ANNEX IV - CONCESSION TECHNICAL SPECIFICATIONS

SUMMARY

1 INTRODUCTION

This report presents a description of the operational activities to be performed by the CONCESSIONAIRES in the operation of the various units integrating the water supply systems (WSS) and sanitation systems (SAS).

To this end, the present document describes the main typical operational routines for each type of facility/unit of the water supply and sanitation systems.

It is important to emphasize that this ANNEX should be understood as a collection of general guidelines, which aim to standardize practices and conducts in the operation of the water supply and sanitation systems, in order to achieve the established service and performance targets and best engineering, management, commercial, financial and socio-environmental practices.

The actions, strategies and investments required to achieve the established targets must be presented by each CONCESSIONAIRE in a Master Plan, covering each municipality of the respective concession block, over the 35 years of the concession, observing the regulatory competencies of Agenersa.

The specific operational routines shall be detailed by the CONCESSIONAIRES, through Operation and Maintenance Manuals, for each of the existing operational facilities, as well as the monitoring of the results obtained.

Finally, this ANNEX also addresses other general aspects, such as: master plan, corporate governance and *compliance*, user awareness, maintenance deadlines - user interface, integrated information system, operational control center, energy efficiency optimization program, technical and consumer registration program, water loss reduction and control program, hydrometer coverage program, personnel training and qualification program, contingency plans, fraud elimination programs and social-environmental programs and the pending Cease and Desist Agreements.

2 DESIGN AND CONSTRUCTION TECHNICAL OBLIGATIONS

Conceptually, a Standard is a document established by consensus and approved by a recognized body, which provides rules, guidelines or minimum characteristics for particular activities or their results, aiming to achieve an optimal level of orderliness in a given context.

The standard is, in principle, of voluntary use, but it is almost always used because it represents a consensus on the state of the art of a certain subject, obtained among specialists of the stakeholders.

In the development of the designs and construction of the various units that make up the water supply and sewage systems, the Standards of the Brazilian Association of Technical Standards (ABNT) applicable to each case, in its most recent versions, shall be followed. We highlight some of these standards below:

- NBR 5.681/80 - Technological Control of Execution and Landfills in Construction Works.
- NBR 6.122/80 - Design and Execution of Foundations.
- NBR 6.146/80 - Electrical equipment casings - Protection - Specification
- NBR 7968/83 - Nominal diameters in sewer pipes in the distribution network, pipelines, sewage collection networks interceptor sewer.
- NBR 6.459/84 - Soil - Determination of Liquidity Limit.
- NBR 6.493/84 - Employment of Fundamental Colors for Industrial Piping.
- NBR 9.648/86 - Study of sanitation systems design.
- NBR 9.649/86 - Sanitary sewer collection system design.
- NBR 9.814/86 - Execution of sanitary sewer collection system.
- NBR 10.844/89 - Stormwater service connections.
- NBR 12.207/92 - Interceptor sewer design.
- NBR 12.208/92 - Sewage lifting stations design.
- NBR 12.209/92 - Sewage treatment plants design.
- NBR 12.215/91 - Design of water pipeline for public supply.
- NBR 12.211/92 - Design studies of public water supply systems.
- NBR 12.213/92 - Design of surface water abstraction for public supply.
- NBR 12.214/92 - Design of water lifting system for public supply.
- NBR 12.216/92 - Design of water treatment plant for public supply.
- NBR 12.266/92 - Design and execution of trenches for the laying of water, sewage or urban drainage pipes
- NBR 12.586/92 - Water Supply System Registration.
- NBR 12.587/92 - Sanitation System Registration.
- NBR 7.195/93 - Colour in Occupational Safety.
- NBR 7.678/93 - Safety in the Execution of Construction Works and Services.
- NBR 7.229/94 - Design, construction and operation of septic tank systems.
- NBR 12.217/94 - Design of water distribution tank for public supply.

- NBR 12.218/94 - Design of water distribution network for public supply.
- NBR 13.133/94 - Execution of topographical survey.
- NBR 12.655/95 - Concrete - Preparation, control and receipt
- NBR 5.626/98 - Cold water service connections.
- NBR 7.367/98 - Design and laying of rigid PVC pipes for sanitation systems.
- NBR 8.160/99 - Sewer service connection systems.
- NBR 14.565/99 - Basic procedures for the preparation of cabling designs
- NBR 5.419/01 - Protection of structures against atmospheric discharges
- NBR 6.484/01 - Execution of Simple Soil Surveys.
- NBR 14.039/03 - High voltage electrical installations (from 1.0 kV to 36.2 kV).
- NBR 6118/04 - Design and execution of reinforced concrete works.
- NBR 10.004/04 - Solid waste.
- NBR 7.362/05 - Rigid PVC Pipe with Elastic Joint for Sewer Main.
- NBR 6.118//04 - Concrete structure design - procedure.
- NBR 5.410/05 - Low Voltage Electrical Installations.
- NBR 12.212/06 - Groundwater well design.
- NBR 7.212/12 - Execution of concrete batched in plant.
- NBR 12.655/15 - Portland cement concrete.
- NT-202.R-10 - Criteria and Standards for Discharge of Liquid Effluents into Inland or Coastal, Surface or Underground Water in the State of Rio de Janeiro.

For any services not covered by national technical standards, it is necessary to consider the criteria and parameters set out in international standards or specialized bibliography, which must be authorized for use by the regulatory agency.

In case there is no applicable national or international technical standard, the concessionaire may apply to solutions of its *expertise*, ensuring adhesion to the Master Plan of the municipality involved and compliance with the Performance Indicators as well as due approval from the regulatory agency.

3 TARGETS

3.1 Service Targets

The service targets established in the Project are 99% for the water supply system and 90% for the sanitation system. The targets were established for the urban areas of the municipalities to be served, including slum areas, subnormal agglomerations and areas of special social interest, excluding from the targets only those areas established by the public authorities as ineligible for investment. Specifically in relation to the non-urbanized irregular areas in the municipality of Rio de Janeiro, the provisions of item 3.4.2 of this Concession Technical Specifications must be observed.

The year that each municipality must achieve the stipulated targets is in accordance with the current service rate and the urban population of the municipality, according to the following criteria, not going beyond the year 2033:

Service	WATER SUPPLY		Sewage Collection
	> 70%	< 70%	
Rio de Janeiro	8 years		12 years
Municipality with population > average population - CEDAE Study Area	10 years	12 years	
Municipality with population < average population - CEDAE Study Area	12 years	12 years	

The population average refers to the average urban population of the municipalities served by CEDAE, based on the 2010 IBGE census, of approximately 103,250 inhabitants.

The municipalities whose river basins flow into the Guandu River are excluded from this general criterion in order to minimize, in the shortest term, the contamination of the main source of the RMRJ: Japeri, Miguel Pereira, Paracambi, Piraí, Queimados, Rio Claro and Seropédica.

The following Table 1 to Table 4 are the WSS and SAS service targets for the locations covered, grouped by concession blocks, with year 1 being the year of start of the concession. The percentage of service is detailed for every five years for each municipality in the Performance Indicators Annex.

Table 1 - Year of concession for meeting the WSS and SAS universalization targets of the municipalities of Block 1

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Aperibé	12	12
Cachoeiras de Macacu	12	12
Cambuci	12	12
Cantagalo	12	12
Casimiro de Abreu Note 1	12	12
Cordeiro	12	12
Duas Barras	12	12
Itaboraí	10	12
Itaocara	12	12
Magé	10	12

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Maricá	12	Note 3
Miracema	12	12
Rio Bonito	12	12
Rio de Janeiro Region I	8	12
São Francisco de Itabapoana	12	12
São Gonçalo	10	12
São Sebastião do Alto	12	12
Saquarema (Note 2)	12	12
Tanguá	12	12

Note 1: Only the district of Barra de São João. Other districts will be operated by the City Hall
Note 2: Only the district of Sampaio Correia. Other districts with concession for private entity
Note 3: SAS operation with Maricá City Hall

Table 2 - Year of concession for meeting the WSS and SAS universalization targets of the municipalities of Block 2

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Miguel Pereira	5	5
Paty do Alferes	12	12

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Rio de Janeiro Region II	8	12

Table 3 - Year of concession for meeting the WSS and SAS universalization targets of the municipalities of Block 3

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Itaguaí	5	5
Paracambi	5	5
Pinheiral	12	12

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Pirai	12	5
Rio Claro	5	5
Seropédica	5	5

Rio de Janeiro Region II	8	Note 1			

Note 1: Location with SAS under concession for private entity

Table 4 - Year of concession for meeting the WSS and SAS universalization targets of the municipalities of Block 4

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Belford Roxo	10	12
Duque de Caxias	10	12
Japeri	5	5
Mesquita	10	12
Nilópolis	10	12

Municipality	Year of concession for meeting the Target	
	WSS	SAS
Nova Iguaçu	10	12
Queimados	5	5
Rio de Janeiro Region IV	8	12
São João de Meriti	10	Note 1

Note 1: Local with sewerage under concession for private entity

3.2 Water Loss and Hydrometer Coverage Targets

The total water loss target (physical loss and apparent loss) is 25% and this target shall be measured from the 5th year of the AGREEMENT. A linear decrease over 10 years was considered, and the target for loss reduction shall be measured annually.

The physical or real loss refers to the volume of water made available in the system by the water contractors that is wasted during the distribution process, and the apparent or commercial water loss is the volume of water that, despite the water distribution arriving at the final consumer, the product is not properly billed, either due to technical problems in the measurement by the hydrometers, or for lack of measurement or consumer fraud.

The expected hydrometration index is 100% for all locations, to be gradually achieved in 5 years as from the assumption of the system, without, however, consisting in a Performance Indicator.

The tables with the respective annual water loss rates are presented for each municipality in Annex III - Performance Indicators.

3.3 Dry Weather Collector

In the following locations it is provided for the construction of dry weather collectors, to be implemented within the first 05 years of the concession and satisfactory operation throughout the concession period: Belford Roxo, Duque de Caxias, Mesquita, Nilópolis, Nova Iguaçu, Rio de Janeiro, Itaboraí and São Gonçalo and their respective districts. The implementation of dry weather collection of pluvial gutters should be avoided in the situation where the river dam (even if channeled) may aggravate local flooding or in the event that the flows and the pollution loads captured are higher than the limit of the STP.

In these locations of the Municipalities indicated above, the proposal is to postpone the extension of the sanitation system (*delay*) for 5 years, maintaining only the inertial growth while the dry weather collector system is under implementation.

Satisfactory operation is understood to be at least, without limitation, the following operations: the continuous or intermittent removal of the gridded material, and, when necessary, retained in desanders according to the quantity retained, and its disposal in compliance with environmental and municipal legislation to a duly licensed location; to avoid bad odors and effluent leakage in the area; to operate the pumping stations with preventive maintenance to avoid interruptions; to clean the collectors and interceptors to avoid obstructions.

The system consists of a structure for collecting (or intercepting) sewage in the stormwater galleries and in water courses that receive the sewage *in natura*, followed by screening of the desander coarse material, for removal of mineral material, when necessary, and routing to the nearest sewage treatment plant, through existing or to be built sewer mains, lifting stations and discharge lines.

Extensions or renovations to existing Treatment Plants or the construction of new Treatment Plants, even though necessary, shall not be considered as investments in dry weather collector system, as neither shall the interceptor sewers, lifting stations and their discharge lines, which will also be used by the separation network to be implemented.

It should be emphasized that compliance with the standards for the discharge of treated effluents provided for in the relevant legislation should be ensured, including for STPs that receive input from dry weather collection structures, during dry season and rainfall events.

The sewage interception structures are sized to collect water flow in dry weather periods and when it rains any excess follows the normal course of the mains or watercourses.

The implementation of dry weather collection structures is planned with the aim of achieving some of these objectives in the short term and on a provisional basis: to reduce the water pollution resulting from the discharge of untreated sewage from slum areas in rainwater galleries or water bodies, to minimize the pollution of Baía of Guanabara and its affluent bodies, as well as to achieve the same objectives in relation to the Guandu River, which is the main source of the RMRJ (Nova Iguaçu case), besides improving the balneability of the beaches and lagoons.

The site for the implementation of the dry weather collection structures should result from the joint analysis of all the available elements on the area reserved for this purpose, including the registry with the actual location of all the rainwater galleries and open sewer valleys in the areas.

The CONCESSIONAIRE shall be responsible for defining the most appropriate and pressing sites for the implementation of the dry weather collection structures as well as for the design and implementation of all the structures required for transportation to the existing or to be built treatment station, including the hydrological study of the source river basins, with the determination of the applicable rainfall flows, the selection of which for design purposes shall be determined together with the REGULATORY AGENCY. In the preparation of the planning, the CONCESSIONAIRE should prioritize the following areas:

(i) Regions with a sewage system not connected to a STP; and

(ii) Area without a sewage system, but with the possibility of sending the collected sewage through dry weather collector to an existing STP (even if the STP needs some intervention)

The dry weather collection structures must be sized in accordance with the criterion Degree of Effectiveness of interception of flows, which has as parameters of calculation the ratio between sewage and rainwater flow, as well as the dynamics of rainwater flow propagation.

In the case of the implementation of dry weather collection in coastal areas of lowlands, with the implementation of belt galleries (which may be barring piped rivers or have the galleries of rainwater an expressive affluence of groundwater), the system cannot collect flows that exceed 30% of the maximum flow of sewage produced in the drainage basin, depending on the number of inhabitants in the region of influence of the dry weather collection system.

In this case, the design has to be readjusted in order to ensure an effective collection of sewage.

The dry weather collection structures provided for in the concession agreement should be adopted as a priority in irregular areas, always as a temporary solution until the performance of an absolute separator network, when technically feasible.

The CONCESSIONAIRE shall submit to the STATE and the REGULATORY AGENCY, within 6 months after the execution of the AGREEMENT, an investment plan for the region, informing the list of works and the amounts to be invested, year by year, for 5 years, which shall be validated by the REGULATORY AGENCY within 30 (thirty) days.

Upon submission to the STATE and the REGULATORY AGENCY, the CONCESSIONAIRE shall send the planning for knowledge of the municipalities included in said planning.

The REGULATORY AGENCY may propose changes to the plan submitted, which should be discussed with the CONCESSIONAIRE. If there are disagreements, the dispute can be submitted to arbitration.

After the conclusion of the planning and insofar as the CONCESSIONAIRE starts to make the investments, there shall be a process of accountability on the part of the CONCESSIONAIRE, for the REGULATORY AGENCY to monitor the effective realization of the investments and disbursement of the amounts set out in this ANNEX; the REGULATORY AGENCY may use an INDEPENDENT CERTIFIER, pursuant to the guidelines of ANNEX VIII - PROVISIONS FOR HIRING INDEPENDENT VERIFIER AND CERTIFIER, in compliance with the procedure provided for in item 3.5 of this Concession Technical Specifications.

The investments established for the MUNICIPALITIES, including the respective districts, for the performance of the works for implementing the dry weather collector, are as follows:

Block 1 - Rio de Janeiro region 1 - R$ 87,560,443.26
Block 1 - Itaboraí - R$ 146,568,811.41
Block 1 - São Gonçalo - R$ 590,672,857.93
Block 1 - Total - R$ 824,802,112.60

Block II: Rio de Janeiro region 2: R$ 125,913,466.93

Block IV - Rio de Janeiro region 4- R$ 735,545,430.63
Block IV - Belford Roxo - R$ 184,869,987.57
Block IV - Duque de Caxias - R$ 539,778,037.29
Block IV - Mesquita - R$ 71,523,063.01
Block IV - Nilópolis - R$ 84,269,304.16
Block IV - Nova Iguaçu - R$ 269,956,479.34
Block IV - Total - R$ 1,885,942,302.00

In the event that the CONCESSIONAIRE does not manage to carry out the planned investment in full, the REGULATORY AGENCY shall proceed with the rebalancing of the AGREEMENT.

The control of the targets will be through the analysis of the projected and approved investment in relation to the investments actually made.

The remaining amounts to be invested year by year shall be updated by the IPCA index, or other equivalent index that may replace it.

