**	**7,296**	**7,296**	**31,563**	**36,114**	**50,522**
PA04	110	0	35	4	5	7		0	0	0	0	0	4	5	7
	160	577	35,358	5,657	6,718	10,077		0	0	2,493	2,493	2,493	8,150	9,211	12,570
Sub-Total		**577**	**35,394**	**5,661**	**6,723**	**10,084**	**0**	**0**	**0**	**2,493**	**2,493**	**2,493**	**8,154**	**9,215**	**12,577**
PA05	110	8	986	108	128	192		0	0	35	35	35	143	163	227
	160	570	69,670	11,147	13,237	19,856		0	0	2,462	2,462	2,462	13,610	15,700	22,318
Sub-Total		**578**	**70,655**	**11,256**	**13,365**	**20,048**	**0**	**0**	**0**	**2,497**	**2,497**	**2,497**	**13,753**	**15,862**	**22,545**
PA07	110	159	14,652	1,612	1,905	2,857		0	0	687	687	687	2,299	2,592	3,544
Sub-Total		**159**	**14,652**	**1,612**	**1,905**	**2,857**	**0**	**0**	**0**	**687**	**687**	**687**	**2,299**	**2,592**	**3,544**
PA09	110	16	1,892	208	246	369		0	0	69	69	69	277	315	438
	125	237	28,063	3,508	4,209	6,314		0	0	1,024	1,024	1,024	4,532	5,233	7,338
Sub-Total		**253**	**29,955**	**3,716**	**4,455**	**6,683**	**0**	**0**	**0**	**1,093**	**1,093**	**1,093**	**4,809**	**5,548**	**7,776**
PA06	110	0	0	0	0	0		0	0	0	0	0	0	0	0
	160	88	6,380	1,021	1,212	1,818		0	0	380	380	380	1,401	1,592	2,198
Sub-Total		**88**	**6,380**	**1,021**	**1,212**	**1,818**	**0**	**0**	**0**	**380**	**380**	**380**	**1,401**	**1,592**	**2,198**
Total	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	110	729	38,213	4,203	4,968	7,451	0	0	0	3,002	3,002	3,002	7,206	7,970	10,454
	125	408	35,261	4,408	5,289	7,934	0	0	0	1,706	1,706	1,706	6,114	6,996	9,640
	160	2,817	248,981	39,837	47,306	70,960	28	34	50	11,280	11,280	11,280	51,145	58,620	82,290
	Total	**3,954**	**322,455**	**48,448**	**57,563**	**86,345**	**28**	**34**	**50**	**15,988**	**15,988**	**15,988**	**64,464**	**73,585**	**102,384**

Table A.4-3 Computation Table for Wastewater Flow in Cabanga System (1/3)

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
44	80	13	2,134	171	213	320		0	0	56	56	56	227	270	376
		13	**2,134**	**171**	**213**	**320**	**0**	**0**	**0**	**56**	**56**	**56**	**227**	**270**	**376**
	160	112	11,675	1,868	2,218	3,327		0	0	484	484	484	2,352	2,702	3,811
		112	**11,675**	**1,868**	**2,218**	**3,327**	**0**	**0**	**0**	**484**	**484**	**484**	**2,352**	**2,702**	**3,811**
Sub-Total		**125**	**13,809**	**2,039**	**2,432**	**3,647**	**0**	**0**	**0**	**540**	**540**	**540**	**2,579**	**2,972**	**4,187**
45	80	4	407	33	41	61		0	0	17	17	17	50	58	78
		4	**407**	**33**	**41**	**61**	**0**	**0**	**0**	**17**	**17**	**17**	**50**	**58**	**78**
	160	57	3,562	570	677	1,015		0	0	246	246	246	816	923	1,261
		57	**3,562**	**570**	**677**	**1,015**	**0**	**0**	**0**	**246**	**246**	**246**	**816**	**923**	**1,261**
Sub-Total		**61**	**3,969**	**603**	**718**	**1,076**	**0**	**0**	**0**	**264**	**264**	**264**	**866**	**981**	**1,340**
46	80	42	8,187	655	819	1,228		0	0	181	181	181	836	1,000	1,409
		42	**8,187**	**655**	**819**	**1,228**	**0**	**0**	**0**	**181**	**181**	**181**	**836**	**1,000**	**1,409**
	160	80	9,613	1,538	1,826	2,740		0	0	346	346	346	1,884	2,172	3,085
		80	**9,613**	**1,538**	**1,826**	**2,740**	**0**	**0**	**0**	**346**	**346**	**346**	**1,884**	**2,172**	**3,085**
Sub-Total		**122**	**17,800**	**2,193**	**2,645**	**3,968**	**0**	**0**	**0**	**527**	**527**	**527**	**2,720**	**3,172**	**4,495**
85	160	39	2,302	368	437	656		0	0	168	168	168	537	606	824
Sub-Total		**39**	**2,302**	**368**	**437**	**656**	**0**	**0**	**0**	**168**	**168**	**168**	**537**	**606**	**824**
87	160	96	22,319	3571	4241	6361	0	0	0	415	415	415	3986	4655	6776
Sub-Total		**96**	**22,319**	**3,571**	**4,241**	**6,361**	**0**	**0**	**0**	**415**	**415**	**415**	**3,986**	**4,655**	**6,776**
88	80	39	7,873	630	787	1,181		0	0	168	168	168	798	956	1,349
		39	**7,873**	**630**	**787**	**1,181**	**0**	**0**	**0**	**168**	**168**	**168**	**798**	**956**	**1,349**
	160	51	5,224	836	993	1,489		0	0	220	220	220	1,056	1,213	1,709
		51	**5,224**	**836**	**993**	**1,489**	**0**	**0**	**0**	**220**	**220**	**220**	**1,056**	**1,213**	**1,709**
Sub-Total		**90**	**13,097**	**1,466**	**1,780**	**2,670**	**0**	**0**	**0**	**389**	**389**	**389**	**1,854**	**2,169**	**3,059**
89	80	13	3,007	241	301	451		0	0	56	56	56	297	357	507
		13	**3,007**	**241**	**301**	**451**	**0**	**0**	**0**	**56**	**56**	**56**	**297**	**357**	**507**
	160	22	3,385	542	643	965		0	0	95	95	95	637	738	1,060
		22	**3,385**	**542**	**643**	**965**	**0**	**0**	**0**	**95**	**95**	**95**	**637**	**738**	**1,060**
Sub-Total		**35**	**6,392**	**782**	**944**	**1,416**	**0**	**0**	**0**	**151**	**151**	**151**	**933**	**1,095**	**1,567**
94	80	57	3,473	278	347	521		0	0	246	246	246	524	594	767

Table A.4-3 Computation Table for Wastewater Flow in Cabanga System (2/3)

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
		57	**3,473**	**278**	**347**	**521**	**0**	**0**	**0**	**246**	**246**	**246**	**524**	**594**	**767**
	160	11	1,462	234	278	417		0	0	48	48	48	281	325	464
	160	7	1,140	182	217	325		0	0	30	30	30	213	247	355
		18	**2,602**	**416**	**494**	**741**	**0**	**0**	**0**	**78**	**78**	**78**	**494**	**572**	**819**
Sub-Total		**75**	**6,075**	**694**	**842**	**1,262**	**0**	**0**	**0**	**324**	**324**	**324**	**1,018**	**1,166**	**1,586**
95	80	52	14,165	1,133	1,416	2,125		0	0	225	225	225	1,358	1,641	2,349
		52	**14,165**	**1,133**	**1,416**	**2,125**	**0**	**0**	**0**	**225**	**225**	**225**	**1,358**	**1,641**	**2,349**
	160	22	1,387	222	264	395		0	0	95	95	95	317	359	490
	160	2	266	43	51	76		0	0	9	9	9	51	59	84
		24	**1,653**	**264**	**314**	**471**	**0**	**0**	**0**	**104**	**104**	**104**	**368**	**418**	**575**
Sub-Total		**76**	**15,818**	**1,398**	**1,731**	**2,596**	**0**	**0**	**0**	**328**	**328**	**328**	**1,726**	**2,059**	**2,924**
96	80	70	4,520	362	452	678		0	0	302	302	302	664	754	980
Sub-Total		**70**	**4,520**	**362**	**452**	**678**	**0**	**0**	**0**	**302**	**302**	**302**	**664**	**754**	**980**
97	80	48	6,169	494	617	925		0	0	207	207	207	701	824	1,133
		48	**6,169**	**494**	**617**	**925**	**0**	**0**	**0**	**207**	**207**	**207**	**701**	**824**	**1,133**
	160	26	1,700	272	323	485	98	118	176	112	112	112	482	553	773
		26	**1,700**	**272**	**323**	**485**	**98**	**118**	**176**	**112**	**112**	**112**	**482**	**553**	**773**
Sub-Total		**74**	**7,869**	**766**	**940**	**1,410**	**98**	**118**	**176**	**320**	**320**	**320**	**1,183**	**1,377**	**1,906**
D1	80	14	2,095	168	210	314		0	0	60	60	60	228	270	375
	160	244	14,163	2,266	2,691	4,036	450	540	810	1,054	1,054	1,054	3,770	4,285	5,901
Sub-Total		**258**	**16,258**	**2,434**	**2,900**	**4,351**	**450**	**540**	**810**	**1,115**	**1,115**	**1,115**	**3,998**	**4,555**	**6,275**
D2	80	28	6,596	528	660	989		0	0	121	121	121	649	781	1,110
	160	135	20,954	3,353	3,981	5,972	330	396	594	583	583	583	4,266	4,960	7,149
Sub-Total		**163**	**27,550**	**3,880**	**4,641**	**6,961**	**330**	**396**	**594**	**704**	**704**	**704**	**4,914**	**5,741**	**8,259**
D2A	80	48	4,074	326	407	611		0	0	207	207	207	533	615	818
	125	6	333	42	50	75		0	0	26	26	26	67	76	101
	160	57	3,312	530	629	944		0	0	246	246	246	776	875	1,190
Sub-Total		**111**	**7,718**	**897**	**1,086**	**1,630**	**0**	**0**	**0**	**480**	**480**	**480**	**1,377**	**1,566**	**2,109**
D3	80	1	271	22	27	41		0	0	6	6	6	28	33	47
	160	42	640	102	122	182	542	650	976	181	181	181	826	953	1,339