In addition to the investments provided for in the investment schedule, the CONCESSIONAIRE is responsible for the following activities of operation and maintenance of the stretches of the drainage network used in the provision of the sanitation service:

a) registration of the irregular sewage draining connections made in the stretches of the drainage network used in the provision of sanitation service and the respective relocation to the absolute separator system if already existing, or whenever it is implemented. The deadline for the registration and correction of unlawful connections is 5 (five) years as from the assumption of the system, while the inspection to avoid new irregular connections should occur throughout the period of the concession;

b) unblocking services in rainwater galleries in simple concrete and reinforced concrete with a maximum diameter of 600 mm; and

c) replacement of damaged stretches when the extension is less than 10 meters, at no cost to the municipality.

d) operation and maintenance of the following current dry weather structures existing in the drainage system of the city of Rio de Janeiro, and each concessionaire shall be responsible for its respective region of operation in the city of Rio de Janeiro:

Structure Location	Region
Botafogo	1
Rua Aurelino Leal	1
Avenida Atlântica (next to Rua Santa Clara)	1
Avenida Atlântica (next to Rua Barão de Ipanema)	1
Extravasor da Rua Souza Lima	1

Structure Location	Region
Ipanema Beach Belt Gallery (empties into SN next to the pavement, near Rua Paul Redfern)	1
Jardim de Alah	1
Belt Gallery of Lagoa 1 (empties into SN next to the cycle path between Rua Maria Quitéria and Rua Garcia D'Ávila)	1
Belt Gallery of Lagoa 2 (empties into SN near the Cantagalo court)	1
Av. Visconde de Albuquerque	1
Belt Gallery of Lagoa 4 (empties into SN near the access to the Rebouças Tunnel)	2
Rua Prof. Abelardo lobo / Av. Borges de Medeiros (Maconhão)	2
Belt Gallery of Lagoa 3 (empties into the SN next to the riding club)	2
Av. General Garzon	2
Rocinha's Channel dry weather collection	2
Pires River dry weather collection	2
Canoas River dry weather collection	2
Rua Mata Machado (Rio Maracanã)	2
Belt Gallery of Marina da Glória	4
Rua Teixeira de Freitas next to Rua do Passeio	4
dry weather collection from Marina da Glória near SEAERJ (central quarry between Av. Beira Mar and Av. Infante Dom Henrique)	4
Rua Silveira Martins (between the soccer fields, in front of Hotel Novo Mundo)	4
Rua Corrêa Dutra (Canteiro Central, next to Parque das Crianças - Recreio Infantil Lotta Macedo Soares)	4
Rua Dois de Dezembro (Canteiro Central, Parking next to Posto BR)	4
Carioca River dry weather collection (link at OI)	4
Rua Rodolfo Dantas	4

The current approximate extensions of the rainwater gallery networks with diameters equal to or less than 600mm are as follows, according to information provided by the Fundação Instituto das Águas do Município do Rio de Janeiro - Rio Águas:

Rio de Janeiro - Region 1 - 373 km

Rio de Janeiro - Region 2 - 1.880 km

Rio de Janeiro - Region 4 - 3.652 km

3.4 Non Urbanized Irregular Areas

Irregular areas in the municipality of Rio de Janeiro are those identified by the Pereira Passos Urbanism Institute, through SABREN - Low Income Settlements System, as slums and subnormal agglomeration areas.

3.4.1 Operation in irregular areas

The Concessionaire undertakes to maintain the current operation of the existing systems in all irregular areas, of all MUNICIPALITIES, including the current systems that are without regularization.

3.4.2 Investment in NON-URBANIZED IRREGULAR AREAS

Irregular areas are classified into eligible and ineligible areas for investments. Ineligible areas are those where, due to specific local conditions, it is not technically or legally possible to carry out the SYSTEM IMPROVEMENT WORKS, such as, for example, in permanent preservation areas and conservation units (when in disagreement with their management plans). In the event that an area considered ineligible at the time of execution of the AGREEMENT and is subsequently reclassified into an eligible non-urbanized area, the same rules as the other eligible and non-urbanized areas established in this section 3.4 shall apply to such area.

The eligible irregular areas are those that can be the object of SYSTEM IMPROVEMENT WORKS by the CONCESSIONAIRE and are divided into urbanized and non-urbanized areas. Urbanized areas are those that have received infrastructure improvements and non-urbanized areas are those in which there has not yet been any urbanization investment, as classified by the Rio de Janeiro City Hall. The regulation of the non-urbanized areas also applies for the areas classified as partially urbanized.

The irregular urbanized areas will be quantified for the purpose of calculating the universalization targets set out in ANNEX III - PERFORMANCE INDICATORS AND SERVICE TARGETS, and the CONCESSIONAIRE shall render the SERVICES and carry out the SYSTEM IMPROVEMENT WORKS under the same conditions as the other urban areas of the municipality.

In the NON-URBANIZED IRREGULAR AREAS of the city of Rio de Janeiro, it is provided for the expansion of the water supply and sewage system and the respective operation and maintenance by the CONCESSIONAIRE. However, the investments to be made in these areas will not be quantified for the purpose of calculating the universalization targets described in ANNEX III - PERFORMANCE INDICATORS AND SERVICE TARGETS. The CONCESSIONAIRE's obligation will be linked to the realization of a certain volume of investments during the first 15 (fifteen) years from the execution of the AGREEMENT.

The CONCESSIONAIRE shall align with the STATE and the municipality of Rio de Janeiro, which will be the NON-URBANIZED IRREGULAR AREAS that the CONCESSIONAIRE needs to invest in, and the areas that meet the requirements (i) of urbanization planning by the public authorities and (ii) of greater security conditions must be prioritized.

In NON-URBANIZED IRREGULAR AREAS that have some sanitation network already implemented by the City Hall, there should be a prioritization of the connection of said existing network in the sanitation system of the formal urban area, in order to give it functionality and efficiency.

The population living in the NON-URBANIZED IRREGULAR AREAS, base date 2019, as well as those found in urbanized irregular areas is presented below:

Irregular Areas	Population (inhab)		
	Total	Urbanized area	Participation (%)
Rio de Janeiro Block I (Region 1)	186,032	61,656	33,14%
Rio de Janeiro Block II (region 2)	251,941	13,820	5,49%
Rio de Janeiro Block III (Region 3)	273,202	37,206	13,62%
Rio de Janeiro Block IV (Region 4)	807,912	189,222	23,42%
Total	1,519,088	301,904	19,87%

After this alignment, the CONCESSIONAIRE will prepare an ACTION PLAN, informing how it intends to move forward with the investments in the regions defined in mutual agreement, prioritizing, whenever possible, investments in the sanitation system, and alternative solutions in place of the universal sewage separation system may be implemented in those locations where the implementation of the universal sewage separation system is technically unfeasible. When adopted as a solution for sanitation for NON-URBANIZED IRREGULAR AREAS, the structures of dry weather collection must be complementary to structures that promote the adequate removal of sewage inside the perimeter of the NON-URBANIZED IRREGULAR AREAS.

The CONCESSIONAIRE shall submit the ACTION PLAN within 180 (one hundred and eighty) days after signing the TERMS FOR THE TRANSFER OF THE SYSTEM, for analysis and approval by the REGULATORY AGENCY within the period set out in the AGREEMENT.

On the occasion of each ORDINARY REVIEW, a new planning for the next 5 (five) year investment cycle will be presented.

The REGULATORY AGENCY may propose changes to the plan submitted, which should be discussed with the CONCESSIONAIRE. If there are conflicts, the dispute can be adjudicated by the TECHNICAL COMMITTEE or by arbitration.

After the conclusion of the planning and insofar as the CONCESSIONAIRE starts to make the investments, there shall be a process of accountability on the part of the CONCESSIONAIRE, for the REGULATORY AGENCY to monitor the effective realization of the investments and disbursement of the amounts set out in this ANNEX; the REGULATORY AGENCY may use an INDEPENDENT CERTIFIER, pursuant to the guidelines of ANNEX VIII - PROVISIONS FOR HIRING INDEPENDENT VERIFIER AND CERTIFIER, in compliance with the procedure provided for in item 3.5 of this Concession Technical Specifications.

The investments planned for each region of Rio de Janeiro for the works of expansion of the Water Supply System and the Sanitation System in the NON-URBANIZED IRREGULAR AREAS are as follows:

Rio de Janeiro Block I (region 1) - Total - R$ 148,768,535.34

Rio de Janeiro Block II (region 2) - Total - R$ 305,183,336.74

Rio de Janeiro Block III (region 3) - Total - R$ 354,027,585.43

Rio de Janeiro Block IV (region 4) - Total - R$ 1,052.459.676,85

The above amounts must be implemented during the first 12 (twelve) years of the CONCESSION. The verification of the investments shall be made by the REGULATORY AGENCY annually, and the procedure provided for in item 3.5 of this Concession Technical Specifications shall be observed. If the CONCESSIONAIRE proves that it did not make the annual investments due to a fact not attributable to it, the amounts not invested may be reallocated to the following years of the ACTION PLAN.

In the event that the CONCESSIONAIRE does not manage to carry out the investment planned for each 4-year period in full, the REGULATORY AGENCY may postpone such investment for the next 4-year period, observing the maximum limit of twenty 12 (twelve) or proceed to rebalance the AGREEMENT.

If the investments made in the 12 (twelve) years are insufficient to serve all the NON-URBANIZED IRREGULAR AREAS, the AGREEMENT must be rebalanced, in order to ensure the service until the year 2040.

3.5 Guidelines for monitoring of the investments by the independent certifier

For investments in dry weather collectors (item 3.3), NON-URBANIZED IRREGULAR AREAS (item 3.4), Barra lagoon complex (item 7.2.1) and replacement of the undersized sanitation network (items 7.1.2 and 7.4.1), which will be followed up on by the INDEPENDENT CERTIFIER, the following guidelines must be observed:

The implementation of the investments shall be preceded by the preparation of an investment schedule drawn up by the CONCESSIONAIRE, to be submitted to the STATE and to the REGULATORY AGENCY within 150 (one hundred fifty) days as from the execution of the AGREEMENT, for analysis and approval by the REGULATORY AGENCY within a maximum period of 30 (thirty) days as from its submission.

The schedule should be of a construction-financial type establishing each of the structures to be implemented, as well as their necessary accessory facilities, considering the needs concerning the control by the INDEPENDENT CERTIFIER.

The investment schedule shall have the purpose of presenting the detailed planning for the investments provided for in this item 3.5, and may be a schedule for each investment item, for a five-year cycle, and shall contain:.

- Pre-design for the works, observing the relevant norms of the Brazilian Association of Technical Norms - ABNT;
- Reference budget for the performance of the preliminary design of the works

The investment schedule will be analyzed by the REGULATORY AGENCY, with the support of the INDEPENDENT CERTIFIER's opinion, with a view to deciding on its approval within 30 (thirty) days, with divergences between the PARTIES and/or of the REGULATORY AGENCY concerning the investment schedule may be settled by the TECHNICAL COMMITTEE or submitted to arbitration, under the terms of the AGREEMENT.

Once the investment schedule is approved, the preliminary design for the works of the dry weather collector structures and the reference budget, shall be incumbent on the CONCESSIONAIRE, which shall within 90 (ninety) days, prepare the executive design for implementation of the works of the preliminary design, as well as the detailed and definitive budget for them, with a view to presenting them to the REGULATORY AGENCY for its decision, with the support of the INDEPENDENT CERTIFIER, within a period of up to sixty (60) days. The verification of compliance with the investment schedule shall be the responsibility of the REGULATORY AGENCY, which may make use of the services of the INDEPENDENT CERTIFIER.

Once the executive design and the respective final budget are approved by the REGULATORY AGENCY, its contents will be binding and of mandatory compliance by the CONCESSIONAIRE in the implementation of the investments, and any defects or inadequacies of the project or delay in its performance will be at the CONCESSIONAIRE's risk, not giving rise to any change in the binding budget values approved for the purposes of certification of the volume of investment applied in the works, except for the allocation of risks provided in clause 34 of the AGREEMENT.

With the start of the investments, CONCESSIONAIRE undertakes liability for the issuance of the report provided for in sub-clause 21.7.1 of the AGREEMENT. The REGULATORY AGENCY shall urge the INDEPENDENT CERTIFIER to examine the report submitted by the CONCESSIONAIRE in order to assess the volume of investments made by the CONCESSIONAIRE and to present a conclusive opinion as to the correspondence of the volume of investments made with the obligations set forth in this Concession Technical Specifications.

If the volume of investments made by the CONCESSIONAIRE do not comply with the obligations provided for in the ACTION PLAN, in the DRY WEATHER COLLECTION SCHEDULE and in this AGREEMENT, based on the opinion of the INDEPENDENT CERTIFIER and from the analysis of the REGULATORY AGENCY, in the present AGREEMENT and in the ACTION PLAN, may give rise to the

application, by the latter, of sanctions to the CONCESSIONAIRE, or, if recurrent, to forfeiture, pursuant to this AGREEMENT.

The REGULATORY AGENCY shall have up to 180 (one hundred and eighty) days as from the receipt of the report to recognize and certify the investments, including the financial amount corresponding to such investments, pursuant to article 42, §2 of Federal Law no. 11,445/2007.

Once the investments have been made, provided that they correspond to the contents of the executive design and the previously approved investment schedule, the REGULATORY AGENCY, with the support of the INDEPENDENT CERTIFIER's opinion, shall definitively certify the volume of investments made by the CONCESSIONAIRE, taking as reference the values set out in the definitive budget previously approved by the REGULATORY AGENCY.

In order to carry out the technical evaluation of the suitability of the investments referred to in this item 3.5 and its correspondence with the executive design as previously approved, the INDEPENDENT CERTIFIER, as well as the REGULATORY AGENCY, shall have unrestricted access to the facilities of the construction sites, upon previous communication to the CONCESSIONAIRE.

In the event of disagreement by the STATE or the CONCESSIONAIRE in relation to the values of the investments that might be recognized by the REGULATORY AGENCY, the mechanisms for resolution of disputes provided for in clauses 49 and 50 may be implemented.

4 WATER SUPPLY SYSTEMS

The source of water for water supply systems can be surface or underground.

In the first case, usually called the conventional standard water supply system, it consists of the following main units: surface collection, water supply, water treatment plant, reservoirs, distribution networks and household connections. The supply can be subdivided into raw water supply and treated water supply. Depending on local topographic conditions, there are also lifting stations or booster pump stations for pumping the water.

In the second case, the surface collection is replaced by a well and the treatment usually consists of water disinfection and fluoridation.

Particularly for the Metropolitan Region of Rio de Janeiro, Cedae shall supply drinking water in strategically located places of interface with the concessionaires, called Delivery Points, where Measurement Points (definition set out in Annex X - "System Governance") shall be installed by CEDAE, with the CONCESSIONAIRE of each BLOCK being responsible for the installation of macro meters at the points of intersection between the infrastructures and the BLOCKS, and the Concessionaire that operates the upstream part of the pipeline shall be responsible for the acquisition, installation and maintenance of the macro meter. However, there is no objection to a mutual agreement between the concessionaires for a joint installation.

The rules governing the purchase and sale of water between the Concessionaire and CEDAE are set out in the interdependence agreement.

Cedae's water supply will serve the following municipalities:

- Guandu/Lajes/Acari System: Belford Roxo, Duque de Caxias, Itaguaí, Japeri, Mesquita, Nilópolis, Nova Iguaçu, Paracambi, Rio de Janeiro, São João do Meriti and Seropédica;
- Imunana-Laranjal System: São Gonçalo and Paquetá Island, in Rio de Janeiro.

Also through the Imunana-Laranjal System, CEDAE will supply raw water to Itaboraí, with the installation of a Measurement Point in the existing raw water pipeline that feeds this location.

The flow provided by Cedae will have instantaneous and continuous measurement, with *online* data transmission to the Operational Control Centers of each concessionaire.

In principle, the locations of interface between the CEDAE and the CONCESSIONAIRE, also called Delivery Points, are the following:

- Imunana/Laranjal System: delivery points located at the entry of the treated water pipeline in the Amendoeira reservoir, at Laranjal WTP; at the exit of the Inoã booster (provisional macrometer until the system starts operating from the reservoir on the Tanguá River); and in 03 (three) meters in the raw water sub-pipelines that feed the 3 water treatment plants in Itaboraí;
- Guandu System: In the treated water pipelines of the Lameirão and Nova Lameirão pumping stations and in the exit of the Marapicu reservoir and the new Marapicu reservoir (forecast);

- Ribeirão das Lajes System: delivery points located at the exit of the Ribeirão das Lajes Treatment Unit (TU);
- Acari System: delivery points located at the exit of the 5 TUs: São Pedro, Rio d'Ouro, Tinguá, Xerém and Mantiquira.

The provisions of the INTERDEPENDENCE AGREEMENT must be observed with regard to the rules on the installation and maintenance of flow meters.

The following is a description, per unit, of the existing types, their purposes and the main operational routines, with emphasis on the fact that the concessionaire must detail the specific operational routines in the Operation and Maintenance Manuals, for each of the existing operational facilities.

4.1 Catchment

The catchment is the source of fresh surface water or groundwater used for human consumption or development of economic activities. Catchments are: rivers, lakes, dams, groundwater and aquifers.

The increase in demand for water, disorderly use of the soil, inadequate land and water use practices, lack of sanitation infrastructure, removal of vegetation, erosion and silting up of rivers and streams, and industrial activities that are carried out in violation of environmental legislation, among other factors, contribute to the increasing degradation of water sources.

The continuity of the adversities detailed above compromises water quality, exposing a significant portion of the population to diseases. Therefore, the catchment areas must be given specific attention, with the adoption of legal measures and the development of managerial instruments of protection, planning and use, in order to adapt the urban planning of the drainage basins to the uses of the water body.