Table A.4-3 Computation Table for Wastewater Flow in Cabanga System (3/3)

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
Sub-Total		**43**	**911**	**124**	**149**	**223**	**542**	**650**	**976**	**187**	**187**	**187**	**854**	**987**	**1,386**
D4	80	20	2,852	228	285	428		0	0	86	86	86	315	372	514
	160	156	14,228	2,276	2,703	4,055	74	89	133	674	674	674	3,024	3,466	4,862
Sub-Total		**176**	**17,080**	**2,505**	**2,989**	**4,483**	**74**	**89**	**133**	**760**	**760**	**760**	**3,339**	**3,838**	**5,376**
D5	80	2	524	42	52	79		0	0	9	9	9	51	61	87
	160	170	30,912	4,946	5,873	8,810	386	463	695	734	734	734	6,066	7,071	10,239
Sub-Total		**172**	**31,436**	**4,988**	**5,926**	**8,888**	**386**	**463**	**695**	**743**	**743**	**743**	**6,117**	**7,132**	**10,326**
D6	160	118	14,671	2,347	2,787	4,181		0	0	510	510	510	2,857	3,297	4,691
Sub-Total		**118**	**14,671**	**2,347**	**2,787**	**4,181**	**0**	**0**	**0**	**510**	**510**	**510**	**2,857**	**3,297**	**4,691**
D6A	160	54	6,408	1,025	1,218	1,826	69	83	124	233	233	233	1,328	1,534	2,184
Sub-Total		**54**	**6,408**	**1,025**	**1,218**	**1,826**	**69**	**83**	**124**	**233**	**233**	**233**	**1,328**	**1,534**	**2,184**
D7	80	14	5,533	443	553	830		0	0	60	60	60	503	614	890
	160	398	35,221	5,635	6,692	10,038	138	166	248	1,719	1,719	1,719	7,493	8,577	12,006
Sub-Total		**412**	**40,754**	**6,078**	**7,245**	**10,868**	**138**	**166**	**248**	**1,780**	**1,780**	**1,780**	**7,996**	**9,191**	**12,896**
D9	80	4	989	79	99	148		0	0	17	17	17	96	116	166
	160	90	9,380	1,501	1,782	2,673	207	248	373	389	389	389	2,097	2,419	3,435
Sub-Total		**94**	**10,369**	**1,580**	**1,881**	**2,822**	**207**	**248**	**373**	**406**	**406**	**406**	**2,193**	**2,536**	**3,600**
D15	160	207	19,572	3,132	3,719	5,578	318	382	572	894	894	894	4,344	4,995	7,045
Sub-Total		**207**	**19,572**	**3,132**	**3,719**	**5,578**	**318**	**382**	**572**	**894**	**894**	**894**	**4,344**	**4,995**	**7,045**
Total	80	469	72,869	5,830	7,287	10,930	0	0	0	2,028	2,028	2,028	7,857	9,315	12,958
	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	125	6	333	42	50	75	0	0	0	26	26	26	67	76	101
	160	2,196	233,495	37,359	44,364	66,546	2,612	3,134	4,702	9,487	9,487	9,487	49,458	56,985	80,734
	Total	**2,671**	**306,696**	**43,230**	**51,701**	**77,551**	**2,612**	**3,134**	**4,702**	**11,540**	**11,540**	**11,540**	**57,383**	**66,376**	**93,793**

Table A.4-4 ComputationTable for Wastewater Flow in Boa Viagem System (1/2)

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
68	80	3	105	8	10	16		0	0	13	13	13	21	23	29
	80	84	14,240	1139	1424	2136		0	0	363	363	363	1502	1787	2499
		87	**14,345**	**1,148**	**1,434**	**2,152**	**0**	**0**	**0**	**376**	**376**	**376**	**1,523**	**1,810**	**2,528**
	110	136	6,300	693	819	1228		0	0	588	588	588	1280	1406	1816
		136	**6,300**	**693**	**819**	**1,228**	**0**	**0**	**0**	**588**	**588**	**588**	**1,280**	**1,406**	**1,816**
Sub-Total		**223**	**20,644**	**1,841**	**2,253**	**3,380**	**0**	**0**	**0**	**963**	**963**	**963**	**2,804**	**3,217**	**4,344**
78	80	5	466	37	47	70		0	0	22	22	22	59	68	91
		5	**466**	**37**	**47**	**70**	**0**	**0**	**0**	**22**	**22**	**22**	**59**	**68**	**91**
	160	20	3,668	587	697	1045		0	0	87	87	87	674	784	1132
		20	**3,668**	**587**	**697**	**1,045**	**0**	**0**	**0**	**87**	**87**	**87**	**674**	**784**	**1,132**
Sub-Total		**25**	**4,134**	**624**	**743**	**1,115**	**0**	**0**	**0**	**108**	**108**	**108**	**733**	**852**	**1,224**
79	80	15	2,600	208	260	390		0	0	65	65	65	273	325	455
		15	**2,600**	**208**	**260**	**390**	**0**	**0**	**0**	**65**	**65**	**65**	**273**	**325**	**455**
	160	42	4,021	643	764	1146		0	0	181	181	181	825	945	1327
		42	**4,021**	**643**	**764**	**1,146**	**0**	**0**	**0**	**181**	**181**	**181**	**825**	**945**	**1,327**
Sub-Total		**57**	**6,621**	**851**	**1,024**	**1,536**	**0**	**0**	**0**	**246**	**246**	**246**	**1,098**	**1,270**	**1,782**
80	80	5	1,358	109	136	204		0	0	22	22	22	130	157	225
		5	**1,358**	**109**	**136**	**204**	**0**	**0**	**0**	**22**	**22**	**22**	**130**	**157**	**225**
	160	35	5,449	872	1035	1553		0	0	151	151	151	1023	1187	1704
		35	**5,449**	**872**	**1,035**	**1,553**	**0**	**0**	**0**	**151**	**151**	**151**	**1,023**	**1,187**	**1,704**
Sub-Total		**40**	**6,807**	**980**	**1,171**	**1,757**	**0**	**0**	**0**	**173**	**173**	**173**	**1,153**	**1,344**	**1,929**
81	80	5	427	34	43	64		0	0	22	22	22	56	64	86
		5	**427**	**34**	**43**	**64**	**0**	**0**	**0**	**22**	**22**	**22**	**56**	**64**	**86**
	160	76	3,880	621	737	1106		0	0	328	328	328	949	1066	1434
	160	1	235	38	45	67		0	0	6	6	6	44	51	73
		77	**4,115**	**658**	**782**	**1,173**	**0**	**0**	**0**	**334**	**334**	**334**	**993**	**1,116**	**1,507**
Sub-Total		**82**	**4,542**	**693**	**825**	**1,237**	**0**	**0**	**0**	**356**	**356**	**356**	**1,049**	**1,181**	**1,593**
82	80	14	2,367	189	237	355		0	0	60	60	60	250	297	416
		14	**2,367**	**189**	**237**	**355**	**0**	**0**	**0**	**60**	**60**	**60**	**250**	**297**	**416**
	160	72	7,295	1167	1386	2079		0	0	311	311	311	1478	1697	2390
	160	28	3,427	548	651	977		0	0	121	121	121	669	772	1098
		100	**10,723**	**1,716**	**2,037**	**3,056**	**0**	**0**	**0**	**432**	**432**	**432**	**2,148**	**2,469**	**3,488**

Table A.4-4 ComputationTable for Wastewater Flow in Boa Viagem System (2/2)