4.1.1 Operational Routines of a Catchment

The operation of a catchment area is basically focused on protecting the quality of its waters. Therefore, appropriate measures must be taken so that no external actions to the environment of the source may alter or compromise the quality of the water. In this sense, despite not representing a regulatory obligation or deriving from Brazilian legislation, it is common to enclose the catchment areas, as well as to protect the riparian forests of the watercourses that are used as sources of supply.

Thus, the main operational routine of a catchment refers to the regular surveys of the area around the drainage basin used in order to identify activities or situations that may compromise the quality of the water of the source of supply. The main benefit of this inspection of the catchments the savings from a more rational use of chemicals in the treatment of the supply water. These surveys should be conducted quarterly, or at shorter periods depending on the occupation of the basin area.

4.2 Abstraction

The abstraction is the installation of a water system with the purpose to remove the water from the water supply source. It may be of a surface or underground type.

Surface abstraction is performed in springs, rivers, lakes or dams, and the water is abstracted by use of gravity or through a pumping system.

The underground abstraction is performed with wells, and the water is usually removed from the groundwater by motor pumps installed at the water level and sent to the surface by pipes.

SURFACE ABSTRACTIONS

In the preparation of surface abstraction designs, which must observe the NBR 12.213/92, some quantitative and qualitative characteristics of the used catchments must be analyzed, of which we highlight: (i) survey of hydrological data of the basin or nearby basins; (ii) survey of fluviometric data of the watercourse under study and information on water level oscillations during periods of drought and flooding; (iii) physical, chemical and bacteriological characteristics of the water; (iv) location of current and potential polluting points in the basin; (vi) potential costs with expropriation; and (vii) availability of electric power to feed motor pump sets.

Still in the context of the surface abstraction, it is important to observe the following aspects:

- Ensure the necessary conditions for water input at any time of the year;
- Regular cleaning of level dams, water intakes and sand boxes;
- Ensure, as much as possible, the best water quality of the spring through actions of recovery and protection of surface sources;
- Ensure operation and protection against damage and obstructions;
- Favor the economy of the facilities;
- Facilitate operation and maintenance over time;
- Properly plan the construction of structures nearby or in the water, in order to facilitate possible expansions;
- Regular maintenance of floating raft structures and other equipment that might be present in the abstractions;
- Provide flood protection and
- Provide for road access throughout the year, regardless of rainfall incidence.

Underground Abstraction

With regard to underground abstraction, which must comply with NBR 12.212/06, they may consist of shallow wells or cisterns, manually excavated and covered with bricks or concrete rings, which remove water from the groundwater at depths of around 20 meters and are intended for small consumption.

For use in public supply, the underground abstraction is through deep tubular wells, geologically located, drilled with a drilling probe, with diameters ranging from 4" to 36" and depths of up to 200 meters. After drilling, cleaning is performed to remove the mud and other debris from the excavation.

These wells are lined with pipes to support the walls and have filtration devices made with grooved pipes for the water passage. In addition, the wells also have a pre-filter, made with a gravel filling between the casing/filter and the well wall, whose function is to stabilize fine sediments. In addition to the structure, a cement slurry is injected between the lining and the well wall in the upper portion to prevent polluted water from entering and a concrete slab for sanitary protection is installed on site at the well entrance.

4.2.1 Operational Routines for Surface Abstraction

Generally, surface abstraction is composed of the following devices;

- Dams or spillways to maintain the level or to regulate the flow;
- Water intake units with devices to prevent floating or suspended materials from entering the water;
- Devices to control the entry of water at various levels;
- Bottom outlet devices in the case of dams;
- Suction wells and pump houses for the installation of lifting sets, when necessary.

The operation of surface abstraction is conditioned to the quality of the water collected form the catchment. Due to the variation of the room temperature, there is a recirculation of the water layers of a water body due to the change in the density of the water, thus promoting a revolving of the sedimented material at the bottom of the abstraction, making the water have different physical characteristics (color and turbidity) at different depths. Thus, the main operational routine is associated with the definition of the water intake to be used, when there are gates installed at different depths in the abstraction device.

In accumulation reservoirs, due to the fact that it works as a large sediment, a high concentration of sedimented materials near the dam may occur; in these situations, the bottom outlet of the dam or barrage must be operated in order to clean the area around the water intake, thus ensuring that the water abstracted has lower turbidity concentrations. This is a mere operational procedure and is not the subject of regulatory requirements or inspections. However, to ensure its practice as a preventive measure, the activity must be provided for in the Operation and Maintenance Manual of the operational facility, to be developed by the concessionaire.

4.2.2 Operational Routines for Underground Abstraction

Before commissioning, the deep tubular wells are submitted to a development phase that aims to increase the natural hydraulic conductivity near the well, the selective removal of fine sediments and to correct damage caused to the aquifer by the drilling (compaction, clogging, etc.). The development stabilizes the sandy formation around the well, increasing its porosity and permeability. For this purpose, regular maintenance in the well protection area (fences, floor, gates and easels) should be established.

The pumping equipment used to abstract water from tubular wells may be:

- **submerged pump** - used for pumping medium and large flows (over 3 m^3/h) at varying depths; it works with three-phase power; it is installed inside the well with an ejector tube (type of ejector that works as a jet type fluid pump) and a cable that connects the pump to a switchboard, existing on the surface;
- **injection pump** - used for pumping small and medium flows at varying depths; it usually works with three-phase power or fuel; its installation is with an injector nozzle (or foot valve) inside the well through two pipes (a thin injector tube and a coarse eductor tube), which connects the injector nozzle to the pump that is outside the well;
- **centrifugal pump** - used for pumping small flows at low depths; it works with three-phase power or fuel; it is installed outside the well with just one pipe (a thin eductor tube) that comes out of the well directly to the pump; and
- **compressor** - from an external motor (compressor) the compressed air is injected into the well through a small diameter pipe (air injector); the injected air causes the water to rise to the surface through another pipe with a larger diameter (eductor pipe).

The first operational routine of an underground abstraction refers to the pumping test to determine the exploitation flow of the well (**Q**) and the hydrodynamic parameters relating to the static and dynamic levels. The **Static Level (SL)** is the depth of the water level inside the well when it is not being pumped for a good period of time; the **Dynamic Level (DL)** is the depth of the water inside the well when it is being pumped. The difference between the static and the dynamic level, represents the **Drawdown**, i.e. how much the water level lowered inside the well when it went into operation.

The operations to drive the electric commands for pumping equipment start-up depend on the levels of the reservoirs that receive the well supply. Thus, according to the demand of the system, the level control devices of the reservoirs that receive the production of the wells must be calibrated with specific set-points, in order to automatically trigger the entry into operation of the motor pumps of the wells. Telemetry is optional, however, highly recommended.

4.3 Pipeline

The pipeline connects the abstraction to the treatment plant and/or the treatment plant to the reservoirs or the distribution network, without the existence of branches for supplying distribution networks or household connections. The pipeline design must comply with NBR 12.215/91.

With regard to the nature of the water transported, the pipelines may be of raw water, when they interconnect the abstraction to the water treatment plant, or treated water pipelines, when they interconnect the water treatment plant to the reservoirs or the distribution network.

As for the energy of water movement, the pipelines can be by gravity (penstocks) or pressurized pipelines, when the water is transported by pumping.

Several types of materials can be used when running pipelines. The choice of the most suitable material depends on a number of aspects, of which the following stand out:

- not interfere with the physical and chemical properties of the water;
- change of roughness with time (incrustations);
- Watertight;
- Chemical and mechanical resistance;
- Water pressure resistance (static, dynamic and transient);
- Cost Benefit (cost of piping, installation, construction aspects, corrosion protection needs, maintenance, etc.).

Thus, the most common materials for pipelines are: Steel, Ductile Iron, High Density Polyethylene (HDPE), Polypropylene, PVC and Fiberglass Reinforced Polyester.

Steel pipelines have the following advantages: high resistance to internal and external pressures; watertightness due to the fact that the joints are welded; availability of various diameters; competitive price especially for larger diameters and pressures. As disadvantages: little resistance to external corrosion; precautions for transport and storage; attention to thermal expansion; sizing of the tube walls regarding collapse.

With regard to Ductile Iron pipes, the following points should be highlighted: they are available in 16 diameters, ranging from 50 to 1,200 mm; 6 and 8 meter pipes available; K-7, K-9 and 1 Mpa classes available; ductility and resilience; internal coating with cement mortar; and external coating with zinc and bituminous paint.

Regarding non-iron pipes, it is worth mentioning: they are light and flexible; watertightness; chemical and abrasion resistance; less roughness; low speed (transient); no internal or external coating; and limited length by transport with up to a hundred meters without joints (undersea outfalls).

The main special and protective devices of a pipeline are:

- Flow meters and pressure controllers;
- Gate valves and butterfly valves to control the operation;
- Suction cups for air elimination and intake;
- Pressure reducing valves (PRV);
- Transition tanks for interfaces between pressurized pipelines to penstocks;
- Bottom outlets, for cleaning the pipelines; and
- Hydraulic transient protection equipment - water hammer valves, hydropneumatic reservoirs (HPR), surge tanks, *one-ways*, among others.

4.3.1 Operational Routines of a Pipeline

The main operational routine of a pipeline is focused on its filling process. The raw or treated water pipelines must be watertight and enable the water to be transported safely and economically. Considering that the pipeline when empty is full of air, its charging process for entry into operation must be carried out with great care, promoting the slow filling of the pipeline with water, so that the existing air can be gradually expelled by the suction cups installed in the upper generator of the pipeline. In the case of pressurized pipelines, this process should be even more careful, and all suction cups and bottom outlets from the line should be opened during filling to ensure complete removal of air.

Another important operational routine refers to the steel pipelines, whose occurrences of negative pressures may cause the piping to collapse. Thus, weekly inspections should be carried out on the devices installed in relation to the hydraulic transients, in order to ensure their operation in situations where there are water hammers on the lines or interruption of the electrical power supply, interrupting pressure systems. This is a mere operational procedure and is not the subject of regulatory requirements or inspections. However, to ensure its practice as a preventive measure, the activity must be provided for in the Operation and Maintenance Manual of the operational facility, to be developed by the concessionaire.

Considering the need to keep the pipelines piezometric line within the desired pressure ranges, or those established by hydraulic modeling, an important operational routine is the verification and possible calibration of the pressure reducing valves (PRV) existing in the supply lines and the regular maintenance of connections, stop valves, suction cups and relief devices, where applicable.

In order to maintain the quality of the water in the pipes, another operational action concerns the regular emptying for cleaning of the pipes, thus promoting the removal of solid materials that may hve been deposited in the lower section of the pipes.

In addition, regular inspections should be carried out to control losses and correct leaks immediately.

Specifically for the Pipeline System of the Metropolitan Region of Rio de Janeiro, the geographic location of the pipeline shall determine the concessionaire responsible for its maintenance.

4.4 Water Treatment

The Water Treatment Plant (WTP) is a facility that makes it possible to purify the water taken from the catchments, adapting its quality to the standards of potability established by the Ministry of Health, Annex XX of Consolidation Ordinance no. 5, of 03/10/2017, and which must comply with NBR 12.216/92, and thus make it fit for consumption.

Thus, the water treatment is performed to meet several aspects:

- **Hygienic** - removal of bacteria, protozoa, viruses and other microorganisms, harmful substances, reduction of excessive impurities and high levels of organic compounds;

- **Aesthetics** - correction of color, taste and odor; and
- **Economical** - reduction of corrosivity, color, turbidity, iron and manganese

Public services must always provide healthy and good quality water. Therefore, the treatment should only be adopted and carried out after the need for such a treatment has been demonstrated and, whenever it is performed, it should only include the processes essential to obtaining the desired water quality.

The need for treatment and the required processes should then be determined on the basis of health inspections and the results of analyses (physio-chemical and bacteriological) representative of the catchment to be used as a source of supply.

A conventional water treatment plant, with full cycle, is composed of the following steps:

- **Oxidation** - it is the first step in the treatment process and consists of mixing chlorine into the water to oxidize the metals present in the water, mainly iron and manganese, which are present dissolved in water;
- **Coagulation and Flaking** - the water is mixed with a coagulant that has properties that help to form gelatinous flakes; at these stages the impurities present in the water are grouped by the action of the coagulant, in larger particles (flakes) that can be removed by the decantation process; the flocculation consists in the agitation of the water with the help of rotating paddles or the passage in chicanes, favoring the formation of the flakes; the most used reagents are aluminum sulfate and ferric chloride; if the water is acidic, with values of pH<7, before the addition of the coagulant a correction of the pH is carried out, with the placement of a solution of hydrated lime or sodium carbonate;
- **Decanting -** at this stage, water slowly passes through the decanters (usually rectangular shaped tanks) and the flakes formed are separated by gravity;
- **Flotation with dissolved air -** besides decantation, the flakes can also be removed from the water by the flotation process, being collected in gutters;
- **Filtration -** after passing through the decanters, the water goes to the filters, where the impurities that remained in the water are removed; the filter consists of a porous granular medium, usually sand or activated carbon, of one or more layers, installed on a drainage system, capable of retaining and removing the impurities still present in the water;
- **Disinfection -** although the water is already clean at this stage, it still receives chlorine to eliminate germs that are harmful to health and ensure the water quality in the distribution networks and reservoirs; ozonation and exposure to ultraviolet radiation are also used in the disinfection process;
- **pH correction -** in this step, if necessary, more hydrated lime is added to correct the pH of the water; this action aims to protect the pipes of the distribution networks and of the households against corrosion or incrustation;

- **Fluoridation -** at the end of the treatment process, the water receives a dosage of fluoride compound (fluorosilicic acid), a requirement of the Ministry of Health; the presence of fluoride in water prevents tooth decay, especially during the period of formation of teeth, which happens from gestation until the age of 12.

Still in the context of water treatment, it should be noted that water abstracted from deep wells does not usually require a full treatment, it is usually only necessary to disinfect it with chlorine and fluoridation and, eventually, to remove iron and manganese, depending on the quality of the water from the underground spring.

Thus, the definition of the treatment process shall depend on the quality of the raw water abstracted from the spring, surface or underground.

The legislation regulating the standard of potability of water for human consumption and which shall be observed by the Concessionaire during the term of the Agreement is Annex XX of the **Consolidation Ordinance no. 5/2017**, of the Ministry of Health. This Ordinance *"establishes the procedures and responsibilities related to the control and monitoring of water quality for human consumption and its standard of potability, and sets out other provisions"*.

4.4.1 Operational Routines for Water Treatment

Within the water treatment process there are several permanent operational routines that ensure its effectiveness, among which the following can be highlighted:

- **Control of WTP input flow -** in order to control the volumes produced by the treatment process, WTP operators need to control and record the input flow rates into the treatment plant; these flow rates can be measured by macro meters installed in the input pipelines of the WTP or by measurements made on the Parshall flume, usually existing at the entrance of the plants;
- **Water quality control at the WTP inlet -** in order to guide the concentration and dosages of coagulants applied at the inlet of the water to the plant, at specified times, the WTP operators shall collect samples of the raw incoming water or ensure that the system for collecting and transporting the raw water to the station control laboratory is working properly;
- **Preparation of the coagulant solution tanks -** based on the concentrations established by the WTP control laboratory, operators should prepare the coagulant solution tanks used in the treatment process, for dosing in the raw water, at the entry of the plant (preferably in the turbulence zone of the Parshall flume);
- **Control of the coagulant dosage -** the operators must check, at specified times, the proper functioning of the devices or pumps (control of their automation) for the application of the chemicals used as coagulants; depending on the variation in raw water quality;

- **Control of the flocculation and settling process -** at specified times, the WTP operators need to evaluate the flake formation process in order to control the effectiveness of the coagulation application, the flocculation process speed and the behavior of the settling system. The test to determine the optimum amount of coagulant to be used in order to obtain the best flocculation is called *jar-test*;
- **Control of the filter run and washing process -** according to pre-established rules, the WTP operators must follow the evolution of the load losses in the filtering system in order to determine the optimum time of the filter runs and to define the filter washing times;
- **Decanter emptying and cleaning process -** pursuant to the procedures established in the WTP Operation Manual, at specified times, the WTP operators shall perform a complete washing cycle of all tanks and decanter gutters and emptying accumulated sludge at the bottom of the tanks; the destination of discarded sludge shall be assessed by the WTP operation supervisors so that the operation is environmentally appropriate;
- **Filter washing process -** pursuant to the routines established for the WTP operation and in accordance with the set-points defined for maximum pressure losses, the operators must carry out the procedures established in the WTP Operation Manual in order to wash the filter units;
- **Control of the disinfection process -** at specified times, the WTP operators must evaluate the chlorine dosing systems used for disinfection in order to identify any leak points and correct them immediately;
- **Control of the fluoridation process and final pH correction -** at specified times, the WTP operators must evaluate the fluorosilicic acid dosing systems used for fluoridation and the hydrated lime dosing systems for pH correction, in order to identify any leak/clogging points and correct them immediately.
- **Regulate preventive maintenance of pumps and dosers, control panels, stop valves, meters and other WTP equipment** - in accordance with the procedures established in the WTP Operation Manual.