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
83	80	5	1,261	101	126	189		0	0	22	22	22	122	148	211
		5	**1,261**	**101**	**126**	**189**	**0**	**0**	**0**	**22**	**22**	**22**	**122**	**148**	**211**
	110	1	17	2	2	3		0	0	4	4	4	6	6	8
		1	**17**	**2**	**2**	**3**	**0**	**0**	**0**	**4**	**4**	**4**	**6**	**6**	**8**
	160	58	15,861	2538	3014	4520		0	0	251	251	251	2788	3264	4771
		58	**15,861**	**2,538**	**3,014**	**4,520**	**0**	**0**	**0**	**251**	**251**	**251**	**2,788**	**3,264**	**4,771**
Sub-Total		**64**	**17,138**	**2,640**	**3,142**	**4,713**	**0**	**0**	**0**	**276**	**276**	**276**	**2,917**	**3,418**	**4,989**
84	80	21	3,240	259	324	486		0	0	91	91	91	350	415	577
		21	**3,240**	**259**	**324**	**486**	**0**	**0**	**0**	**91**	**91**	**91**	**350**	**415**	**577**
	160	156	23,815	3810	4525	6787		0	0	674	674	674	4484	5199	7461
		156	**23,815**	**3,810**	**4,525**	**6,787**	**0**	**0**	**0**	**674**	**674**	**674**	**4,484**	**5,199**	**7,461**
Sub-Total		**177**	**27,055**	**4,070**	**4,849**	**7,273**	**0**	**0**	**0**	**765**	**765**	**765**	**4,834**	**5,613**	**8,038**
86	80	15	1,998	160	200	300		0	0	65	65	65	225	265	365
		15	**1,998**	**160**	**200**	**300**	**0**	**0**	**0**	**65**	**65**	**65**	**225**	**265**	**365**
	160	2	345	55	66	98	136	163	245	9	9	9	200	237	352
	160	135	24,530	3925	4661	6991		0	0	583	583	583	4508	5244	7574
		137	**24,875**	**3,980**	**4,726**	**7,089**	**136**	**163**	**245**	**592**	**592**	**592**	**4,708**	**5,481**	**7,926**
Sub-Total		**152**	**26,873**	**4,140**	**4,926**	**7,389**	**136**	**163**	**245**	**657**	**657**	**657**	**4,932**	**5,746**	**8,291**
JB15	80	1	20	2	2	3		0	0	4	4	4	6	6	7
	110	174	11,445	1259	1488	2232		0	0	752	752	752	2011	2240	2983
	160	29	2,114	338	402	602		0	0	125	125	125	464	527	728
Sub-Total		**204**	**13,579**	**1,599**	**1,891**	**2,837**	**0**	**0**	**0**	**881**	**881**	**881**	**2,480**	**2,773**	**3,719**
JB17	80	8	2,914	233	291	437		0	0	35	35	35	268	326	472
	160	57	13,616	2179	2587	3881		0	0	246	246	246	2425	2833	4127
Sub-Total		**65**	**16,530**	**2,412**	**2,878**	**4,318**	**0**	**0**	**0**	**281**	**281**	**281**	**2,692**	**3,159**	**4,598**
Total	80	181	30,994	2,480	3,099	4,649	0	0	0	782	782	782	3,261	3,881	5,431
	110	311	17,761	1,954	2,309	3,463	0	0	0	1,344	1,344	1,344	3,297	3,652	4,807
	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	160	712	108,256	17,321	20,569	30,853	136	163	245	3,074	3,074	3,074	20,531	23,806	34,172
	Total	**1,203**	**157,012**	**21,754**	**25,977**	**38,966**	**136**	**163**	**245**	**5,199**	**5,199**	**5,199**	**27,089**	**31,339**	**44,410**

Table A.4-5 ComputationTable for Wastewater in Cordeiro System

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
39	80	62.0	3,337	267	334	501		0	0	268	268	268	535	602	768
		62.00	**3,337**	**267**	**334**	**501**	**0**	**0**	**0**	**268**	**268**	**268**	**535**	**602**	**768**
Sub-Total		**62.00**	**3,337**	**267**	**334**	**501**	**0**	**0**	**0**	**268**	**268**	**268**	**535**	**602**	**768**
40	80	201.0	12,726	1018	1273	1909		0	0	868	868	868	1886	2141	2777
		201.00	**12,726**	**1,018**	**1,273**	**1,909**	**0**	**0**	**0**	**868**	**868**	**868**	**1,886**	**2,141**	**2,777**
	160	36.0	1,569	251	298	447		0	0	156	156	156	407	454	603
		36.00	**1,569**	**251**	**298**	**447**	**0**	**0**	**0**	**156**	**156**	**156**	**407**	**454**	**603**
Sub-Total		**237.00**	**14,296**	**1,269**	**1,571**	**2,356**	**0**	**0**	**0**	**1,024**	**1,024**	**1,024**	**2,293**	**2,595**	**3,380**
41	80	53.0	7,915	633	792	1187		0	0	229	229	229	862	1020	1416
		53.00	**7,915**	**633**	**792**	**1,187**	**0**	**0**	**0**	**229**	**229**	**229**	**862**	**1,020**	**1,416**
	160	271.0	27,651	4424	5254	7880		0	0	1171	1171	1171	5595	6424	9051
		271.00	**27,651**	**4,424**	**5,254**	**7,880**	**0**	**0**	**0**	**1,171**	**1,171**	**1,171**	**5,595**	**6,424**	**9,051**
Sub-Total		**324.00**	**35,566**	**5,057**	**6,045**	**9,068**	**0**	**0**	**0**	**1,400**	**1,400**	**1,400**	**6,457**	**7,445**	**10,467**
42	80	12.0	2,212	177	221	332		0	0	52	52	52	229	273	384
		12.00	**2,212**	**177**	**221**	**332**	**0**	**0**	**0**	**52**	**52**	**52**	**229**	**273**	**384**
	160	0.1	4	1	1	1		0	0	0	0	0	1	1	2
	160	193.9	24,113	3858	4581	6872		0	0	838	838	838	4696	5419	7710
		194.00	**24,117**	**3,859**	**4,582**	**6,873**	**0**	**0**	**0**	**838**	**838**	**838**	**4,697**	**5,420**	**7,711**
Sub-Total		**206.00**	**26,329**	**4,036**	**4,803**	**7,205**	**0**	**0**	**0**	**890**	**890**	**890**	**4,926**	**5,693**	**8,095**
43	80	31.0	6,383	511	638	957		0	0	134	134	134	645	772	1091
		31.00	**6,383**	**511**	**638**	**957**	**0**	**0**	**0**	**134**	**134**	**134**	**645**	**772**	**1,091**
	160	99.0	14,138	2262	2686	4029		0	0	428	428	428	2690	3114	4457
		99.00	**14,138**	**2,262**	**2,686**	**4,029**	**0**	**0**	**0**	**428**	**428**	**428**	**2,690**	**3,114**	**4,457**
Sub-Total		**130.00**	**20,521**	**2,773**	**3,324**	**4,987**	**0**	**0**	**0**	**562**	**562**	**562**	**3,334**	**3,886**	**5,548**
53	80	11.0	1,436	115	144	215		0	0	48	48	48	162	191	263
		11.00	**1,436**	**115**	**144**	**215**	**0**	**0**	**0**	**48**	**48**	**48**	**162**	**191**	**263**
	160	84.0	7,741	1238	1471	2206		0	0	363	363	363	1601	1834	2569
		84.00	**7,741**	**1,238**	**1,471**	**2,206**	**0**	**0**	**0**	**363**	**363**	**363**	**1,601**	**1,834**	**2,569**
Sub-Total		**95.00**	**9,176**	**1,353**	**1,614**	**2,421**	**0**	**0**	**0**	**410**	**410**	**410**	**1,764**	**2,025**	**2,832**
Total	80	370.00	34,008	2,721	3,401	5,101	0	0	0	1,598	1,598	1,598	4,319	4,999	6,700
	110	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
	125	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
	160	684.00	75,216	12,034	14,291	21,436	0	0	0	2,955	2,955	2,955	14,989	17,246	24,391
	Total	**1,054.00**	**109,224**	**14,755**	**17,692**	**26,538**	**0**	**0**	**0**	**4,553**	**4,553**	**4,553**	**19,308**	**22,245**	**31,091**

Table A.4-6 Computation Table for Wastewater Flow in Prazeres System

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
JB16	110	107.00	7,868	865	1023	1534		0	0	462	462	462	1328	1485	1997
	160	242.00	17,759	2841	3374	5061		0	0	1045	1045	1045	3887	4420	6107
Sub-Total		**349.00**	**25,627**	**3,707**	**4,397**	**6,596**	**0**	**0**	**0**	**1,508**	**1,508**	**1,508**	**5,215**	**5,905**	**8,103**
JB18	80	118.00	27,072	2166	2707	4061		0	0	510	510	510	2676	3217	4571
	160	142.00	35,914	5746	6824	10235		0	0	613	613	613	6360	7437	10849
Sub-Total		**260.00**	**62,986**	**7,912**	**9,531**	**14,296**	**0**	**0**	**0**	**1,123**	**1,123**	**1,123**	**9,035**	**10,654**	**15,419**
JB19	80	287.00	69,255	5540	6925	10388		0	0	1240	1240	1240	6780	8165	11628
	160	201.00	14,455	2313	2746	4120		0	0	868	868	868	3181	3615	4988
Sub-Total		**488.00**	**83,710**	**7,853**	**9,672**	**14,508**	**0**	**0**	**0**	**2,108**	**2,108**	**2,108**	**9,961**	**11,780**	**16,616**
JB21	80	197.00	41,877	3350	4188	6282		0	0	851	851	851	4201	5039	7133
	160	276.00	19,204	3073	3649	5473		0	0	1192	1192	1192	4265	4841	6665
Sub-Total		**473.00**	**61,081**	**6,423**	**7,836**	**11,755**	**0**	**0**	**0**	**2,043**	**2,043**	**2,043**	**8,466**	**9,880**	**13,798**
Total	80	602	138,204	11,056	13,820	20,731	0	0	0	2,601	2,601	2,601	13,657	16,421	23,331
	110	107	7,868	865	1,023	1,534	0	0	0	462	462	462	1,328	1,485	1,997
	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	160	861	87,331	13,973	16,593	24,889	0	0	0	3,720	3,720	3,720	17,693	20,312	28,609
	Total	**1,570**	**233,403**	**25,895**	**31,436**	**47,154**	**0**	**0**	**0**	**6,782**	**6,782**	**6,782**	**32,677**	**38,219**	**53,937**

Table A.4-7 Computation Table for Wastewater Flow in Curucurana System

U.E.	ELO District (l/day)	Area (ha)	Future population	Population sewage Volume (m3/day)			Major Consumers (m3/day)			Infiltration (m3/day)			Sewerage Flow (m3/day)		
				Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum	Daily average	Daily maximum	Hourly maximum
JB20	80	23.00	5,523	442	552	828		0	0	99	99	99	541	652	928
	160	50.00	5,919	947	1125	1687		0	0	216	216	216	1163	1341	1903
Sub-Total		**73.00**	**11,442**	**1,389**	**1,677**	**2,515**	**0**	**0**	**0**	**315**	**315**	**315**	**1,704**	**1,992**	**2,831**
JB22	80	82.00	18,025	1442	1802	2704		0	0	354	354	354	1796	2157	3058
	160	249.00	35,184	5629	6685	10027		0	0	1076	1076	1076	6705	7761	11103
Sub-Total		**331.00**	**53,209**	**7,071**	**8,487**	**12,731**	**0**	**0**	**0**	**1,430**	**1,430**	**1,430**	**8,501**	**9,917**	**14,161**
JB23	80	11.00	1,857	149	186	278		0	0	48	48	48	196	233	326
	125	146.00	11,437	1430	1716	2573		0	0	631	631	631	2060	2346	3204
	160	376.00	40,692	6511	7731	11597		0	0	1624	1624	1624	8135	9356	13222
Sub-Total		**533.00**	**53,986**	**8,089**	**9,633**	**14,449**	**0**	**0**	**0**	**2,303**	**2,303**	**2,303**	**10,391**	**11,935**	**16,752**
JB24	80	141.00	22,607	1809	2261	3391		0	0	609	609	609	2418	2870	4000
	160	82.00	8,913	1426	1693	2540		0	0	354	354	354	1780	2048	2894
Sub-Total		**223.00**	**31,520**	**3,235**	**3,954**	**5,931**	**0**	**0**	**0**	**963**	**963**	**963**	**4,198**	**4,918**	**6,895**
Total	80	257	48,011	3,841	4,801	7,202	0	0	0	1,110	1,110	1,110	4,951	5,911	8,312
	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	125	146	11,437	1,430	1,716	2,573	0	0	0	631	631	631	2,060	2,346	3,204
	160	757	90,708	14,513	17,234	25,852	0	0	0	3,270	3,270	3,270	17,783	20,505	29,122
	Total	**1,160**	**150,156**	**19,784**	**23,751**	**35,627**	**0**	**0**	**0**	**5,011**	**5,011**	**5,011**	**24,795**	**28,762**	**40,638**

Table A.4-8 Computation Table for Design of the gravity and pressure-flow in Conceicao System (UE03 and UE02)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
6/03	6/03	6A/03	200	200	0.010	0.027	300	1.7	-3.370	-3.700	2.80	2.80	5.87	6.20
6A/03	6A/03	6B/03	290	490	0.011	0.038	400	1.3	-3.800	-4.090	2.80	2.50	6.20	6.19
6B/03	6B/03	7/03	60	550	0.007	0.045	400	1.2	-4.090	-4.160	2.50	2.50	6.19	6.26
7/03	7/03	EE I-03	30	580	0.016	0.061	500	1.0	-4.060	-4.190	2.50	2.00	6.06	5.69
EE I-03	EE I-03	31/03	690	1270	0.000	0.061	300	0.0	0.800	2.450	2.00	3.50	0.90	0.75
31/03	31/03	32/03	370	1640	0.008	0.068	400	3.5	2.450	1.150	3.50	2.20	0.65	0.65
32/03	32/03	32A/03	270	1910	0.006	0.074	500	0.9	1.050	0.920	2.20	2.00	0.65	0.58
32A/03	32A/03	33/03	220	2130	0.005	0.078	500	0.8	0.850	0.740	2.00	2.10	0.65	0.86
33/03	33/03	6/02	290	2420	0.006	0.084	500	0.8	0.740	0.510	2.10	2.80	0.86	1.79
6/02	6/02	7/02	380	2800	0.072	0.156	700	0.5	0.310	0.020	2.80	2.00	1.79	1.28
7/02	7/02	ETE	500	3300	0.081	0.237	700	0.4	-3.440	-3.640	2.00	2.00	4.74	4.94

Table A.4-9 Computation Table for Design of the gravity and pressure-flow in Conceicao System (UE01)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
2/01	2/01	3/01	340	340	0.011	0.033	300	1.6	-0.900	-1.430	2.00	2.00	2.60	3.13
3/01	3/01	3A/01	270	610	0.006	0.040	400	1.3	-1.530	-1.780	2.00	1.00	3.13	2.38
3A/01	3A/01	4/01	230	840	0.005	0.045	400	1.2	-1.780	-2.060	1.00	1.00	2.38	2.66
4/01	4/01	4A/01	320	1160	0.008	0.053	400	1.1	-2.060	-2.410	1.00	1.50	2.66	3.51
4A/01	4A/01	5/01	370	1530	0.009	0.061	500	1.0	-2.510	-2.760	1.50	2.00	3.51	4.26
5/01	5/01	5A/01	220	1750	0.005	0.066	500	0.9	-2.760	-2.960	3.50	2.00	5.76	4.46
5A/01	5A/01	5B/01	250	2000	0.006	0.072	500	0.9	-2.960	-3.180	2.00	1.50	4.46	4.18
5B/01	5B/01	7/02	320	2320	0.008	0.080	500	0.8	-3.180	-3.440	1.50	2.10	4.18	5.04

Table A.4-10 Computation Table for Design of the gravity and pressure-flow in Janga System (INTERCEPTOR)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
1/RIO DOCE	1/RIO DOCE	2/RIO DOCE	875	875	0.132	0.132	600	0.6	1.50	0.98	3.00	3.00	0.90	1.42
2/RIO DOCE	2/RIO DOCE	3/RIO DOCE	65	940	0.000	0.132	600	0.6	0.98	0.94	3.00	3.00	1.42	1.46
3/RIO DOCE	3/RIO DOCE	4/RIO DOCE	705	1,645	0.092	0.224	800	0.4	0.74	0.64	3.00	5.00	1.46	3.56
4/RIO DOCE	4/RIO DOCE	5/RIO DOCE	355	2,000	0.000	0.224	800	0.4	0.64	0.49	5.00	5.00	3.56	3.71
5/RIO DOCE	5/RIO DOCE	6/RIO DOCE	375	2,375	0.000	0.224	800	0.4	0.49	0.33	5.00	3.00	3.71	1.87
6/RIO DOCE	6/RIO DOCE	EEJ-03	150	2,525	0.150	0.374	800	0.6	-2.52	-2.61	3.00	2.00	4.72	3.81
EEJ-03	EEJ-03	1/OLINDA	30	2,405	0.016	0.390	350	0	0.75	0.75	2.00	2.00	0.90	0.90
1/OLINDA	1/OLINDA	2/OLINDA	545	2,950	0.000	0.390	1200	0.3	-0.10	-0.10	2.00	2.00	0.90	0.90
2/OLINDA	2/OLINDA	3/OLINDA	85	3,035	0.008	0.398	1200	0.3	-0.26	-0.26	2.00	2.00	1.06	1.06
3/OLINDA	3/OLINDA	4/OLINDA	325	3,360	0.019	0.418	1200	0.3	-0.29	-0.29	2.00	2.00	1.09	1.09
4/OLINDA	4/OLINDA	5/OLINDA	465	3,825	0.011	0.429	1200	0.3	-0.39	-0.39	2.00	2.00	1.19	1.19
5/OLINDA	5/OLINDA	6/OLINDA	150	3,975	0.008	0.437	1200	0.7	-0.53	-0.53	2.00	2.00	1.33	1.33
6/OLINDA	6/OLINDA	7/OLINDA	525	4,500	0.011	0.448	1200	0.3	-0.64	-0.64	2.00	2.00	1.44	1.44
7/OLINDA	7/OLINDA	8/OLINDA	95	4,595	0.000	0.448	1200	1.1	-0.80	-0.80	2.00	2.00	1.60	1.60
8/OLINDA	8/OLINDA	9/OLINDA	250	4,845	0.020	0.469	1200	0.4	-0.90	-0.90	2.00	2.00	1.70	1.70
9/OLINDA	9/OLINDA	EEJ-01	40	4,885	0.000	0.469	1200	0.3	-1.00	-1.00	2.00	3.50	1.80	3.30
EEJ-01-1	EEJ-01-1	EEJ-01-2	1,350	6,235	0.000	0.469	2*700	0.0	2.07	3.00	3.50	4.50	0.73	1.50
EEJ-01-2	EEJ-01-2	EEJ-01-3	580	6,815	0.000	0.469	2*700	0.0	3.00	0.70	4.50	4.00	0.80	3.30
EEJ-01-3	EEJ-01-3	EEJ-01-4	900	7,715	0.000	0.469	2*700	0.0	0.70	0.70	4.00	3.50	2.60	2.80
EEJ-01-4	EEJ-01-4	EEJ-01-5	1,860	9,575	0.000	0.469	2*700	0.0	0.70	1.30	3.50	2.90	2.10	1.60
EEJ-01-5	EEJ-01-5	EEJ-01-6	340	9,915	0.000	0.469	2*700	0.0	1.30	6.03	2.90	8.20	0.90	2.17
EEJ-01-6	EEJ-01-6	EEJ-01-7	360	10,275	0.000	0.469	2*700	0.0	6.03	0.58	8.20	2.80	1.47	2.22
EEJ-01-7	EEJ-01-7	EEJ-01-8	640	10,915	0.000	0.469	2*700	0.0	0.58	6.00	2.80	8.40	1.52	2.40
EEJ-01-8	EEJ-01-8	EEJ-01-9	110	11,025	0.000	0.469	2*700	0.0	6.00	15.00	8.40	16.30	1.70	1.30
EEJ-01-9	EEJ-01-9	EEJ-01-10	20	11,045	0.000	0.469	2*700	0.0	15.00	15.00	16.3	16.3	0.60	1.30
EEJ-01-10	EEJ-01-10	ETE	20	11,065	0.000	0.469	2*700	0.0	15.00	15.00	16.3	16.3	0.60	1.30