4.5 Reservoirs

After being treated in the WTPs, the water is stored in closed and sealed reservoirs, which can be underground (subterranean and semi-subterranean), supported or elevated, depending on its position in relation to the soil, in which different volumes are provided according to technical standards. The reservoir design must comply with NBR 12.217/94.

The reservoirs are important to maintain the regularity of supply in a system, even when it is necessary to shut down some production unit for maintenance interventions. In addition, reservoirs are essential in order to meet extraordinary demands that can occur in periods of intense heat.

Depending on the location in the system, the reservoirs may be upstream (before the distribution network) or downstream or leftover (after the network).

The upstream reservoirs are characterized by the following features: all the water distributed downstream passes through it; they have the inlet over the maximum water level and outlet at the minimum level; they are sized to keep the flow and manometric height of the pipeline system constant.

Downstream reservoirs are characterized by the following features: they store water at times when the supply to the network is higher than demand, to supplement the supply when the situation is reversed; they reduce the physical height and initial diameters upstream the network; they have only one pipe serving as an inlet and outlet for the flows.

Distribution reservoirs are sized so that they have the capacity to accumulate a useful volume that exceeds the balance, emergency and firefighting demands.

The balance reserve is so called because it is accumulated at times of lower consumption to compensate for those times of higher demand, i.e., since consumption varies and the flow of the pipeline is constant, especially in the pressurized pipelines, at the times when consumption is lower than demand, then the reservoir fills up, so that at the times when consumption in the network is higher, the previously accumulated volume compensates the deficit in relation to the incoming flow.

In order to ascertain the firefighting reserve, the local fire department must be consulted. With the official norms of the FD and the norms of ABNT, it is then possible to, from the definition of the urban occupation of the area, estimate the volume to be stored in the reservoir intended for firefighting in the location.

The emergency volume is designed to prevent the distribution from collapsing in the event of unforeseen accidents in the supply system, e.g., a power failure or a break in the pipeline. Then, while providing the resolution to the problem, the volume stored for emergency supplies, also called accident reserve, will make up for the lack of water entering the reservoir, not letting consumers run out of water.

4.5.1 Reservoir Associated Operational Routines

The reservoirs must be watertight and protected to prevent contamination of the water after it has been properly treated.

In general, the operational routine associated with reservoirs concerns the process of feeding these units. When the supply of the reservoir is through a treated water pipeline by gravity, originating from a treatment plant, the maximum level of the reservoir is controlled by the WTP; when the supply is through a treated water pressurized pipeline, the maximum level of the reservoir is controlled by the lifting station that is carrying out the supply.

Thus, the operational routines are limited to inspections, at specified times, to check the safety and watertight conditions of the unit, the state of the concrete and metal structures and any leaks in the tank drains. Therefore, the following are the minimum actions to be taken by the Concessionaire to ensure such conditions:

- Control of the automation system, where applicable;
- Regular maintenance of connections, valves, stop valves, level indicator, and all existing equipment in the structure; and
- Regular inspections to ensure watertightness and control of losses.

As these units are linked to the maintenance of quality in a supply system, reservoir must be well protected against undue access by individuals unrelated to the service provider.

Regularly they should be emptied for cleaning and disinfection, a routine that should be performed in periods of lower water consumption.

4.6 Distribution Networks

A distribution system is a set of reservoirs and distribution network, sub-pipelines and lifting stations that receive water from distribution reservoirs, while a distribution network is a set of pipes and their accessory parts intended to make the water to be distributed available to consumers, continuously and at points as close as possible to their needs. The distribution network design must comply with NBR 12.218/94.

The concept of distribution flows, which is the distributed consumption plus the losses that normally happen in the supply pipelines, is also important. Distribution pipe is the penstock of the distribution network on which the service connections are made. This pipe can be classified into main pipes, those that by calculation allow water to reach the entire distribution network, and secondary, other pipes connected to the main pipes.

Another fundamental concept refers to pressure zones. In distribution networks they are each of the parts in which the network is subdivided in order to prevent the minimum dynamic and maximum static pressure from exceeding the recommended and pre-established limits. It is noted, then, that a network can be divided into as many pressure zones as necessary to meet the technical conditions, and it is essential to keep their registration updated.

Conventionally, the pressure zones in drinking water supply networks are between 15 and 50 mca (meters of water column), tolerating up to 60 mca in up to 10% of the area and up to 70 mca in up to 5% of the same zone, as maximum static pressure, and up to 10 mca in 10% and up to 8 mca in up to 5% of the same zone for minimum dynamic pressure.

Usually the distribution networks consist of main pipelines, also called *trunk sewers* or *mains*, fed directly by an upstream reservoir, or one upstream and one downstream reservoir, or even directly from the pipeline with a downstream reservoir. From these mains come the secondary pipelines, from which practically all the service connection branches come out.

The water distribution system must concurrently meet the state's firefighting systems instructions, more specifically the volumes of reserve against fire, the location of hydrants and the minimum diameter of the distribution network for their installation.

The Concessionaire shall also ensure a minimum residual chlorine concentration of 0.2 mg/L in the distribution network and, for this purpose, shall provide water collection points in the distribution network in the quantity and sampling frequency as established in Annex XX of the Consolidation Ordinance No. 5 of 03/10/17. If necessary, water chlorination systems should be installed and operated in the water distribution network.

4.6.1 Operational Routines Associated with Reservoirs and Distribution Networks

The distribution network is not composed only of pipes and connections. It also includes special parts that allow its functionality and the satisfactory operation of the system, such as maneuvering valves, suction cups, outlets and hydrants, requiring, at certain times, maintenance on existing equipment in the networks, such as stop valves and suction cups. The closed circuits have shut-off valves in strategic locations, in order to allow potential repairs or maneuvers in the downstream sections. In the secondary ducts these valves are located at the derivation points of the main.

Most of the operational routines of a distribution network are associated with its start-up, where the process of loading the network must be careful to prevent air pockets from causing disruption.

At some points outlet valves should be installed to allow for the emptying of the upstream sections in the event of any repairs. These valves can be replaced by hydrants. In these cases, care must be taken when locating and draining the site so that there is no danger of contamination of the network through the return of the sewer water. At the highest points suction cups should be installed to expurgate any accumulated air inside the pipe.

Thus another continuous operational routine in distribution networks should be the regular inspections of the network for leaks that are difficult to identify, the repair of any breakages and the immediate correction of any identified leaks. In these cases, the broken section must be identified, the mesh must be isolated by shutting off the control valves and the networks emptied through the available outlet stop valves. The re-entry into operation must be carried out with the outlet stop valves still open in order to avoid the return of the puddling water from the ditches open for the performance of repairs. If necessary, the network should be emptied in order to clean the pipes from any contamination.

The monitoring of the quality of the water distributed in terms of residual chlorine content shall comply, in terms of quantity and frequency of sampling, with the provisions of Annex XX of the Consolidation Ordinance No. 5 of October 3, 2007, including in terms of residual chlorine content.

These and other procedures that the CONCESSIONAIRE deems appropriate must be covered in the Operation and Maintenance Manual, to be prepared by each contractor. Said Manual should be aligned with the integrated information system, enabling the monitoring of the entire operation.

4.7 Household Connections

The household connection is an installation that links the distribution network to each consumer's internal network. Installed at the connection, the hydrometers control, measure and record the amount of water consumed in each property, in order to reduce waste, show water losses and provide a fair basis for billing the service. For this purpose, the hydrometers must be replaced periodically, at ages defined according to the conditions and technology of the park installed at the time, and with efficiency criteria assessed in accordance with the Regulatory Agency and may not exceed the maximum age of 05 years at the end of the concession period.

4.7.1 Operational Routines Associated with Service Connections

The only routines associated with service connections are related to their implementation, which must comply with the installation standard of the service provider, and the potential identification and correction of leaks and irregularities that may occur in the service connection branch.

4.8 Water Lifting Stations

The lifting stations are made up of sets of pumps and accessories that make it possible to lift the piezometric quota of the water transported in public supply services, and thus make it possible to supply regions with higher quotas. In addition, lifting stations are designed to transport water to more distant points and to increase the flow rate in the pipelines. The water lift design must comply with NBR 12.214/92.

They present the obstacle of raising operating expenses due to power expenses and are vulnerable to interruptions and failures in the electric power supply. It also requires specialized operation and maintenance, further increasing personnel and equipment costs.

4.8.1 Operational Routines Associated with Lifting Stations

In view of the technological complexity of the equipment and facilities of a lifting station, the operational routines are specific to each facility and, to this end, the procedures established in the Operating Manual of each unit must be followed.

These procedures generally provide for checking gasket leaks, preventive maintenance and regular replacement of pumps, control panels and starting devices and other parts subject to wear and tear, measurement of vibration in motors, control of amperage and voltage of electrical equipment and of pump running time, control of pump automation systems, adoption of energy efficiency optimization techniques and the regular emptying and cleaning of suction wells, where applicable.

4.9 Water Quality Control Routines

The physical, chemical and bacteriological characteristics of water are associated with a series of processes that occur in the water body and its drainage basin. In a water supply system the treatment processes have the role of making the water drinkable and therefore suitable for human consumption.

As previously mentioned, the quality of the water distributed in a supply system must meet the standards of potability established by the Ministry of Health, through Annex XX of Consolidation Ordinance No. 5/2017, whose origin is Ordinance 2.914, of 12/12/2011. These standards of potability, which consider various criteria associated with the physical, chemical and bacteriological characteristics of water, are assessed and controlled at two different times: (i) generally, at the exit of the water treatment plants or after receiving a simplified treatment (disinfection and fluoridation); and (ii) at random points of the distribution system.

4.9.1 Water Quality Control in Treatment Units

To control the treatment process, there are several routines practiced in water treatment plants. For this purpose, in most of the facilities there are process control laboratories, which supervise the evolution of water quality through the stages of treatment.

At the entrance to the treatment units, physical parameters relating to color, pH and turbidity are checked in order to guide the application of coagulants (aluminum sulphate or ferric chloride and hydrated lime, for example) and bacteriological parameters for possible pre-disinfection with the application of chlorine, whenever necessary, depending on the concentration of algae and microorganisms; after the filtration stage, the physical parameters of color and turbidity are evaluated again to verify the efficiency of this treatment stage; finally, at the end of the treatment process, all the physical-chemical and bacteriological parameters provided for in Annex XX of the Consolidation Ordinance No. 5/2017, of the Ministry of Health are analyzed.

It is worth mentioning that at the exit of the treatment plant the water is checked to assess the levels of:

- Chlorine, as a disinfectant, in a dosage sufficient to maintain the bacteriological quality of the water (generally not more than 2,0 mg/l, for a residual necessary to counter any possible contamination in the distribution network);
- Hydrated lime or other alkaline material, for pH correction, making the distributed water neutral or alkaline, and thus preventing corrosion processes on the distribution networks and household connections; and
- Fluorine, as a sanitary agent for the prevention of tooth decay (usually dosed with 0,8 ppm fluosilicic acid).

In the context of monitoring water quality in the supply systems, it is worth noting that the regulatory control of the concessionaires is carried out using the compliance performance indicator, provided for in the Performance Indicators Report, considering the color, odor, turbidity and residual chlorine parameters in the treated water.

In order to guarantee the quality of the water to be distributed, an Operation Manual shall be prepared including the following minimum activities:

- Availability of a local laboratory and performance of control tests, stage by stage of the process, until the final water supply stage;
- Definition of the frequency of the analyses and operational control routines;
- Establishment of criteria for defining the time between washes of operational units and procedures for washing them;
- Routines for storage of chemical preparations;
- Routines for checking the useful life of reagents;
- Routines for gauging and calibration of equipment;

4.9.2 Water Quality Control in Distribution Networks

The control of water quality in distribution networks is one of the requirements for the consideration of water potability, provided for in Annex XX of the Consolidation Ordinance No. 5/2017 of the Ministry of Health. The Ordinance defines a Sampling Plan that establishes, for each type of evaluation (physical, chemical or bacteriological), the minimum number of samples and the frequency of collection, according to the population served by the system and the size of the distribution network (ANNEXES XI, XII, XIII, XIV and XV).

The minimum residual chlorine content in the distribution network is 0,2 mg/L.

5 SANITATION SYSTEMS

According to the Brazilian Association of Technical Standards (ABNT), a sanitation system is the set of pipelines, facilities and equipment designed to collect, transport, condition and route only the sanitary sewage to a convenient final disposal, in a continuous and hygienically safe manner, consisting of a sewage service connection branch, sewage collection and transportation system, sewage treatment and proper final disposal of the treated effluent and sludge resulting from the treatment. The design of the sanitation system must comply with the norm NBR 9.648, the sewage treatment design with NBR 12.209/92, the lifting stations with NBR 12.208/92, the interceptor design with NBR 12.207/92, the final discharge design with NBR 12.207/92 and the branch and collection network design with NBR 9.649/86, all from ABNT, the Brazilian Association of Technical Norms.

The main operational routines are described below, and it should be noted that the CONCESSIONAIRE shall detail the specific operational routines in the Operation and Maintenance Manuals, for each of the existing operational facilities.

5.1 Operational Routines Associated with Sewer Service Connection Branches and Sewage Collection Network

The only standard operating routine defined for the sewer service connection branches and sewerage systems is the regular unblocking of the piping. This way, it is necessary to perform regular cleaning of manholes (MHs) and network sections with low slope and/or with a history of high number of maintenances and immediate unblocking, eliminating overflows in the network and branches; thus the importance of keeping an updated registry'.

As this is an absolute separator type system, with treatment at the end, the introduction of stormwater will not be allowed under any circumstances, except for the collection in dry weather collector provided for in item 4.3 of this ANNEX. In order to guarantee this requirement, it will be up to the service provider to:

- When approving and performing the sewer service connection of domestic sewage, verify the existence of appropriate conditions for the collection and drainage of stormwater;
- Separate the existing sewerage systems that discharge into stormwater systems/galleries, route them and interconnect them to the trunk sewer;
- When connecting the collection system to the trunk sewer, check that there is no entry of stormwater in the sewerage system;
- Carry out the total separation between the sewage and stormwater system; and
- Adapt existing connections to meet the above topics.

To protect the system against the introduction of foreign objects, all inspection boxes must be provided with hermetic and plug-in plugs.

To comply with the requirements for protection of the public network, the service provider, when approving and performing the sewer service connection of domestic sewage, must verify the existence of appropriate conditions to meet the above-mentioned requirements.

Regularly, and every time there is suspicion of anomaly in the operation of the sewer service connection, the supervision staff of the service provider shall perform an inspection.

In order to comply with any requirements laid down in specific municipal laws, the kerbside and raceways should be recovered under the same conditions as before the intervention, unless prior agreement has been reached with the municipality.

5.2 Specific Operating Routines for Trunk Sewers

Trunk sewers, interceptor sewers and gravity outlets only need regular inspections to determine the need for repairs and cleaning of the main. The manholes and lines should be cleaned whenever they are silted up, which can be checked by drilling from the bottom of the manhole, or when they have crusts of fat or other materials.

At the discretion of the service provider and as convenient, regular cleaning can be scheduled on a preventive basis, reducing the likelihood of blockages.

In the case of pipelines located on the river/ream bank, the service provider shall regularly clean the area with vegetation removal, so as to ensure access to the manholes and inspection boxes.

In the cases of obstruction identified and claimed by users, cleaning and clearance teams must be activated, which will identify the causes and proceed to repair them. This service varies from a simple unblocking by pressure jet equipment to the replacement of the damaged section.

In cases where identification occurs during the preventive maintenance process, services are scheduled and executed according to the requirements of each case.

5.3 Operational Routines for Sewage Lifting Stations

For sewage lifting stations, the operational routines must follow the procedures established by the unit's Operation Manual and are analogous to the routines explained for water lifting stations, with the appropriate sanitary care, as follows:

- Control and maintenance of pump automation;
- Adoption of energy efficiency optimization techniques;
- Regular reading of electrical quantities (amperage, voltage) and of pump operating time;
- Preventive maintenance of pumps, control panels and starting devices; and
- Regular emptying and cleaning of the suction well and grid, and if necessary, desanders; for this purpose, a device for removing and moving pumps should be provided.

5.4 Operational Routines of Discharge Lines

The discharge lines are responsible for transporting the sewage to the Sewage Treatment Plant, Sewage Lifting Station or to some manhole of the nearest sub-basin and are essential components for the system in question, which must be operated according to its specifications. Proper operation of this system may require, for example, a control of the quality, quantity and speed of sewage outflow.

Therefore, the discharge line should also undergo regular inspections to verify the need for repairs, maintenance and cleaning.

In order to facilitate the operation and maintenance of the system, the design usually provides for stop alves along the discharge line, at the points where the lifts are interconnected to the single discharge line, in the interconnection boxes. Such stop valves allow the isolation of both the lifts and the sections between the lifts, facilitating the actions for emptying and cleaning the network.

The isolation of a stretch of the discharge line may be carried out after the shutdown of the lifts that contribute to this particular stretch, shutting off the stop valves of the interconnecting boxes; this closure must be slow so as not to cause disturbance in the hydraulic regime of the following stretch, if it is in operation.

It is worth mentioning that along the discharge sections, outlet valves are usually designed for emptying the line, as well as suction cups for air inlet and outlet. Both emptying and filling the discharge lines should be done gradually, so that there is full filling of the pipe with air - in case of emptying the line, and full expulsion of air - in case of line filling, in order to avoid damage to the pipes.

Throughout the years of operation it is common for sediments to get incrusted to the walls of the discharge pipes and, in this case, to clean the pressure pipe it is recommended the use of *Cleaning PIG* type devices for the scraping of the pipe. This device is projected into the discharge line by means of a launcher installed in the lift and, through hydraulic propulsion, runs the entire section to be cleaned until an exit point which can be a manhole or box.

Regular maintenance of connections,stop valves and suction cups of the discharge lines should also be provided for.

5.5 Operational Routines for Sewage Treatment Plant

The operational routines of the sewage treatment plants must be in line with the procedures established by the Operating Manual of the specific unit, the most common being the removal of the gridded and desanded material for final destination, the control of the sludge age, the oxygen content in the aeration tanks, the concentration of solids in the aeration tanks and the sedimented sludge, the preparation of the chemicals and verification for dosage adjustments, automation of pumps and dosing equipment, regular preventive maintenance of pumps and dosing equipment, UV lamps, control panels, valves, stop valves and other STP equipment, the quality of raw and treated effluent

for final discharge, regular emptying and cleaning of reactors and decanters, the preparation and application of the Management Plan for Sludge and Solid Waste, among others.

Quality control in a sanitation system is correlated with the quality of the effluent from the sewage treatment plants, whose final discharge is usually in a watercourse.

In this context, Resolution 357, of 17/03/2005, of the National Council of the Environment (CONAMA), provides for the classification of water bodies and environmental guidelines, as well as establishes the conditions and standards for the discharge of effluents. In turn, CONAMA's Resolution 430, of 13/05/2011, provides on the conditions and standards of effluent discharge, complementing and amending CONAMA's Resolution 357. The NT-202.R-10, which establishes the Criteria and Standards for Liquid Effluent Discharge into Coastal, Surface or Underground Water in the State of Rio de Janeiro, is in force and under revision. For the purposes of this Concession Technical Specifications, it is considered that it shall be effectively amended in its parameter of maximum ammonia release of 5 mg/L. If this parameter is not made more flexible, the Concessionaire shall be entitled to rebalance the agreement.

The main control criteria are: (i) the Biological Oxygen Demand (BOD), which corresponds to the amount of oxygen consumed in the degradation of organic matter by biological processes, measured in mg/L O2; (ii) Chemical Oxygen Demand (COD), which evaluates the amount of dissolved oxygen (DO) consumed in acid medium, which leads to the degradation of organic matter, biodegradable or not, measured in mg/L O_2; and Total Suspended Solids (TSS), which represents the concentration of solids present in a sample, which may be in suspension or decanted.

All analyses must be performed in accordance with the latest edition of the *Standard Methods for the Examination of Water and Wastewater*, edited by the *American Water Works Association*.

In the context of monitoring the quality of treated sewage, it is worth noting that the regulatory control of the concessionaires is made through the compliance performance indicator, provided in the ANNEX Performance Indicators, considering the $BOD_{5.20}$ parameter in a composite sample of the treated effluent.

The Concessionaire shall conclude a technical study, within two (2) years after the execution of the agreement, to evaluate the possibility of using the organic sludge generated in the Sewage Treatment Plants (STPs) it operates as biogas and organic compound.

In the case of STP Barra and others in a similar situation, the above-mentioned use may only occur after the cessation of the receipt of the contaminating sludge, such as that coming from the River Treatment Units - RTU.

6 GENERAL ASPECTS

6.1 Legal Obligations

The CONCESSIONAIRE shall comply with at least the following legal instruments or legislation that may replace them:

- Principles and guidelines of Federal Law 11,445, of 05/01/2007, which provides on the national guidelines for basic sanitation and the federal basic sanitation policy and the Regulatory Decrees 7,217/2010 and 9,254/2017;
- Principles and guidelines of Federal Law 14.026, of 07/15/2020, which updates the basic sanitation legal framework and sets forth other provisions
- Principles and guidelines of State Law No. 1.988/1994, which provides on the State Environmental Policy in Rio de Janeiro;
- The quality control of the water distributed in the operated systems shall comply with the legal requirements set forth in Annex XX of the Consolidation Ordinance No. 5/2017, of the Ministry of Health;
- The discharge of effluents from sewage treatment plants shall comply with CONAMA Resolution 430/2005 of 13/05/2011 and NT-202.R-10 - Criteria and Standards for Liquid Effluent Release into Inland or Coastal, Surface or Underground Waters of the State of Rio de Janeiro, with the addendum referring to the revision of NT-202 explained in item 5.5; and
- The systems must be operated in compliance with federal labor and occupational safety legislation.

6.2 Master Plan

The CONCESSIONAIRE shall develop a Master Plan for each municipality, covering all the municipalities of the respective block, within a period of up to 18 (eighteen) months after the assumption of the system, addressing the main actions to achieve the targets presented in chapter 4 of this ANNEX, consisting of a work plan, schedule and respective required investments, to be developed within the concession area, which shall enable the efficient management of the investments planned for the expansion and improvement of water and sewerage systems, as well as the control of the achievement of the planned service targets.

In addition, the Plan should also consider the development of corporate governance measures, as explained below, and the establishment of regulatory controls, necessary to maintain the balance of the concession agreement.

Agenersa shall have 90 (ninety) days to issue its statement. If there is no statement from the regulatory agency, the Master Plan shall be considered approved.

6.3 Corporate Governance and *Compliance*

Nowadays, transparency of companies is increasingly demanded by the market and society, thus it is important that CONCESSIONAIRE develops its activities observing the concepts of governance and *compliance*, as a way to ensure good management and the reputation of the company.

Governance refers to the way companies are run, which involves policies, regulations, culture and processes. In this context, it is essential that the CONCESSIONAIRE develops the following instruments: (i) the Services Regulations, approved by the granting authority, regulating all the company's processes; and (ii) its main policies, such as Personnel, Environmental, Procurement, Asset Control, Billing, Investments, and other policies - duly explained, known and observed by all employees.

Corporate governance concerns the relationship between internal stakeholders - partners, board of directors and executive board - and external stakeholders - supervisory bodies, regulators and government. In short, it brings together the company's strategies to demonstrate its value. Thus, governance encompasses actions aimed at strengthening the company's reputation, ensuring the internal benefits of working with ethics and competitiveness by being known as an honest and reliable company.

In turn, *compliance* is the way to ensure that the management and positioning of the concessionaire follow the rules in force, respecting the commitment to ethics and truth. The existence of a *compliance* program presupposes a guarantee that the laws and regulations for operations are strictly complied with. CONCESSIONAIRE, when developing *compliance* concepts, is responsible for identifying points of failure in its activity and resolving these issues. Thus, the company's image is strengthened with regard to the seriousness and commitment of what is executed.

In this context, the CONCESSIONAIRE shall develop a *compliance* policy, observing the applicable laws, and make all stakeholders fully aware of it, through the Internet and other means of communication.

6.4 User Awareness

Considering that the proper functioning of a sanitation system depends, mostly, on the proper use of the system by the serviced USERS, thus an important phase of the operation of the system refers to the process of sanitary education and awareness of the USERS.

This is one of the most important steps to achieve maximum benefit for as long as possible from the installed system. The CONCESSIONAIRE will have to prepare a Social Communication and Environmental Education Program, aiming at USER awareness and, therefore, their collaboration. The Program must be prepared within 3 months after the start of the service operation, and must be approved by the granting authority before its disclosure to the public and may follow the following methodology:

- **Promotion of the Regulations -** may be done through publication in booklets, or leaflets, which must be sent free of charge to the USERS, preferably together with the first bill for sewage service fees.
- **Discussion of sewage issues -** the discussion of the sewage issues can be done directly, through lectures or indirectly through the distribution of informative leaflets.
- **Direct Discussion -** can be done through lectures and round tables to be held regularly and which promote and discuss the problems related to domestic sewage. They may be directed at specific groups such as: primary and secondary schools; neighborhood associations and community leaders.
- **Indirect Discussion -** this can be done through the regular distribution of informative leaflets, containing information on such as the importance and the operation of a sewage system, how to avoid clogging and other damage to the system, pollution of catchments and other specific issues that might be deemed appropriate. The leaflets may be distributed together with the bills for sewage service fees, in schools and other convenient places.

It is important to stress the possibility of using more direct communication with the user, through apps, e-mail or messages. This information process may even include other relevant information for the USER, such as: average monthly water consumption; comparison of average consumption with standard groups; incentives for rational use of water; and warnings of possible leaks in internal service connections, in case of off-average consumption.

6.5 Maintenance Schedules - USER Interface

Considering the need that shut down for maintenance interventions in the water and sewage systems affect the USERS as little as possible, it is important that the CONCESSIONARIES implement appropriate structures for the execution of these services. These structures must be sized and implemented to meet the services within previously established deadlines. In this context, it is worth noting that such deadlines are considered regulatory requirements, subjecting the service provider to notifications and fines in cases of non-compliance.

The Ombudsman website and *app* should be created and announced, to receive inquiries on various information and inclusion of complaints / service requests.

In this sense, in short, it is the CONCESSIONAIRE'S responsibility: (i) to implement a *Call Center*, operating 24 hours a day, to receive, free of charge, the requests for services and information from the USERS of the concession; (ii) to implement in each city at least one physical store, for serving customers in person; (iii) to implement a virtual system of USER service, via the Internet; (iv) to size and structure maintenance teams appropriate to the size, quantity and types of services; (v) to provide the maintenance teams with the tools, equipment, vehicles and materials necessary for the

performance of the services; (vi) to perform the services within a previous schedule, following up and monitoring, online, the teams in the field; (vii) to implement a performance management system of the services performed, verifying indicators and establishing any necessary adjustments.

All service channels must follow the instructions of Decree No. 6.523/2008 regarding the time of service to USERS or definitions established by the REGULATORY AGENCY.

6.5.1 Meeting Deadlines for Requests and Complaints

This obligation relates to compliance with the deadlines for services relating to complaints and/or requested and which must comply with the deadlines as set out in the Performance Indicators ANNEX. These services include, at least: a- Water connection; b- Repair of water leaks; Ridge repair; c- Local or general water shortage; Sewage connection; d- Clearance of sewage networks and branches and occurrences related to resurfacing; f- Checking water quality; g- Checking water shortage / low pressure; h- Resumption of water supply due to debt; i- Resumption of water supply on request; j- Commercial occurrences (review of reading, analysis of documentation and conditions for granting social tariff); k- Deployment of water branch; l- Ridge displacement; m- Replacement of hydrometer at customer's request.

To this end, the CONCESSIONAIRE shall establish at least the following procedures:

- Provision of personnel structure, vehicles and tools necessary for the execution of requests;
- Computerized Service Orders (SO) registration system, tracking the progress until resolution, in order to inform the applicant and the regulator on compliance with deadlines; and
- Statistical management report with summary of compliant and non-compliant deadlines.

As far as corrective maintenance is concerned, timeliness in correcting failures is of utmost importance, since it is strongly related to the user's perception and evaluation of the service provided. Thus, regarding corrective maintenance, the CONCESSIONAIRE shall propose, at least, the following deadlines:

Service	Deadline for service
Water or Sewer Connections	5 working days
Repair or unblocking of water or sewage networks and branches in locations with urban population of up to 100,000 inhabitants	24 h

Repair or unblocking of water or sewage networks and branches in locations with an urban population of over 100,000 inhabitants	48 h
Sewer Lifts	8 hours
Hydrometer replacement (except park renovation)	2 (two) working days
Water or sewer service connection inspection	8 (eight) working days
Resurfacing of roads or sidewalks	2 working days
Other services to USERS*	2 working days

* "Other services to the USERS" are the additional services, referring to the requests for services by the USERS, which may generate new demands.

The service deadline is defined as the time elapsed between the request of the service by the user and the date of its effective completion.

All occurrences of leaks, both those reported by USERS and those identified by the CONCESSIONAIRE itself, must be recorded in the integrated information systems and made available for access by the REGULATORY AGENCY.

6.6 Integrated Information System

In order to enable the full management of the operation and maintenance of the entire water and sewage infrastructure in operation, the CONCESSIONAIRE shall develop and implement an integrated information system that considers the main stages of operation, maintenance and marketing of the systems.

In this context, Operation and Maintenance Manuals should be prepared for the units that make up the existing water and sewerage systems, considering the *as-built* of the facilities, the performance and control indicators and the detailed description of the operation and maintenance routines of the units in operation. In the context of Maintenance, the corrective, preventive and predictive routines (maintenance based on the state of the equipment) should be considered.

As a result of the Integrated Information System, an Integrated Management System should be implemented, between the operation activities and the maintenance activities of the systems.

6.7 Operational Control Center

6.7.1 OCCs for the locations served in each block

The CONCESSIONAIRE shall design and implement an Operational Control Center (OCC) sizing it feasibly for each operated site, to allow the remote supervision of the systems in operation, by

obtaining the main data and quantities by telemetry, *online* analysis in previously developed modeling and the decision making and remote action in real time, via remote control.

The Control Center presupposes the implementation of a measurement and automation infrastructure, which considers flow meters, pressure meters, level meters, control valves and other equipment necessary for the supervision and remote control of the systems in operation.

The OCC must be structured for 24-hour operation and, in addition to controlling the operating status of the water and sewage systems, it must, through closed circuit television (CCTV), perform continuous surveillance and monitoring of the operating units, preserving the integrity of the facilities against invasions and depredations.

The CONCESSIONAIRE should install sensors at the operational units, preferably in:

a) Substations and Units in General - the electrical variables (voltage, current, power), rotation, operating status, bearing temperature, vibration, level sensors and spillage shall be controlled, including presence sensor and remote control through a supervisory system;

b) Surface Water Abstraction, Wells, Lifts, WTPs and Reservoirs - sensors should be installed at characteristic points to monitor flows, to allow control operations in normal operational situations, as well as in emergencies;

c) Rivers, Catchment Dams and Treated Water Reservoirs - level sensors to allow visualization of the available volume in the units;

d) Pipeline and Distribution Network - flow and pressure sensors at strategic points, macro meters and pressure regulating valves to allow the management and balance of pressures and flows of the distribution system;

e) Hydrometers - it is desirable that the micrometer is telemetric and integrated with the CCO controls;

f) Water Treatment Station and Wells - a set of sensors should be installed to monitor electrical variables (voltage, current, power, etc.), hydraulic (flow, pressure, etc.), mechanical (rotation, vibration, temperature), treatment parameters (residual chlorine, pH, color, turbidity, hardness and specific conductivity) defined for each type of equipment, as well as the control of the environment (presence sensor and video camera) in the main points of operation that are integral parts of the treatment process and with remote control of the OCC to manage the operation through a supervisory system;

g) Sewage Collection Network and Interceptor Sewers - flow sensors shall be installed at strategic points to monitor the flow rates, especially in periods of exceptional load (rain, etc.), to allow control operations in situations of operational anomaly, and level sensors in strategic manholes to anticipate possible overflows;

h) Sewage Lifting Stations - level, flow and pressure sensors should be installed in the discharge lines; and

i) Sewage Treatment Station - a set of sensors should be installed to monitor electrical variables (voltage, current, power, etc.), hydraulic (flow, pressure, etc.), mechanical (rotation, vibration, temperature), treatment parameters (DO, BOD, SS, etc.) defined for each type of equipment, as well as the control of the environment (presence sensor and video camera) in the main points of operation that are integral parts of the treatment process and with remote control of the OCC to manage the operation through a supervisory system.

6.7.2 OCC for the Rio de Janeiro Metropolitan Region macro supply system

The procedures for implementing and governing the OCC of the Macro Supply System (SMA) of the Metropolitan Region of Rio de Janeiro (RMRJ) are detailed in Annex VI - Interdependence Agreement and Annex X - Water Supply System Rules of the Concession Contract.

6.8 Energy Efficiency Optimization Program

Considering the second most relevant operational expenditure of a sanitation service provision, each CONCESSIONAIRE shall implement an Energy Efficiency Optimization Program that considers, in the facilities in operation, measures to reduce unit consumption (R$/m^3) and specific consumption (KWh/m^3).