Table A.4-11 Computation Table for Design of the gravity and pressure-flow in Janga System (UEAE4 and UE23)

	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
1/AE4	1/AE4	2/AE4	280	280	0.025	0.025	300	1.8	10.80	10.31	12.00	13.00	0.90	2.39
2/AE4	2/AE4	3/AE4	205	485	0.003	0.028	300	12.2	10.31	7.80	13.00	9.00	2.39	0.90
3/AE4	3/AE4	4/AE4	155	640	0.002	0.030	300	1.6	7.80	7.55	9.00	10.00	0.90	2.15
4/AE4	4/AE4	5/AE4	155	795	0.002	0.032	300	17.7	7.55	4.80	10.00	6.00	2.15	0.90
5/AE4	5/AE4	6/AE4	187	982	0.002	0.034	300	1.5	4.80	4.52	6.00	10.00	0.90	5.18
6/AE4	6/AE4	7/AE4	155	1,137	0.002	0.036	300	11.7	4.52	2.70	10.00	4.00	5.18	1.00
7/AE4	7/AE4	8/AE4	210	1,192	0.003	0.039	400	1.3	2.70	2.43	4.00	5.00	0.90	2.17
8/AE4	8/AE4	9/AE4	215	1,407	0.003	0.041	400	1.3	2.43	2.16	5.00	5.00	2.17	2.44
9/AE4	9/AE4	10/AE4	215	1,622	0.003	0.044	400	1.2	2.16	1.90	5.00	5.00	2.44	2.70
10/AE4	10/AE4	11/AE4	220	1,842	0.003	0.047	400	1.2	1.90	1.65	5.00	5.00	2.70	2.95
11/AE4	11/AE4	12/AE4	210	2,052	0.003	0.049	400	1.2	1.65	1.41	5.00	5.00	2.95	3.19
12/AE4	12/AE4	1/23	115	2,167	0.001	0.051	400	1.1	1.41	1.28	5.00	5.00	3.19	3.32
1/23	1/23	2/23	140	2,307	0.001	0.052	400	1.1	1.28	1.13	5.00	2.50	3.32	0.97
2/23	2/23	3/23	120	2,427	0.001	0.053	400	1.1	1.13	1.00	2.50	2.50	0.97	1.10
3/23	3/23	4/23	290	2,717	0.071	0.124	600	0.6	-1.86	-2.04	2.50	2.50	3.76	3.94
4/23	4/23	5/23	105	2,822	0.015	0.139	700	0.6	-2.04	-2.10	2.50	2.50	3.84	3.90
5/23	5/23	6/23	150	2,972	0.001	0.140	700	0.6	-2.10	-2.18	2.50	2.50	3.90	3.98
6/23	6/23	7/23	160	3,132	0.001	0.142	700	0.6	-2.18	-2.27	2.50	2.00	3.98	3.57
7/23	7/23	8/23	70	3,202	0.001	0.142	700	0.6	-2.27	-2.31	2.00	6.00	3.57	7.61
8/23	8/23	9/23	138	3,270	0.006	0.148	700	0.5	-2.31	-2.38	6.00	3.00	7.61	4.68
9/23	9/23	10/23	140	3,410	0.001	0.149	700	0.5	-2.38	-2.46	3.00	3.00	4.68	4.76
10/23	10/23	06/RIO DOCE	95	3,505	0.001	0.150	700	0.5	-2.46	-2.51	3.00	3.00	4.76	4.81

Table A.4-12 Computation Table for Design of the gravity and pressure-flow in Janga System (UE05)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
3/05	3/05	4/05	250	250	0.044	0.008	400	1.1	0.29	0.02	4.00	3.00	3.31	2.58
4/05	4/05	5/05	260	510	0.004	0.052	400	1.1	0.02	-0.26	3.00	4.00	2.58	3.86
5/05	5/05	6/05	195	705	0.003	0.055	400	1	-0.26	-0.46	4.00	3.90	3.86	3.96
6/05	6/05	7/05	220	925	0.003	0.058	500	1	-0.56	-0.67	3.90	3.90	3.96	4.07
7/05	7/05	8/05	140	1,065	0.002	0.062	500	0.9	-0.67	-0.80	3.90	3.90	4.07	4.20
8/05	8/05	9/05	75	1,140	0.006	0.064	500	0.9	-0.80	-0.87	3.90	3.90	4.20	4.27
9/05	9/05	10/05	75	1,215	0.001	0.070	500	0.9	-0.87	-0.94	3.90	2.00	4.27	2.44
10/05	10/05	11/05	30	1,245	0.043	0.072	600	0.6	-1.04	-1.06	2.00	2.00	2.44	2.46
11/05	11/05	EE-1/05-1	50	1,295	0.019	0.115	600	0.6	-1.06	-1.09	2.00	2.00	2.46	2.49
EE-1/05-1	EE-1/05-1	EE-1/05-2	400	1,695	0.000	0.134	400	0.0	0.70	2.50	2.00	3.80	0.90	0.90
EE-1/05-2	EE-1/05-2	EE-1/05-3	1,200	2,895	0.000	0.134	400	0.0	2.50	2.70	3.80	4.00	0.90	0.90
EE-1/05-3	EE-1/05-3	EE-4/05-1	580	3,475	0.000	0.134	400	0.0	2.70	0.90	4.00	2.20	0.90	0.90
EE-4/05-1	EE-4/05-1	EE-4/05-2	450	3,925	0.105	0.239	500	0.0	0.80	11.60	2.20	13.00	0.90	0.90
EE-4/05-2	EE-4/05-2	EE-4/05-3	700	4,625	0.000	0.239	500	0.0	11.60	8.40	13.00	9.80	0.90	0.90
EE-4/05-3	EE-4/05-3	EE-4/05-4	750	5,375	0.000	0.239	500	0.0	8.40	1.50	9.80	2.90	0.90	0.90
EE-4/05-4	EE-4/05-4	ETE	900	6,275	0.000	0.239	500	0.0	1.50	14.90	2.90	16.30	0.90	0.90

Table A.4-13 Computation Table for Design of the gravity and pressure-flow in Janga System (UE04)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
4/04	4/04	5/04	245	245	0.012	0.027	300	1.7	-0.90	-1.31	3.00	3.50	3.60	4.51
5/04	5/04	6/04	430	675	0.007	0.034	300	1.5	-1.31	-1.96	3.50	3.00	4.51	4.66
6/04	6/04	7/04	85	760	0.001	0.035	400	1.4	-2.06	-2.18	3.00	3.00	4.66	4.78
7/04	7/04	8/04	380	1,140	0.006	0.041	400	1.3	-2.18	-2.56	3.00	4.00	4.78	6.16
8/04	8/04	9/04	310	1,450	0.005	0.046	400	1.2	-2.56	-2.92	4.00	4.50	6.16	7.02
9/04	9/04	10/04	140	1,590	0.002	0.048	400	1.1	-2.92	-3.08	4.50	4.50	7.02	7.18
10/04	10/04	10A/04	110	1,700	0.025	0.073	500	0.9	-3.18	-3.27	4.50	4.50	7.18	7.27
10A/04	10A/04	11/04	350	2,050	0.065	0.139	700	0.6	-3.47	-3.67	4.50	1.00	7.27	3.97
11/04	11/04	EE-1/04	40	2,090	0.015	0.153	700	0.5	-3.67	-3.87	1.00	1.00	3.97	4.17
EE-1/04	EE-1/04	EE-1/04	950	3,040	0.000	0.153	500	0.0	-0.40	2.10	1.00	3.50	0.90	0.90
EE-1/04	EE-1/04	EE-1/04	850	3,890	0.000	0.153	500	0.0	2.10	4.60	3.50	6.00	0.90	0.90
EE-1/04	EE-1/04	EE-1/04	600	4,490	0.000	0.153	500	0.0	4.60	1.60	6.00	3.00	0.90	0.90
EE-1/04	EE-1/04	ETE	900	5,390	0.000	0.153	500	0.0	1.60	14.90	3.00	16.30	0.90	0.90