With this approach, CONCESSIONAIRES shall assess the technical and financial feasibility of migrating existing units to the Free Energy Market Environment, in order to reduce expenditure on this important operational input. Depending on the hydraulic characteristics of the systems, the opportunity for self-generation of energy should also be analyzed.

On the other hand, in order to reduce the specific consumption indicator, measures should be taken to modernize and increase the operating efficiency of the electrical equipment in operation, such as the *retrofitting* of motor-pump sets, switchboards, control panels and the installation of frequency inverters, among other actions.

6.9 Technical and USER Registration Program

In order to maintain reliable information on the operational infrastructure in operation and on the USERS benefitting from the services provided, each CONCESSIONAIRE shall maintain permanent routines to update the technical registration of the operational assets of the concession and the registration of the USERS.

In this context, the systems must be georeferenced with GIS (*Geographic Information System*), and the USER registration must be interconnected with the geographical basis of the water distribution

and sewage collection systems and with the billing and collection system, within a period of 2 (two) years;

The implementation of permanent routines to update the information resulting from the implementation of new systems (*as-built*), as well as of data collected during network maintenance interventions, will enable the continuous updating of the infrastructure databases. Likewise, the systematic updating of the USERS' information, at the time of monthly reading and billing, will ensure the reliability of the USERS' data, allowing the billing and collection process to be effective.

6.10 Water Loss Reduction and Control Program

Considering the high rates of water losses in water supply systems, the CONCESSIONAIRE shall develop and implement a Water Loss Reduction and Control Program that establishes specific actions to prevent losses, such as implementation of flow, pressure and level macro meters for measuring all hydraulic quantities; implementation of pressure reducing valves; implementation of *datalogers* for obtaining and storing operational data*;* sectorization of distribution networks; micrometer programs; implementation of Measurement and Control Districts (MCDs); research and elimination of invisible leaks (geophoning) and other measures in order to reduce losses, in addition to universalizing the micrometer measurement.

Depending on the age of the networks, the materials used and the operating conditions, there should be an analysis on the feasibility of replacement of older pipes and service connection branches, which present frequent rupture and leakage issues.

Still in the context of losses, it is essential that the concessionaires operate the water systems based on results obtained in hydraulic modelling, which ensure the efficient operation of the systems, under appropriate flow and pressure conditions.

The loss reduction targets are established in Annex III - Performance Indicators.

6.11 Hydrometer Coverage Program

The presence of a hydrometer in the service connection, besides the fair billing of consumption, promotes the dissemination of practices of rational use of water.

With this approach, water supply systems should preferably be 100% fitted with hydrometers, with the fitted meters working properly. To this end, the CONCESSIONAIRES must develop programs that consider, at least, the following activities: (i) installation, within a period of up to 5 years, of hydrometers in all connections not currently measured; (ii) replacement within a period of up to 5 years of all hydrometers that present reading issues - stoppage, blurred dome, damaged meter, etc.(iii) scheduled replacement of all hydrometers that have exceeded their useful life - usually around 7 years; (iv) scheduled replacement of hydrometers that have exceeded their ability to record consumption, according to previously established limits; and (v) installation of hydrometers with remote reading

transmission mechanisms, for recording and monitoring consumption of connections of large consumers.

Adding on to the points mentioned above, the CONCESSIONAIRE shall also: have an adequate minimum stock in order to ensure that no new connection is implemented without a meter; have operational facilities with benches that allow the performance of gauging and calibration tests of the meters; and have standardized systems that allow the performance of commissioning and quality tests in hydrometer factories, in the case of calls for bids for the purchase of new hydrometers.

The permanent execution of all mentioned actions will enable the concessionaires to reduce apparent water losses, with the elimination of consumption sub-measures and waste prevention.

6.12 Staff Training and Qualification Program

As a way to ensure that the activities within the CONCESSION are carried out in accordance with the best practices established in the operation and maintenance manuals, each CONCESSIONAIRE shall develop a broad Training and Qualification Program, with the objective of developing the technical skills and competencies of its employees.

The Program should consider actions at the various levels of service provision, thus contributing to increased productivity, improved performance, reduced errors within operational routines, reduced costs, improved performance, motivation of people and teams and a reduction in the number of accidents during working hours.

6.13 Contingency Plans

Considering the priority and indispensable nature of the provision of sanitation services, the CONCESSIONAIRE should develop Contingency Plans for the strategic units, defining the responsibilities within the organization, for the operation of these systems in emergency situations.

With this approach, Contingency Plans should consider: (i) what risks may cause the systems to shut down and what effects this might entail; (ii) when the risk occurs what can be done to mitigate its effects; and (iii) what can be done before the risk occurs to prevent its occurrence.

Contingency Plans shall objectively describe the actions that will be executed in emergency situations and have the purpose of training, organizing, expediting and standardizing the actions necessary to control and respond to anomalous situations. Thus, the Plans deal with the consequences of an accident and prevent them from happening as a result of the conditions generated.

Once the risks are identified, the Plans should structure the strategies, gather the human, technical and logistical resources and disseminate and train the organization through simulations.

6.14 Fraud Elimination Program

In order to optimize the billing and collection process, the CONCESSIONAIRE must implement programs to detect and eliminate by-passes and other commercial fraud. Such frauds are identified by

the average consumption analysis, by comparisons between areas of the concession, by tests in the service connection branches, to identify the existence of by-pass or fraud in hydrometers, and by visual inspection.

The systematic implementation of this type of survey, its dissemination within the concession and the imposition of fines, curbs the proliferation of the practice among USERS.

6.15 Socio-environmental Programs

Socio-environmental programs can be defined as management tools that make it possible to potentialize the positive impacts and to mitigate/control the negative impacts of a given development.

These programs originate from the environmental licensing, and are based on the logic of continuous improvement, guided by ISO 9001 and 14001 Standards.

Within this approach, contractors must implement programs such as: Environmental Education; Water Quality Control; Effluent Quality Control; and Dam Safety, among others. The development and implementation of these programs should be laid down in separate manuals and should comply with the best practices and technical standards involved.

6.16 Environmental Guidelines

The development of the design, implementation and operation of WATER SUPPLY SYSTEMS and SANITATION SYSTEMS requires that the current environmental guidelines be observed, as provided for in the legal and regulatory provisions at federal, state and municipal levels, as well as the dictates of best practices and competent environmental agencies. The CONCESSIONAIRE has the obligation to comply with such provisions, in connection with the developments for which it will have environmental liability.

For liability and obligation purposes, the CONCESSIONAIRE is strictly liable for the civil redress of environmental liabilities originated during the term of the AGREEMENT and related to its operation.

In addition to the obligations related to the legality of the operations, the CONCESSIONAIRE must be committed to good practices in the use and preservation of natural resources.

6.16.1 Environmental Licensing and Permits

For purposes of environmental good standing, all infrastructure and activities under implementation and/or operation by the CONCESSIONAIRE must meet the legal requirements of licensing, authorizations, certifications, registrations and concession fees required at the federal, state and municipal levels, of the validity of said documents, and the respective guidelines (such as technical conditions and validity requirements).

The CONCESSIONAIRE, at the end of its contract, must deliver the facilities in full environmental compliance, with licenses and concessions valid for a minimum period of 6 (six) months, or with a request for renewal filed within the legal deadline.

6.16.2 Regularization

Part of the infrastructure currently operated by CEDAE and that will be transferred to the CONCESSIONAIRE is not currently environmentally compliant, and may require partial licensing (from the Installation License) or a preliminary authorization request until the effective regularization in compliance with the applicable environmental norms and guidelines.

In many cases licensing is pending due to the need for improvements or specific technical studies to comply with the technical requirements of the licensing bodies.

It is the CONCESSIONAIRE's obligation to take the necessary measures for the full regularization of these facilities and of the operation, which may involve the identification and resolution of any liabilities and obtaining all licenses, permits or concessions from the competent authorities.

The start of the regularization process should occur within a maximum period of 01 (one) year from the execution of the agreement, and the CONCESSIONAIRE should act together with CEDAE to establish the terms of a Cease-and-Desist Agreement (*Termos de Ajustamento de Conduta - TAC*) with the licensing bodies and Public Prosecutor's Office, if necessary.

Any costs relating to fines and charges for environmental liabilities prior to the date of transfer of operational responsibility to the concessionaire will be the responsibility of CEDAE, even if found after the transfer.

Any costs relating to obligations, compensation and conditions of any kind arising from the TACs entered into to remedy such environmental liabilities prior to the date of transfer of operational liability will also be the responsibility of the CEDAE.

All costs related to mitigating, corrective, compensatory measures, fees and charges, studies and designs, renovations or expansions required for environmental regularization not directly related to pre-existing liabilities, are the responsibility of the CONCESSIONAIRE.

6.16.3 Renewal

Upon the transfer of operational responsibility, the CONCESSIONAIRE shall submit the request for change of ownership of all existing licenses, authorizations or concessions.

From this act on, the renewal of these licenses and maintenance of their validity is the entire responsibility of the CONCESSIONAIRE.

6.16.4 Infrastructure Expansion

The environmental regularity of the expansion of the systems infrastructure is the entire responsibility of CONCESSIONAIRE.

6.17 Environmental Licensing Process

The environmental licensing process for water supply systems and sanitation systems includes, on the part of the CONCESSIONAIRE, the request to the competent environmental body for licenses in accordance with the stage of the development.

The competence of the licensing must be verified considering the activity to be developed, the size of the undertaking, the polluting potential and the scope of the impact, thus, the licensing may be requested at the federal (IBAMA), state (INEA) or municipal (Municipal Environmental Secretariat) level.

It is the CONCESSIONAIRE's responsibility to comply with environmental norms at all licensing stages of the development under its environmental liability.

6.18 Concession For Use Procedure

Water abstraction and effluent discharge are regulated by the water abstraction and effluent discharge concessions.

The concession of water bodies are issued at the state level by INEA.

It is the CONCESSIONAIRE's responsibility to comply with environmental norms at all licensing stages of the development under its environmental liability.

For existing concessions, the CONCESSIONAIRE will be responsible for providing the registration in its name.

6.19 Partial Cease and Desist Agreement Between Cedae, State of Rio De Janeiro and the State Public Prosecutor's Office, from Public Civil Action No. 0218928-66.2007.8.19.0001 - TAC PSAM/PDBG

CEDAE and the STATE executed a Cease-and-Desist Agreement with the State Public Prosecutor's Office, undertaking to make several investments in the Metropolitan Region's sanitation system. Considering the stage of each of the works included in said agreement, the following division was made:

1. For the works listed in item 16.19.1, it was considered that the STATE or the CEDAE shall be responsible for the conclusion of the investments. In case the responsible entity does not conclude these works and, as a result, the CONCESSIONAIRE assumes these investments, the CONCESSIONAIRE shall have the right to the economic-financial rebalancing of the AGREEMENT;

2. For the works listed in item 16.19.2, it was considered that the CONCESSIONAIRE shall be responsible for making the investments, and the CONCESSIONAIRE shall consider them in its investment plan. For these investments, the delay described in item 3.3 is disregarded, and they must be scheduled to start at the most one year after the start of the OPERATION OF THE SYSTEM and

concluded until the end of the fifth year from the start of the OPERATION OF THE SYSTEM. If the public entity (STATE or CEDAE) makes some of the investments listed in this sub-item, there shall be the economic-financial rebalancing provided for in sub-clause 30.2 (IV) of the AGREEMENT.

6.19.1 Investments under the responsibility of CEDAE or the STATE

a) Lot XV, Olavo Bilac and Retiro Feliz Reservoirs: they are part of the scope of the National Competition CN no. 05/2014 and of the Exemption of Bid DL no. 02/2017, in the scope of the financing for the implementation of water supply in Baixada Fluminense. Estimated value: 49,088,622.23. Works finished at the Olavo Bilac Reservoir and in progress at the Lote XV Reservoirs and Retiro Feliz. Deadline for completion 21/03/2021;

b) Alcantara system: This intervention is the subject matter of the Agreement SEA/UEPSAM no. 20/2014 entered into on 24/6/2014, and covers the installation of about 92km of collecting network, 5,2km of trunk collector and its interconnections, Sewage Treatment Station (STP) of 1.200 L/s, besides about 17.400 household connections for the collection of sewage of the Sanitation System of Alcântara, Municipality of São Gonçalo - RJ. The updated contract value is $ 500.85 million with outstanding balance to implement of $ 372.53 million, base May/2019. The maximum term is 48 months. The other investments for the Alcântara sanitation system are provided for in item 7.1.3, which shall be the responsibility of the CONCESSIONAIRE;

c) Manguinhos Collection Trunk: This intervention is the subject matter of Agreement no. 167 0350.917-78 entered into on 22/06/2012, and covers the implementation of 3.830m of reinforced concrete piping DN 1.500 mm - MND and 780 m of reinforced concrete piping DN 900 mm - MND. Contract value of $ 137 million, in values of Sept/2018 The term for the implementation of the works is 24 months, ending on 03/07/2021.

d) Faria Timbó Collection Trunk: this intervention is the subject matter of Agreement no. 0346.926-05, and covers the implementation of 4,740m of reinforced concrete piping DN 1.500 mm - MND, 644m of reinforced concrete piping DN 1,000 mm - VCA and 711 m of reinforced concrete piping DN 600mm, being 653m VCA and 56m in MND. Contract value of $ 132 million, updated in September/2018 and implementation term in 24 months. The works are underway, ending on 03/07/2021.

6.19.2 Investments under the CONCESSIONAIRE's responsibility

a) Sarapui System Collection Network: (i) complementation of the sanitation works of the sub-basins 01, 02, 03 in the city of Nova Iguaçu, agreement no. 19/2013 (related bidding procedure according to process E-07/100.393/2018, also identified by no. 116.706-2.18), term of 24 months and composed of the settlement 1.772,10 meters of DN 150mm, 535,00 meters of DN 200mm, 263,50 meters of DN 250mm, 861,00 meters of DN 400mm, the installation of 2.049 household connections and 2.049 household connections and (ii) performance of the sanitation works of the neighborhoods

Caonze and Centro (part) of Nova Iguaçu, covering the neighborhoods of Presidente Juscelino, Centro (part) and Caonze covering 12.447.68 meters DN 150mm, 962.30 meters DN 200mm, 54.00 meters DN 250mm, 513.00 meters DN 300mm, the installation of 1,163 household connections, 1,163 Intradomic household connections and 01 sewage pumping station with power of 1CV. In both cases it shall be up to the Concessionaire to update these figures in order to make the system fully operational;

b) Pavuna Sanitation System (SES Pavuna): this intervention includes the execution of agreement no. 18/2013, which consist of the implementation of a PVC sewage collection system. With 14,892.40m of 150mm, 176m of 200mm and 158m of 250mm, implementation of 93 manholes, 1,536 household connections, with a 24-month implementation period, and the Concessionaire shall be responsible for updating these figures in order to make the system fully operational.

6.20 OPERATION AND MAINTENANCE MANUALS

The following are the minimum necessary information, without limitation, that must be present in the operation and maintenance manuals that shall be detailed by the CONCESSIONAIRES, containing the operational, maintenance and safety/emergency procedures for the performance of the activities, covering the units of the water supply and sanitation systems.

The guidelines must be clear and without double meaning, so that the operator has the real understanding of the message. Whenever necessary, warning signs should be posted to draw the attention of operators when an action is likely to cause some kind of risk.

The manuals should also be accompanied by illustrations/photographs, which help the understanding of the text and be available to all users in the workplace.

Maintenance activities shall be divided into three categories: Preventive, Repair and Emergency.

The information present in the operation and maintenance manuals shall be the following:

- Hygiene and safety care;
- Environmental and personal accident control plan;
- Contingency Plan
- Technical standards used in design and construction;
- Description of the general and operational characteristics of the systems;
- Design cadastre and drawings;
- Manuals from manufacturers;
- Technical listing and characteristics of the equipment;
- Description of the main problems that occur in each of the units and measures to be taken to remedy them;
- Description of the operational routines in the process units of the system, namely water and sewage treatment plants

- Indication of the procedures to be adopted when entering and withdrawing operation of each system unit;
- Schedule of periodic reviews to be performed aiming at the performance of preventive / maintenance operation;
- List the minimum team and equipment to be allocated to the operation/maintenance of each system unit, taking into consideration its size and degree of automation;
- Plugs or forms of each equipment with the relevant data (flow, pressure, voltage, motor amperage, operating time, vibration, etc.) and other relevant data such as frequency of filling out forms, weather conditions, odor in the units, etc. In addition to this information, the forms shall cover the occurrences relevant to the operation, such as: equipment breakdown, duration of the operation, power failure and duration of the operation, and if possible, the causes of such problems;
- Instructions to operators to be observed in the inspection of systems aiming at the performance of preventive/maintenance operation, such as: tightness, leaks, abnormal noises, vibration, operationality and the finishing of all civil works, the operationality and the finishing of electromechanical systems, piping support devices; etc.
- Distribution network monitoring plan for investigation and repair action in cases of non-conformity in water potability standards, with detection and repair protocols, with the preparation of a plan that ensures frequent system evaluation, effective operational monitoring and management and communication.

7 BLOCK-SPECIFIC ASPECTS

7.1 Block 1

7.1.1 Maricá

In Maricá the CONCESSIONAIRE shall be responsible for providing water supply and commercial management services, since the sanitation services are currently operated by the City Hall.

7.1.2 Cachoeira de Macacu

The existing Water Supply System (WSS) in Cachoeiras de Macacu is subdivided into 4 (four) systems operated by CEDAE: Rio Souza System, Posto Pena System, Apolinário System and Córrego Grande System, in addition to 9 (nine) systems operated by AMAE-CM, called: Tocas Tuim System, France System, Farm System, Zacarias System, Lota System, Bela Vista System, Bonanza System and Maraporã System.

In Cachoeiras de Macacu, the CONCESSIONAIRE shall be responsible for providing water supply services in the systems currently operated by Cedae, for the sanitation services in the entire urban area of the municipality, as well as for the commercial management of all water supply and sanitation systems.

7.1.3 Guapiaçu Dam

The CONCESSIONAIRE of Block 1 is responsible for executing the works related to the Guapiaçu dam, within a maximum period of 5 years as from the start of the OPERATION OF THE SYSTEM. To this end, the STATE shall declare the areas around the dam as eminent domain and conclude the preparation of the Water Security Plan for the State of Rio de Janeiro, which shall include a specific chapter on the supply of the East Fluminense region, including the Guapiaçu dam. The State and INEA shall also comply with the other obligations set forth in the so-called "Cease and Desist Agreement COMPERJ", entered into on 09/08/2019 (and approved in the scope of proceeding no. 9919-12.2018.8.19.0023), especially those provided for in §4 of clause 1 and items 2 and 3 of clause 2. The compensation for the expropriation of this area shall be borne by the CONCESSIONAIRE.

In the event that the investment for the construction of the Guapiaçu dam is made by the public authorities or by third parties, in whole or in part, the resources necessary for this investment shall be applied to the irregular areas of Block 1.

7.1.4 AP 2.1 Sanitation System

There are no reports on the current state of the Ipanema submarine pipeline, notably in the submerged part of the structure. In this way, the SYSTEM IMPROVEMENT WORKS by the

CONCESSIONAIRE in the submerged part of the structure, if necessary, shall be subject to economic-financial rebalancing, as provided for in the AGREEMENT.

If, as a result of a judicial decision, it is determined that the CONCESSIONAIRE must build a Sewage Treatment Plant, for prior treatment of sewage directed to the submarine pipeline of Ipanema, said SYSTEM IMPROVEMENT WORKS must also be the subject of economic-financial rebalancing, as provided for in the AGREEMENT.

Depending on the older age of the sewerage systems in AP 2.1, the CONCESSIONAIRE shall make greater efforts in their registration and maintenance, in addition to intensifying actions to fight irregular sewer connections in the drainage system. Until the start of the OPERATION OF THE SYSTEM, the CONCESSIONAIRE must present a planning to the REGULATORY AGENCY in order to, during the first five years of the OPERATION OF THE SYSTEM, fight irregular connections in the drainage system.

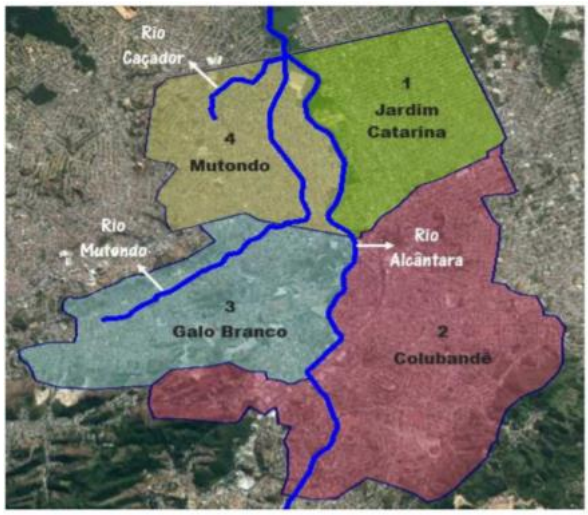
The CONCESSIONAIRE undertakes to carry out SYSTEM IMPROVEMENT WORKS in the amount of R$ 300 million, during the first 12 years of effectiveness of the AGREEMENT, in order to replace the existing sewerage network that is undersized and does not meet the current demand of the USERS. The CONCESSIONAIRE shall carry out technical studies during the first 24 months after the execution of the AGREEMENT in order to determine the locations that need such intervention, for approval by the REGULATORY AGENCY. In the event that the CONCESSIONAIRE is unable to make the forecasted investment in full or to make investments higher than R$ 300 million, the REGULATORY AGENCY shall proceed with the rebalancing of the AGREEMENT.

The monitoring of the implementation of the investments shall comply with the procedure provided in item 3.5 of this Concession Technical Specifications.

7.1.5 São Gonçalo

In São Gonçalo, the Concessionaire shall prioritize the works to expand the sanitation system located in the districts of Mutondo, Jardim Catarina, Galo Branco and Colubandê to be performed with absolute sewage separator system as of the 6th year of the CONCESSION, except for the responsibility of the STATE for the investments provided for in item 6.19.1 (b) of this ANNEX IV - CONCESSION TECHNICAL SPECIFICATIONS.

The map below highlights the neighborhoods listed in this item 7.1.3 of this ANNEX IV - CONCESSION TECHNICAL SPECIFICATIONS.



7.1.6 **TAC COMPERJ II (ACPS 9884-52.2018.8.19.0023, 9897-51.2018.8.19.00023, 9869-83.2018.8.19.0023 e 9859-39.2018.8.19.0023)**;

It is worth mentioning that Petrobras, the STATE and INEA entered into a Cease-and-Desist Agreement with the PUBLIC PROSECUTOR'S OFFICE OF RIO DE JANEIRO, through which Petrobras undertook to invest the amount of 24,000.000.00 (twenty-four million) in the funding of projects related to basic sanitation in the Municipalities of Itaboraí, Maricá, Cachoeiras de Macacu, Magé, Guapimirim and Duque de Caxias, with 4,000,000.00 (four million BRL) for each Municipality.

The obligation was established in Clause 6, 1), of the TAC COMPERJ II, in the following terms: "*PETROBRAS shall financially support the Municipalities of Itaboraí, Maricá, Cachoeiras de Macacu, Magé, Guapimirim and Duque de Caxias in the preparation (and possible updating, if necessary) of the executive design and in the implementation (limited to the amount received) of their respective Basic Sanitation Municipal Plans - PMSBs, in the total amount of R$ 24.000,000.00 (twenty four million BRL), being R$ 4.000.000,00 (four million BRL) for each of the mentioned municipalities, to be deposited in six specific judicial accounts, and its release to each beneficiary municipality shall be carried out only with the prior agreement of the MPRJ and SEAS/INEA, through the presentation of previous design and submitting teh statement of accounts during and after the use of the amount. The total amount shall be deposited by PETROBRAS within 180 (one hundred and eighty) days as from the approval of the TAC".*

As agreed, the Municipalities of Itaboraí, Maricá, Cachoeiras de Macacu and Magé are part of Block 01 of the concession. The Municipality of Guapimirim, on the other hand, may be included in Block 01, according to Clause 36.6.2 of the ITB. Thus, in case the Municipality benefited by such clause effectively receives the funds for works/investments related to sanitation services that are part of the concession subject matter, the concessionaire shall assume the operation of the structure/equipment.

Without prejudice, there may be the economic-financial rebalancing as provided for in sub-clause 30.2 (IV) of the AGREEMENT.

The same rules provided for in the previous paragraph shall be applied to the works provided for in item 3 of clause 2 of the so called "TAC COMPERJ" - entered into on 09/08/2019 (and approved in the scope of the proceeding no. 9919-12.2018.8.19.0023 -, interventions which shall be managed by UEPSAM and shall have the contribution of R$ 98,642.130.83 million, six hundred and forty-two thousand, one hundred and thirty BRL and eighty-three cents) for the complementation of certain sanitation works in Itaboraí and Maricá.

7.2 Block 2

7.2.1 Lagoon Complex of Barra da Tijuca and Jacarepaguá

- 1st Phase

The Concessionaire shall, within a maximum period of 12 months, after the start of the OPERATION OF THE SYSTEM, carry out a study on the environmental conditions of the Barra da Tijuca and Jacarepaguá Lagoon Complex. This study shall cover at least:

- Bathymetric survey of the lagoons of Jacarepaguá, Camorim, Tijuca, Marapendi and of at least 10 km of the low stretches of its main tributaries, with collection of samples for determination of thickness and physical-chemical characterization of the layers of sediments, organic sludge and garbage existing in the bottom of the lagoons;

- Preparation of technical studies necessary to file with INEA for the environmental licensing process for the dredging of sludge, fine sediments and garbage, in an extension of 10 km of low stretches of polluted rivers of the region and at the bottom of the Jacarepaguá, Camorim, Tijuca and Marapendi lagoons;

- Proposition of short, medium and long term actions, with details of the short term actions (first 5 years) already including the dredging of sludge, fine sediments and removal of urban solid waste at the bottom of the Jacarepaguá, Camorim, Tijuca and Marapendi lagoons;

- Identification of environmental risk factors associated with the actions, with mapping of potential mitigations;

The studies and designs shall be monitored and inspected by INEA, which shall receive quarterly reports with information on the progress of the studies, and may propose adjustments and amendments to the material produced. At the end of 12 months, the Concessionaire must submit the final report for approval by INEA.

Within sixty (60) days of approval of the study by INEA, the Concessionaire must apply for the environmental licenses necessary to start Phase 2.

- 2nd Phase

The Concessionaire undertakes to invest R$ 250,000,000.00 (two hundred and fifty million BRL), in up to 3 (three) years as from the issuance of the environmental license by INEA, in actions with the objective of assisting in the depollution of the Barra da Tijuca and Jacarepaguá Lagoon System. These actions shall cover:

- Dredging works (with appropriate boot out) of sludge, fine sediments and garbage, in an extension of 10 km of low stretches of the gutter of polluted rivers of the region and at the bottom of the lagoons of Jacarepaguá, Camorim, Tijuca and Marapendi;

- Other actions to be carried out by the Concessionaire must be previously authorized by the STATE and must be compatible with the study prepared;

The proof of disbursement of the funds must be approved by AGENERSA, with the assistance of the independent certifier. The monitoring of the implementation of the investments shall comply with the procedure provided in item 3.5 of this Concession Technical Specifications.

The failure to perform or to prove the disbursement of funds by the CONCESSIONAIRE, due to a fact attributable to it, shall entitle the STATE to:

a) proceed with the economic-financial rebalancing of the CONCESSION in favor of the STATE, in relation to the amounts not spent;

b) application of a fine of 40% of the value of the unspent funds;

c) the possibility of declaring the forfeiture of the CONCESSION

7.2.2 Environmental monitoring

In order to prove the effectiveness of the sanitation services provided by the Concessionaire in the formal and informal areas of the AP-4, the Concessionaire must implement a permanent six-monthly environmental monitoring program (in January and July), from the start of the OPERATION OF THE SYSTEM, of the water quality of the rivers that make up the lagoon complex's watershed, covering at least fifty (50) points distributed along the draining watershed, analyzing exclusively the parameters Escherichia Coli, Total Coliforms, DQO and pH of the water.

This monitoring shall under no circumstances be used to apply sanctions to the Concessionaire.

7.3 Block 3

The Concessionaire must serve the Planning Area no. 05 (AP5) of the city of Rio de Janeiro.

In this area, the CONCESSIONAIRE shall be responsible for providing water supply services, since the sanitation services and commercial management activities are currently operated by another contractor.

During the term of the respective agreement, said contractor shall continue responsible for the maintenance and operation of the sanitation system, as well as for the performance of supplementary services related to the reading of hydrometers, inspection, billing and commercial management.

At the end of the term of the respective agreements, the STATE may, in accordance with clause 5.5 of the AGREEMENT, include the provision of the services in the scope of the CONCESSIONAIRE, with the CONCESSIONAIRE becoming responsible for the operation of the sanitation system, including the full assumption of the commercial management and becoming entitled, at this moment, to receive the sanitation tariffs.

In view of the pre-existence of the aforementioned concession agreement for the sanitation system of AP-5, the CONCESSIONAIRE shall succeed CEDAE in providing water supply services, assuming the rights and obligations of the Company in the existing interdependence agreement.

7.4 Block 4

7.4.1 São João do Meriti

In São João do Meriti the CONCESSIONAIRE shall be responsible for providing abstraction, piping, treatment and distribution of drinking water, since the sanitation services and commercial management activities are currently operated by another contractor.

During the term of the respective agreement, said contractor shall continue responsible for the maintenance and operation of the sanitation system, as well as for the performance of supplementary services related to the reading of hydrometers, inspection, billing and commercial management.

At the end of the term of the respective agreements, the STATE may, in accordance with clause 5.5 of the AGREEMENT, include the provision of the services in the scope of the CONCESSIONAIRE, with the CONCESSIONAIRE becoming responsible for the operation of the sanitation system, including the full assumption of the commercial management and becoming entitled, at this moment, to receive the sanitation tariffs.

In view of the pre-existence of the aforementioned concession agreement, the CONCESSIONAIRE will succeed CEDAE in providing water supply services, assuming the rights and obligations of the Company in the existing interdependence agreement.

7.4.2 Nova Iguaçu

In Nova Iguaçu, the Concessionaire shall prioritize the expansion works of the sanitation system located in the sub-basins of the Guandu River, especially the sub-basins of the Cabuçu and Ipiranga Rivers, both for the Dry Weather Collection works to be implemented in the first 5 (five) years of Concession, as well as those of the absolute sewage separator system as from the 6th year.

7.4.3 Cinturão da Maré – Rio de Janeiro

In the city of Rio de Janeiro, for investments in dry weather collection, the Concessionaire shall prioritize the studies and works of the Dry Weather Collection known as "belt of Maré". The site of interest covers a total area of 3.69km^2, including Conjunto Esperança, Vila do João, Conjunto Pinheiros, Salsa e Merengue, Vila dos Pinheiros, Morro do Timbau, Baixa do Sapateiro, Nova Maré, Parque Maré, Nova Holanda, Parque Rubens Vaz, Parque União and Conjunto Bento Ribeiro Dantas, whose collection system releases the sewage in five pumping stations, of which only one is working, in a precarious way, and the others are out of service with the land invaded or already without the equipment installed. Cedae prepared a basic design for the maré belt, which shall be approved or modified by the Concessionaire, diverting the flow from the pumping stations to STP Alegria, through the construction of 4.584 m of trunk collectors thus distributed: 376m of DN 200mm, 329m of DN 300mm, 445m of DN 600mm, 307m of DN 700mm, 333m of DN 800mm, 302m of DN 900mm, 2,407m of DN 1,200mm and 85mm of DN 1,500mm.

If the value of this investment exceeds the value of the investment provided for dry weather collection in Block 4 of the municipality of Rio de Janeiro, the Concessionaire shall be entitled to the economic-financial rebalancing of the agreement.

7.4.4 Sanitation System of APs 1, 2.2 and 3

Depending on the older age of the sewerage systems in AP 1, 2.2 and 3, the CONCESSIONAIRE shall make greater efforts in their registration and maintenance, in addition to intensifying actions to fight irregular sewer connections in the drainage system. Until the start of the OPERATION OF THE SYSTEM, the CONCESSIONAIRE must present a planning to the REGULATORY AGENCY in order to, during the first five years of the OPERATION OF THE SYSTEM, fight irregular connections in the drainage system.

The CONCESSIONAIRE undertakes to carry out SYSTEM IMPROVEMENT WORKS in the amount of R$ 300 million, during the first 12 years of effectiveness of the AGREEMENT, in order to replace the existing sewerage network that is undersized and does not meet the current demand of the USERS. The CONCESSIONAIRE shall carry out technical studies during the first 24 months after the execution of the AGREEMENT in order to determine the locations that need such intervention, for approval by the REGULATORY AGENCY. In the event that the CONCESSIONAIRE is unable to make the forecasted investment in full or to make investments higher than R$ 300 million, the REGULATORY AGENCY shall proceed with the rebalancing of the AGREEMENT.

The monitoring of the implementation of the investments shall comply with the procedure provided in item 3.5 of this Concession Technical Specifications.

7.4.5 Duque de Caxias

In Duque de Caxias, the Concessionaire shall prioritize the works to expand the sanitation system located in the neighborhoods Doutor Laureano, Centenário, Periquitos, Bar dos Cavaleiros, Centro,

Jardim 25 de Agosto, Olavo Bilac, Jacatirão Norte, Vila São José, Gramacho, Vila São Luiz, Parque Beira Mar and Parque Duque, to be implemented with absolute sewage separator system from the 6th year of the CONCESSION.