Table A.4-14 Computation Table for Design of the gravity and pressure-flow in Cabanga System (UED15)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
4/D15	4/D15	5/D15	515	515	0.005	0.027	300	1.7	-2.19	-3.06	2.00	2.00	3.89	4.76
5/D15	5/D15	6/D15	430	945	0.004	0.031	300	1.6	-3.06	-3.75	2.00	3.00	4.76	6.45
6/D15	6/D15	7/D15	535	1,480	0.005	0.036	400	1.4	-3.85	-4.50	3.00	2.50	6.45	6.60
7/D15	7/D15	8/D15	320	1,800	0.003	0.039	400	1.3	-4.50	-4.92	2.50	3.00	6.60	7.52
8/D15	8/D15	9/D15	580	2,380	0.005	0.044	400	1.2	-4.92	-5.61	3.00	2.50	7.52	7.71
9/D15	9/D15	10/D15	580	2,960	0.039	0.084	500	0.8	-5.71	-6.08	2.50	3.00	7.71	8.58
10/D15	10/D15	11/D15	180	2,560	0.002	0.085	500	0.8	-6.08	-6.22	3.00	2.00	8.58	7.72
11/D15	11/D15	EEC-03	180	2,740	0.014	0.099	600	0.7	-6.32	-6.44	2.00	2.00	7.72	7.84
EEC-03	EEC-03	EEC-03	700	3,440	0.000	0.099	400	0.0	0.70	1.70	2.00	3.00	0.90	0.90
EEC-03	EEC-03	EEC-03	1550	4,990	0.000	0.099	400	0.0	1.70	0.70	3.00	2.00	0.90	0.90
EEC-03	EEC-03	EEC-03	450	5,440	0.000	0.099	400	0.0	0.70	5.00	2.00	7.00	0.90	1.60
EEC-03	EEC-03	EEC-03	600	6,040	0.000	0.099	400	0.0	5.00	5.00	7.00	7.00	1.60	1.60
EEC-03	EEC-03	ETE	50	6,090	0.000	0.099	400	0.0	5.00	0.70	7.00	2.00	1.60	0.90

Table A.4-15 Computation Table for Design of the gravity and pressure-flow in Cabanga System (UED5 and D6)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
3/D5	3/D5	4/D5	530	530	0.013	0.035	400	1.5	0.85	0.06	2.00	2.00	0.75	1.55
4/D5	4/D5	5/D5	425	955	0.010	0.045	400	1.5	0.06	-0.59	2.00	2.00	1.54	2.19
5/D5	5/D5	6/D5	300	1255	0.007	0.052	400	1.5	-0.59	-1.03	2.00	2.00	2.19	2.63
6/D5	6/D5	7/D5	285	1540	0.007	0.058	400	1.5	-1.03	-1.46	2.00	2.00	2.63	3.06
7/D5	7/D5	8/D5	310	1850	0.007	0.066	400	1.5	-1.46	-1.93	2.00	2.00	3.06	3.53
8/D5	8/D5	9/D5	155	2005	0.022	0.087	500	0.8	-4.33	-4.46	2.00	2.00	5.83	5.96
9/D5	9/D5	EEX-04	115	1965	0.093	0.181	700	0.8	-4.66	-4.76	2.00	2.00	5.96	6.06
EEX-04	EEX-04	EEX-04	450	2415	0.000	0.181	400	0.0	0.70	2.70	2.00	4.00	0.90	0.90
EEX-04	EEX-04	1/D1	180	2595	0.000	0.181	400	0.0	2.70	2.70	4.00	4.00	0.90	0.90
1/D1	1/D1	2/D2	310	2905	0.005	0.186	600	1.5	0.95	0.50	4.00	2.00	2.45	0.90
2/D1	2/D1	3/D1	410	3315	0.006	0.192	800	0.5	0.30	0.18	2.00	2.00	0.90	1.02
3/D1	3/D1	4/D1	255	3570	0.004	0.196	800	0.5	0.18	0.07	2.00	2.00	1.02	1.13
4/D1	4/D1	5/D1	240	3810	0.004	0.199	800	0.5	0.07	-0.05	2.00	2.00	1.13	1.25
5/D1	5/D1	6/D6	210	4020	0.009	0.209	800	0.4	-0.05	-0.13	2.00	2.00	1.25	1.33
6/D1	6/D1	7/D1	420	4440	0.197	0.405	1000	0.4	-4.55	-4.55	2.00	2.00	5.55	5.55
7/D1	7/D1	8/D1	150	4590	0.002	0.408	1000	0.4	-4.72	-4.72	2.00	2.00	5.72	5.72
8/D1	8/D1	9/D1	370	4960	0.006	0.413	1200	0.3	-4.98	-4.98	2.00	2.00	5.78	5.78
9/D1	9/D1	10/D1	190	5150	0.003	0.416	1200	0.3	-5.09	-5.09	2.00	2.00	5.89	5.89
10/D1	10/D1	11/D1	235	5385	0.015	0.431	1200	0.3	-5.15	-5.15	2.00	2.00	5.95	5.95
11/D1	11/D1	12/D1	300	5685	0.005	0.436	1200	0.3	-5.22	-5.22	2.00	2.00	6.02	6.02
12/D1	12/D1	13/D1	285	5970	0.465	0.900	1500	0.3	-5.61	-5.61	2.00	2.00	6.11	6.11
13/D1	13/D1	ETE	100	6070	0.002	0.902	1500	0.3	-5.70	-5.70	2.00	2.00	6.20	6.20

Table A.4-16 Computation Table for Design of the gravity and pressure-flow in Cabanga System (UED7,D2 and D1)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
3/D7	3/D7	4/D7	515	515	0.014	0.032	300	1.6	-0.83	-1.63	2.00	2.00	2.53	3.33
4/D7	4/D7	5/D7	300	815	0.008	0.040	400	1.3	-1.73	-2.02	2.00	2.00	3.33	3.62
5/D7	5/D7	6/D7	25	840	0.001	0.041	400	1.3	-2.02	-2.05	2.00	2.00	3.62	3.65
6/D7	6/D7	EE-D7	230	1,070	0.006	0.047	400	1.2	-2.05	-2.32	2.00	2.00	3.65	3.92
EE-D7	EE-D7	6/D7	150	1,220	0.000	0.047	250	0.0	2.85	2.85	4.00	4.00	0.90	0.90
6/D7	6/D7	7/D7	240	1,460	0.014	0.118	600	0.7	-0.67	-0.83	2.00	2.00	2.07	2.23
7/D7	7/D7	8/D7	280	1,500	0.017	0.134	600	0.7	-0.83	-1.03	2.00	2.00	2.23	2.43
8/D7	8/D7	EEC-02	40	1,540	0.002	0.137	600	0.7	-1.03	-1.06	2.00	2.00	2.43	2.46
EEC-02	EEC-02	1/D2	650	2,190	0.000	0.137	400	0.0	0.70	2.60	2.00	3.90	0.90	0.90
1/D2	1/D2	2/D2	345	2,535	0.012	0.148	700	1.5	2.30	2.30	3.90	4.50	0.90	1.50
2/D2	2/D2	2A/D2	175	2,710	0.006	0.154	700	0.5	1.78	1.78	4.50	4.50	2.02	2.02
2A/D2	2A/D2	3/D2	260	2,970	0.037	0.192	700	6.5	1.69	1.69	4.50	2.50	2.11	0.11
3/D2	3/D2	4/D2	395	3,365	0.013	0.205	800	0.8	-0.10	-0.10	2.50	2.30	1.80	1.60
4/D2	4/D2	5/D2	330	3,695	0.061	0.266	800	0.5	-0.42	-0.42	2.30	2.50	1.92	2.12
5/D2	5/D2	6/D2	435	4,130	0.015	0.281	1000	0.4	-0.79	-0.79	2.50	2.50	2.29	2.29
6/D2	6/D2	7/D2	480	4,610	0.067	0.348	1000	0.4	-0.96	-0.96	2.50	2.80	2.46	2.76
7/D2	7/D2	EEC-01	50	4,660	0.063	0.411	1000	0.4	-1.15	-1.15	2.80	2.80	2.95	2.95
EEC-01	EEC-01	1/D1	630	5,290	0.000	0.411	500	0.0	1.40	0.60	2.80	2.00	0.90	0.90
1/D1	1/D1	2/D1	150	5,440	0.005	0.416	1000	0.5	0.10	0.10	2.00	2.00	0.90	0.90
2/D1	2/D1	3/D3	380	5,820	0.033	0.449	1000	0.5	0.03	0.03	2.00	2.00	0.97	0.97
3/D1	3/D1	4/D1	230	6,050	0.008	0.457	1000	0.5	-0.12	-0.12	2.00	2.00	1.12	1.12
4/D1	4/D1	12/D1	90	6,140	0.003	0.461	1000	0.5	-0.24	-0.24	2.00	2.00	1.24	1.24