7.4.5.1 TAC COMPERJ II (ACPS 9884-52.2018.8.19.0023, 9897-51.2018.8.19.00023, 9869-83.2018.8.19.0023 and 9859-39.2018.8.19.0023);

It is worth mentioning that Petrobras, the STATE and INEA entered into a Cease-and-Desist Agreement with the PUBLIC PROSECUTOR'S OFFICE OF RIO DE JANEIRO, through which Petrobras undertook to invest the amount of 24,000.000.00 (twenty-four million) in the funding of projects related to basic sanitation in the Municipalities of Itaboraí, Maricá, Cachoeiras de Macacu, Magé, Guapimirim and Duque de Caxias, with 4,000,000.00 (four million BRL) for each Municipality.

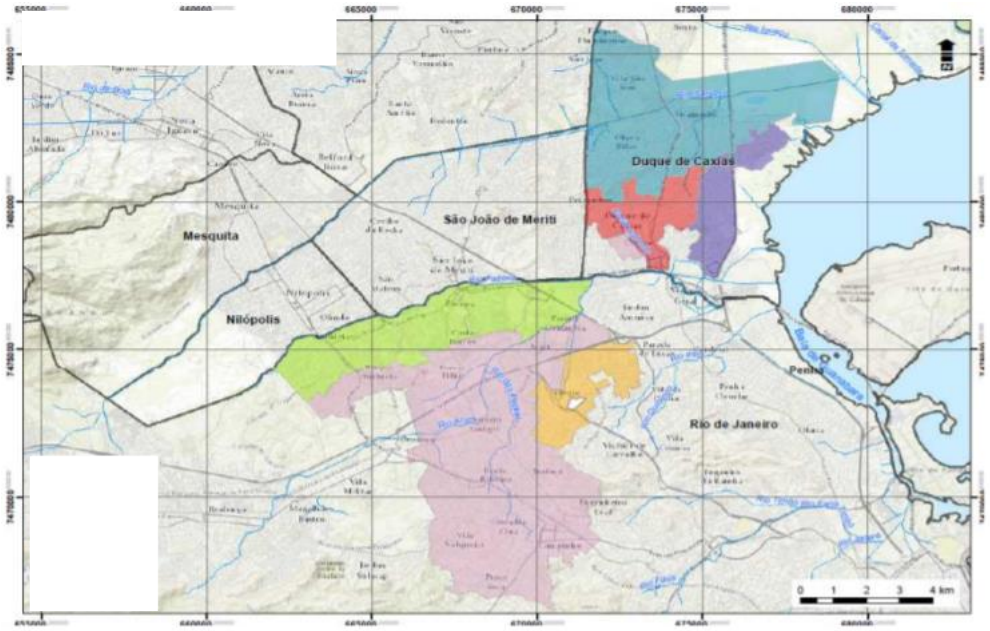
The obligation was established in Clause 6, 1), of the TAC COMPERJ II, in the following terms: "*PETROBRAS shall financially support the Municipalities of Itaboraí, Maricá, Cachoeiras de Macacu, Magé, Guapimirim and Duque de Caxias in the preparation (and possible updating, if necessary) of the executive design and in the implementation (limited to the amount received) of their respective Basic Sanitation Municipal Plans - PMSBs, in the total amount of R$ 24.000,000.00 (twenty four million BRL), being R$ 4.000.000,00 (four million BRL) for each of the mentioned municipalities, to be deposited in six specific judicial accounts, and its release to each beneficiary municipality shall be carried out only with the prior agreement of the MPRJ and SEAS/INEA, through the presentation of previous design and submitting teh statement of accounts during and after the use of the amount. The total amount shall be deposited by PETROBRAS within 180 (one hundred and eighty) days as from the approval of the TAC".*

As agreed, the Municipality of Duque de Caxias integrates Block 04 of the concession. Thus, in case the Municipality benefited by such clause effectively receives the funds for works/investments related to sanitation services that are part of the concession subject matter, the concessionaire shall assume the operation of the structure/equipment. Without prejudice, there may be the economic-financial rebalancing as provided for in sub-clause 30.2 (IV) of the AGREEMENT.

7.4.6 Rio de Janeiro

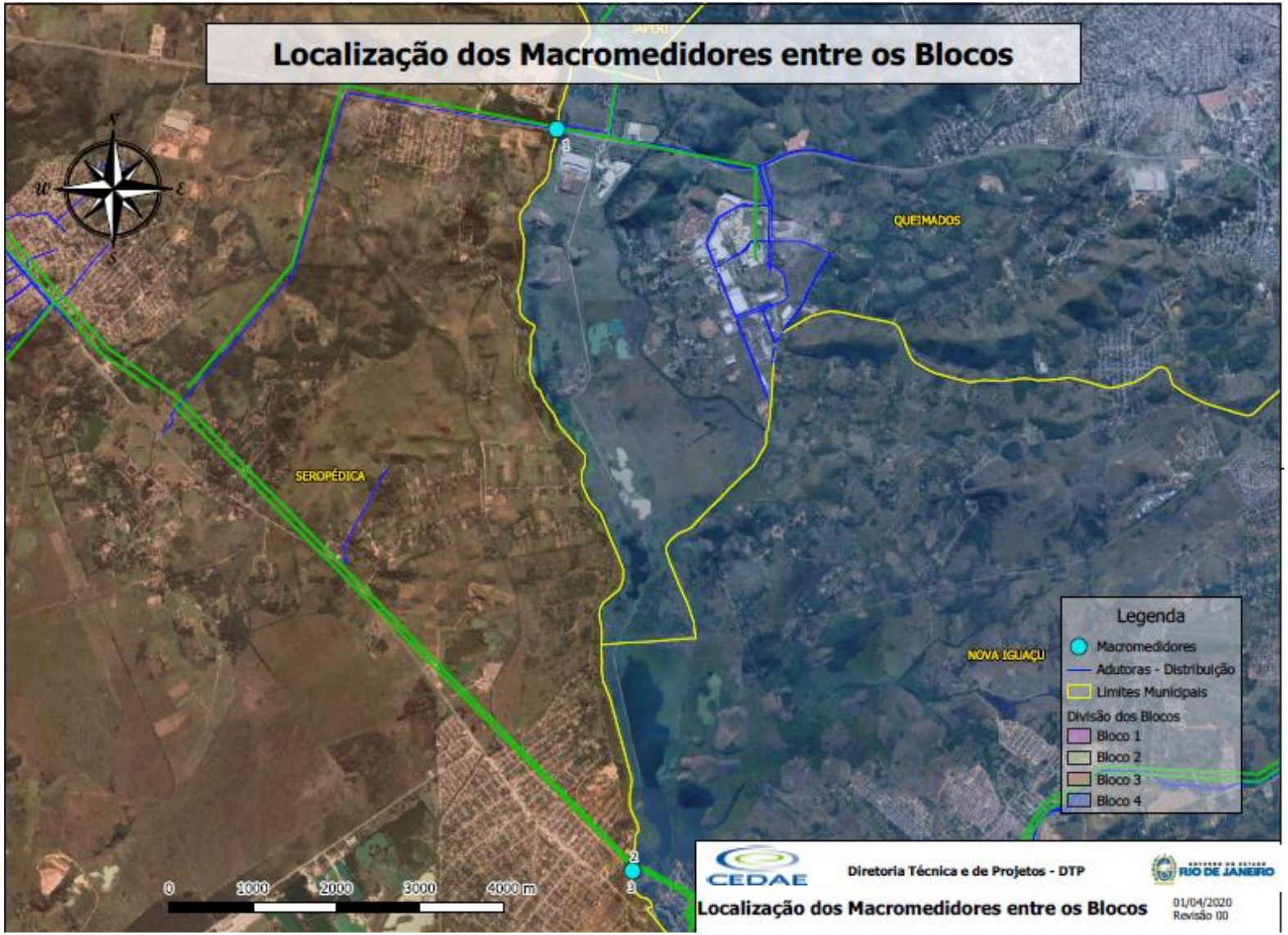
In Rio de Janeiro, the Concessionaire shall prioritize the expansion works of the sanitation system located in the neighborhoods of Irajá, Vista Alegre, Brás de Pina, Colégio, Rocha Miranda, Barros Filho, Costa Barros, Pavuna, Parque Anchieta, Acari, Osvaldo Cruz, Honório Gurgel, Turiaçu, Bento Ribeiro, Colégio, Parque Columbia, Engenheiro Leal, Campinho, Vila Vaqueire, Praça Seca, Cascadura, Coelho Neto, Guadalupe, Madureira, Marechal Hemes, Ricardo de Albuquerque, Anchieta and Parque Anchieta, to be implemented with absolute sewage separator system from the 6th year of the CONCESSION.

The map below highlights the neighborhoods listed in items 7.4.5 and 7.4.6 of this ANNEX IV - Concession Technical Specifications.



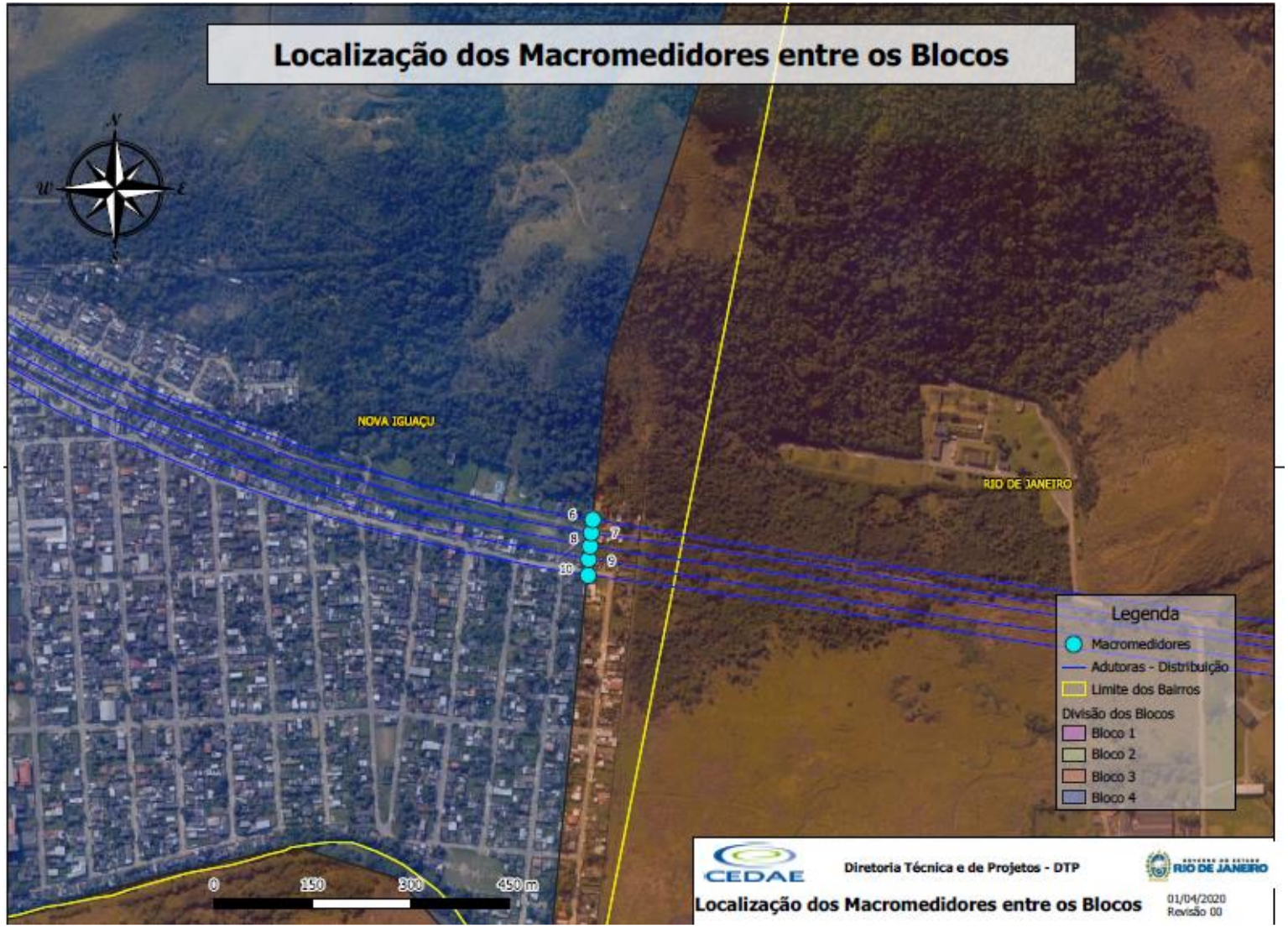
APPENDIX - GUIDE MAPS FOR THE LOCATION OF MACROMETERS

Macro meter location 1 to 3



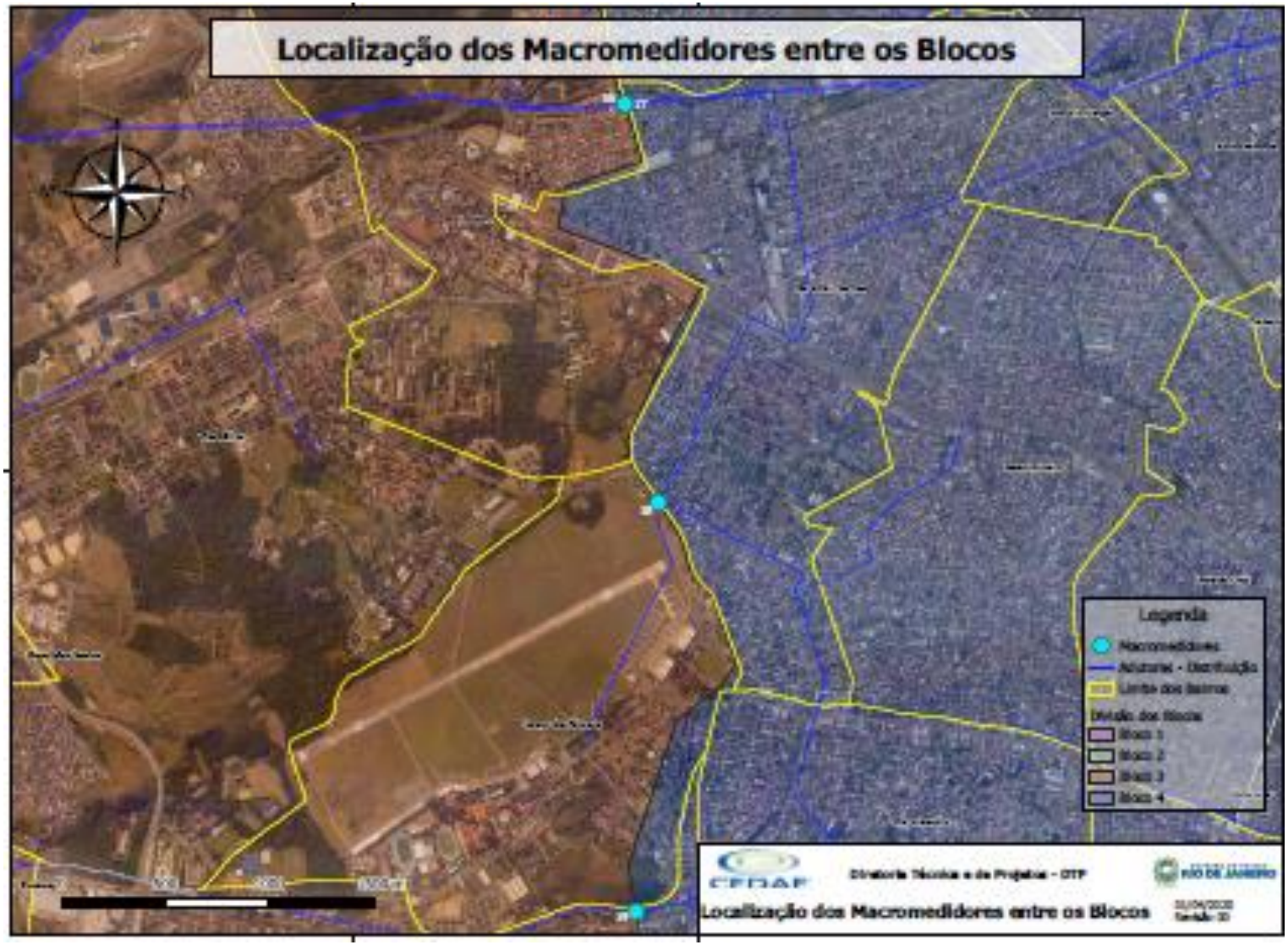
Macro meter location 4 and 5

Macro meter location 6 to 10



Macro meter location 11 to 15

Macro meter location 16 to 19



Macro meter location 20 to 27

Macro meter location 28 to 33