Table A.4-17 Computation Table for Design of the gravity and pressure-flow in Boa Viagem System (UE68,83,81 and 80)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
5/68	5/68	6/68	350	350	0.007	0.030	300	1.6	13.70	13.15	15.00	15.00	1.00	1.55
6/68	6/68	7/68	250	600	0.005	0.036	400	1.7	13.05	8.95	15.00	10.00	1.55	0.65
7/68	7/68	8/68	360	960	0.008	0.043	400	1.2	8.95	8.52	10.00	10.00	0.65	1.08
8/68	8/68	9/68	290	1,250	0.006	0.050	400	1.1	8.52	8.20	10.00	10.00	1.08	1.40
9/68	9/68	10/68	80	1,330	0.002	0.051	400	1.1	8.20	8.11	10.00	10.00	1.40	1.49
10/68	10/68	11/68	335	1,665	0.007	0.058	400	1.0	8.11	7.76	10.00	10.00	1.49	1.84
11/68	11/68	12/68	300	1,965	0.006	0.065	500	0.9	7.66	7.48	10.00	10.00	1.84	2.02
12/68	12/68	13/68	240	2,205	0.005	0.070	500	0.9	7.48	7.27	10.00	10.00	2.02	2.23
13/68	13/68	14/68	260	2,465	0.006	0.075	500	0.9	7.27	7.05	10.00	10.00	2.23	2.45
14/68	14/68	EE-1/68	75	2,540	0.097	0.172	700	0.5	6.85	6.81	10.00	10.00	2.45	2.49
EE-1/68	EE-1/68	23/83	440	2,980	0.000	0.172	350	0.0	3.81	7.40	10.00	9.00	5.84	1.25
23/83	23/83	24/83	300	3,280	0.003	0.175	700	0.5	7.40	7.25	9.00	9.00	0.90	1.05
24/83	24/83	25/83	325	3,605	0.003	0.179	700	1.1	7.25	6.90	9.00	8.50	1.05	0.90
25/83	25/83	1/81	220	3,825	0.002	0.181	700	0.5	6.90	6.79	8.50	8.50	0.90	1.01
1/81	1/81	2/81	120	3,945	0.001	0.182	700	0.5	6.79	6.73	8.50	8.50	1.01	1.07
2/81	2/81	3/81	310	4,255	0.003	0.186	800	1.1	6.63	3.30	8.50	5.00	1.07	0.90
3/81	3/81	4/81	260	4,515	0.003	0.189	800	3.8	3.30	2.30	5.00	4.00	0.90	0.90
4/81	4/81	5/81	310	4,825	0.003	0.192	800	3.2	2.30	1.30	4.00	3.00	0.90	0.90
5/81	5/81	6/81	400	5,225	0.004	0.196	800	2.5	1.30	0.30	3.00	2.00	0.90	0.90
6/81	6/81	7/81	280	5,505	0.003	0.199	800	0.5	0.30	0.17	2.00	3.50	0.90	2.53
7/81	7/81	8/81	250	5,755	0.003	0.202	800	0.5	0.17	0.06	3.50	2.00	2.53	1.14
8/81	8/81	9/81	280	6,035	0.003	0.205	800	0.5	0.06	-0.07	2.00	4.00	1.14	3.27
9/81	9/81	10/81	325	6,360	0.004	0.208	800	0.4	-0.07	-0.22	4.00	4.00	3.27	3.42
10/81	10/81	11/81	230	6,590	0.002	0.211	800	0.4	-0.22	-0.32	4.00	4.00	3.42	3.52
11/81	11/81	6/80	50	6,640	0.002	0.213	800	0.4	-0.32	-0.42	4.00	4.00	3.52	3.62
6/80	6/80	ETE	330	6,970	0.245	0.458	1200	0.3	-0.82	-0.92	4.00	4.00	3.62	3.72

Table A.4-18 Computation Table for Design of the gravity and pressure-flow in Boa Viagem System (UE84,83 and 82A)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
8/84	8/84	9/84	150	150	0.002	0.025	300	1.8	4.33	4.07	7.00	8.00	2.37	3.63
9/84	9/84	10/84	270	420	0.004	0.029	300	1.1	4.07	3.76	8.00	5.00	3.63	0.94
10/84	10/84	11/84	90	510	0.001	0.030	300	1.6	3.76	3.62	5.00	5.00	0.94	1.08
11/84	11/84	12/84	205	715	0.003	0.033	300	1.5	3.62	3.31	5.00	5.00	1.08	1.39
12/84	12/84	13/84	200	915	0.003	0.036	400	1.4	3.21	3.04	5.00	5.00	1.39	1.56
13/84	13/84	14/84	120	1,035	0.002	0.038	400	19.5	3.04	0.70	5.00	2.00	1.56	0.90
14/84	14/84	15/84	110	1,145	0.006	0.044	400	1.2	0.70	0.57	2.00	2.00	0.90	1.03
15/84	15/84	16/84	145	1,290	0.002	0.046	400	1.2	0.57	0.40	2.00	2.00	1.03	1.20
16/84	16/84	17/84	70	1,360	0.001	0.047	400	1.2	0.40	0.32	2.00	2.00	1.20	1.28
17/84	17/84	EE-1/84	55	1,415	0.042	0.089	500	0.8	0.22	0.29	2.00	2.00	1.28	1.21
EE-1/84	EE-1/84	9/83	650	2,065	0.000	0.089	300	0.0	0.25	3.80	2.00	5.00	1.45	0.90
9/83	9/83	10/83	220	2,285	0.024	0.113	600	0.7	-2.07	-2.21	5.00	2.00	6.47	3.61
10/83	10/83	11/83	300	2,585	0.002	0.115	600	0.7	-2.21	-2.41	2.00	2.00	3.61	3.81
11/83	11/83	12/83	70	2,655	0.005	0.120	600	0.6	-2.41	-2.45	2.00	2.00	3.81	3.85
12/83	12/83	8/82A	140	2,795	0.001	0.121	600	0.6	-2.45	-2.54	2.00	2.00	3.85	3.94
8/82A	8/82A	4/82A	70	2,865	0.000	0.121	600	0.6	-2.54	-2.59	2.00	2.00	3.94	3.99
4/82A	4/82A	5/82A	190	3,055	0.010	0.131	600	0.6	-2.59	-2.71	2.00	2.00	3.99	4.11
5/82A	5/82A	6/82A	180	3,235	0.002	0.133	600	0.6	-2.71	-2.82	2.00	2.00	4.11	4.22
6/82A	6/82A	7/82A	230	3,465	0.003	0.136	600	0.6	-2.82	-2.96	2.00	2.00	4.22	4.36
7/82A	7/82A	EE-1/82A	70	3,535	0.110	0.245	800	0.4	-4.48	-4.51	2.00	2.00	5.68	5.71
EE-1/82A	EE-1/82A	6/80	2,550	6,085	0.000	0.245	600	0.0	-4.51	2.50	2.00	4.00	5.91	0.90

Table A.4-19 Computation Table for Design of the gravity and pressure-flow in Cordeiro System (UE42 and UE40)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
1/42	1/42	2/42	180	180	0.032	0.032	300	1.6	6.95	6.67	8.00	8.00	0.75	1.03
2/42	2/42	3/42	230	410	0.003	0.034	400	1.4	6.67	6.35	8.00	8.00	0.93	1.25
3/42	3/42	4/42	330	740	0.004	0.038	400	1.3	6.35	5.92	8.00	8.00	1.25	1.68
4/42	4/42	5/42	370	1,110	0.005	0.043	400	1.3	5.92	5.46	8.00	7.00	1.68	1.14
5/42	5/42	6/42	240	1,350	0.003	0.046	400	1.2	5.46	5.18	7.00	7.00	1.14	1.42
6/42	6/42	7/42	60	1,410	0.019	0.065	500	1.0	0.03	-0.03	7.00	7.00	6.47	6.53
7/42	7/42	8/42	100	1,510	0.030	0.095	600	0.7	-0.03	-0.10	-1.07	7.00	-1.64	6.50
8/42	8/42	EE-1/42	150	1,660	0.007	0.103	600	0.7	-0.10	-0.21	7.00	7.50	6.50	7.11
EE-1/42	EE-1/42	23/40	315	1,975	0.000	0.103	300	0.0	6.30	4.80	7.50	6.00	0.90	0.90
23/40	23/40	24/40	140	2,115	0.003	0.105	600	0.7	4.35	4.25	6.00	6.00	1.05	1.15
24/40	24/40	25/40	160	2,275	0.002	0.107	600	0.7	4.25	4.14	6.00	6.00	1.15	1.26
25/40	25/40	26/40	300	2,575	0.002	0.109	600	10.4	4.14	2.50	6.00	4.00	1.26	0.90
26/40	26/40	27/40	100	2,675	0.158	0.267	800	0.4	2.30	2.26	4.00	4.00	0.90	0.94
27/40	27/40	ETE	40	2,715	0.092	0.359	1000	0.3	2.06	2.04	4.00	4.00	0.94	0.96

Table A.4-20 Computation Table for Design of the gravity and pressure-flow in Cordeiro System (UE43 and UE41)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
5/43	5/43	6/43	140	140	0.020	0.041	400	1.3	0.73	0.55	4.80	5.00	3.67	4.05
6/43	6/43	7/43	180	320	0.003	0.044	400	1.2	0.55	0.33	5.00	4.00	4.05	3.27
7/43	7/43	8/43	190	510	0.004	0.047	400	1.2	0.33	0.11	4.00	4.00	3.27	3.49
8/43	8/43	9/43	230	740	0.004	0.052	400	1.1	0.11	-0.14	4.00	3.00	3.49	2.74
9/43	9/43	EE-1/43	30	770	0.001	0.052	400	1.1	-0.14	-0.17	3.00	3.00	2.74	2.77
EE-1/43	EE-1/43	30/41	685	1,455	0.000	0.052	300	0.0	1.80	3.80	3.00	5.00	0.90	0.90
30/41	30/41	31/41	310	1,765	0.003	0.055	400	3.2	3.70	2.95	5.00	4.00	0.90	0.65
31/41	31/41	32/41	260	2,025	0.003	0.058	400	1.1	2.95	2.68	4.00	4.50	0.65	1.42
32/41	32/41	33/41	140	2,165	0.002	0.060	500	1.0	2.58	2.44	4.50	4.50	1.42	1.56
33/41	33/41	EE-2/41	10	2,175	0.004	0.064	500	1.0	2.44	2.40	4.50	4.00	1.56	1.10
EE-2/41	EE-2/41	23/41	360	2,535	0.000	0.064	300	0.0	2.80	5.80	4.00	7.00	0.90	0.90
23/41	23/41	23A/41	90	2,625	0.001	0.065	300	11.1	5.80	4.95	7.00	6.00	0.90	0.75
23A/41	23A/41	24/41	350	2,975	0.002	0.067	300	7.1	4.95	2.45	6.00	3.50	0.75	0.75
24/41	24/41	25/41	120	3,095	0.001	0.068	300	12.5	2.45	0.95	3.50	2.00	0.75	0.75
25/41	25/41	13/41	60	3,155	0.006	0.074	500	0.9	-1.00	-1.05	2.00	2.00	2.50	2.55
13/41	13/41	14/41	180	3,335	0.069	0.144	700	0.6	-1.25	-1.36	2.00	2.00	2.55	2.66
14/41	14/41	EE-1/41	120	3,455	0.012	0.156	700	0.5	-1.36	-1.42	2.00	2.00	2.66	2.72
EE-1/41	EE-1/41	27/40	745	4,200	0.000	0.156	450	0.0	0.65	2.65	2.00	4.00	0.90	0.90

Table A.4-21 Computation Table for Design of the gravity and pressure-flow in Prazeres System (UE21 and UE16)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
6/21	6/21	7/21	260	260	0.006	0.026	300	1.7	0.72	0.28	5.00	5.00	3.98	4.42
7/21	7/21	8/21	310	570	0.007	0.033	300	1.5	0.28	-0.19	5.00	5.00	4.42	4.89
8/21	8/21	9/21	300	870	0.093	0.126	600	0.6	-1.49	-1.68	5.00	3.50	5.89	4.58
9/21	9/21	10/21	265	1,135	0.006	0.132	600	0.6	-1.68	-1.84	3.50	3.00	4.58	4.24
10/21	10/21	11/21	150	1,285	0.003	0.135	600	0.6	-1.84	-1.93	3.00	3.00	4.24	4.33
11/21	11/21	12/21	230	1,515	0.005	0.140	700	0.6	-1.93	-2.06	3.00	2.50	4.23	3.86
12/21	12/21	13/21	130	1,645	0.076	0.216	800	0.4	-2.06	-2.80	2.50	2.50	3.76	4.50
13/21	13/21	14/21	70	1,715	0.002	0.217	800	0.4	-2.86	-2.89	2.50	2.50	4.56	4.59
14/21	14/21	15/21	230	1,945	0.008	0.225	800	0.4	-2.89	-2.99	2.50	2.50	4.59	4.69
15/21	15/21	16/21	159	2,104	0.003	0.228	800	0.4	-2.99	-3.05	2.50	2.20	4.69	4.45
16/21	16/21	17/21	100	2,204	0.002	0.231	800	0.4	-3.05	-3.09	2.20	2.20	4.45	4.49
17/21	17/21	EE-1/21	50	2,254	0.058	0.288	1000	0.4	-3.29	-3.31	2.20	2.20	4.49	4.51
EE-1/21	EE-1/21	3/16	2,680	4,934	0.000	0.288	700	0.0	0.60	9.40	2.20	11.00	0.90	0.90
3/16	3/16	4/16	190	5,124	0.006	0.294	1000	0.4	7.17	7.10	11.00	10.00	2.83	1.90
4/16	4/16	5/16	280	5,404	0.002	0.296	1000	0.4	7.10	6.90	10.00	9.50	1.90	1.60
5/16	5/16	6/16	315	5,719	0.003	0.299	1000	0.4	6.90	6.87	9.50	9.50	1.60	1.63
6/16	6/16	7/16	160	5,879	0.124	0.423	1200	0.3	6.67	6.62	9.50	10.00	1.63	2.18
7/16	7/16	8/16	100	5,979	0.056	0.479	1200	0.3	6.62	6.52	10.00	12.00	2.18	4.28
8/16	8/16	8A/16	150	6,129	0.001	0.480	1200	0.3	6.52	6.49	12.00	11.00	4.28	3.31
8A/16	8A/16	9/16	115	6,244	0.007	0.486	1200	0.3	6.49	6.44	11.00	10.00	3.31	2.36
9/16	9/16	10/16	170	6,414	0.005	0.492	1200	0.3	4.67	4.62	10.00	9.50	4.13	3.68
10/16	10/16	11/16	230	6,644	0.007	0.499	1200	0.3	4.62	4.55	9.50	10.00	3.68	4.25
11/16	11/16	ETE	600	7,244	0.125	0.624	1500	0.3	4.25	4.07	10.00	9.50	4.25	3.93

Table A.4-22 Computation Table for Design of the gravity and pressure-flow in Curcurana System (UE23)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
6/23	6/23	7/23	280	280	0.064	0.085	500	0.8	3.60	3.60	5.00	5.00	0.90	0.90
7/23	7/23	8/23	270	550	0.003	0.088	500	0.8	3.38	3.38	5.00	5.00	1.12	1.12
8/23	8/23	9/23	300	850	0.004	0.092	500	0.8	3.16	3.16	5.00	5.00	1.34	1.34
9/23	9/23	10/23	300	1,150	0.003	0.095	500	0.8	2.92	2.92	5.00	5.00	1.58	1.58
10/23	10/23	11/23	250	1,400	0.044	0.139	700	0.6	2.63	2.63	5.00	5.00	1.67	1.67
11/23	11/23	12/23	300	1,700	0.004	0.142	700	0.6	2.48	2.48	5.00	5.00	1.82	1.82
12/23	12/23	13/23	300	2,000	0.004	0.147	700	0.6	0.58	0.58	5.00	2.00	3.72	0.72
13/23	13/23	14/23	320	2,320	0.002	0.149	700	0.6	0.40	0.40	2.00	5.00	0.90	3.90
14/23	14/23	15/23	300	2,620	0.002	0.151	700	0.6	0.21	0.21	5.00	5.00	4.09	4.09
15/23	15/23	16/23	150	2,770	0.045	0.196	800	0.5	-0.07	-0.07	5.00	5.00	4.27	4.27
16/23	16/23	17/23	200	2,970	0.002	0.198	800	0.5	-0.15	-0.15	5.00	2.00	4.35	1.35
17/23	17/23	18/23	150	3,120	0.002	0.200	800	0.5	-0.25	-0.25	2.00	1.80	1.45	1.25
18/23	18/23	19/23	185	3,305	0.010	0.211	800	0.4	-0.33	-0.33	1.80	1.50	1.33	1.03
19/23	19/23	20/23	260	3,565	0.003	0.214	800	0.4	-0.40	-0.40	1.50	1.50	1.10	1.10
20/23	20/23	21/23	180	3,745	0.002	0.216	800	0.4	-0.50	-0.50	1.50	2.00	1.20	1.70
21/23	21/23	22/23	310	4,055	0.032	0.248	800	0.4	-0.57	-0.57	2.00	1.50	1.77	1.27
22/23	22/23	23/23	250	4,305	0.003	0.251	1000	3.9	-0.89	-0.89	1.50	0.20	1.39	0.09
23/23	23/23	24/23	325	4,630	0.004	0.255	1000	0.4	-1.87	-1.87	0.20	0.20	1.07	1.07
24/23	24/23	25/23	350	4,980	0.004	0.259	1000	0.4	-2.00	-2.00	0.20	0.50	1.20	1.50
25/23	25/23	ETE	20	5,000	0.214	0.474	1200	0.3	-2.34	-2.34	0.50	0.80	1.64	1.94

Table A.4-23 Computation Table for Design of the gravity and pressure-flow in Curcurana System (UE22 and UE23)

Line Number	Location		Sewer Length (m)		Sewer Max.Flow (m3/s)		Diameter (mm)	Gradient (0/00)	Invert Elevation (m)		Ground Elevation (m)		Earth Covering (m)	
	From manhole	To manhole	Increment	Total	Increment	Total			Starting Point	End Point	Starting Point	End Point	Starting Point	End Point
5/22	5/22	6/22	160	160	0.003	0.024	300	1.8	0.75	0.46	4.50	5.00	3.45	4.24
6/22	6/22	7/22	100	260	0.002	0.026	300	1.7	0.46	0.29	5.00	5.80	4.24	5.21
7/22	7/22	8/22	340	600	0.006	0.032	300	1.6	0.29	-0.24	5.80	6.00	5.21	5.94
8/22	8/22	9/22	270	870	0.005	0.037	400	1.4	-0.34	-0.60	6.00	5.50	5.94	5.70
9/22	9/22	10/22	335	1,205	0.107	0.144	700	0.6	-0.90	-1.10	5.50	2.00	5.70	2.40
10/22	10/22	EE-1/22	85	1,290	0.020	0.165	700	0.5	-1.10	-1.15	2.00	2.00	2.40	2.45
EE-1/22	EE-1/22	37/23	1,515	2,805	0.000	0.165	450	0.0	0.65	-0.35	2.00	1.00	0.90	0.90
37/23	37/23	26/23	390	3,195	0.008	0.173	700	0.5	-0.60	-0.80	1.00	0.80	0.90	0.90
26/23	26/23	25/23	250	3,445	0.038	0.211	700	0.5	-0.80	-0.93	0.80	0.80	0.90	1.03