



# **FORTALEZA DESALINATION PLANT**

---

PRELIMINARY ENVIRONMENTAL STUDIES

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## 1. Presentation

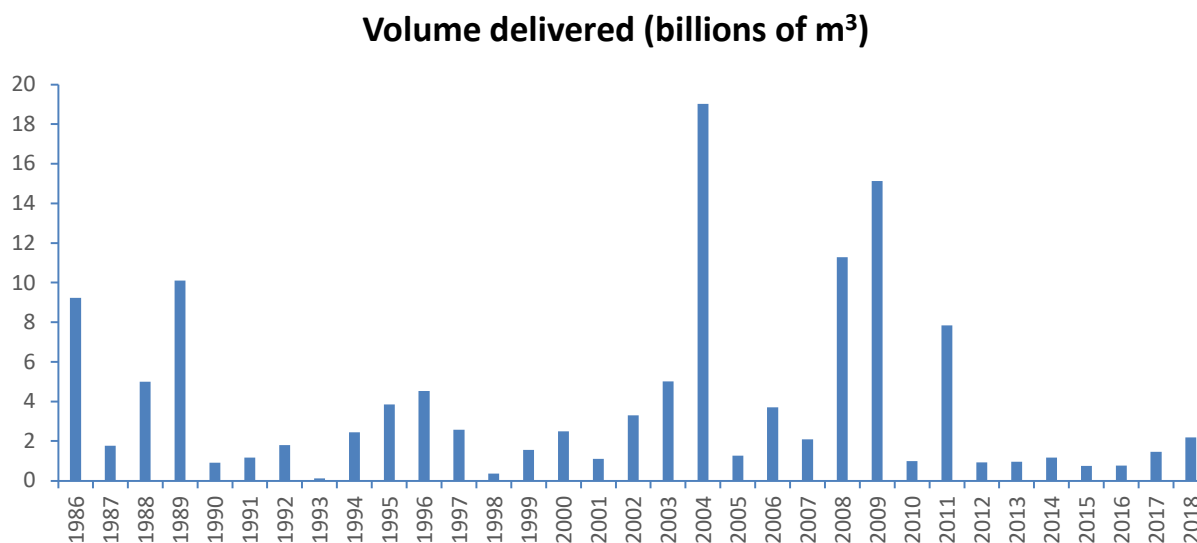
This material corresponds to the revision of “Study 6: Environmental Impact Study”, originally delivered by GS Inima Ltda, a leading company authorized to develop this and other 14 studies prepared within the scope of the Public Call for Proposals for Expression of Interest - PMI 01 / 2017 / CAGECE, whose object was the Preparation of Studies of a Marine Water Desalination Plant for the Metropolitan Region of Fortaleza with a capacity of 1 m<sup>3</sup>/s.

The objective of this study is to provide subsidies to allow decision makers to comprehend the procedures required for the development of the environmental licensing process, identify current environmental legislation related to the project, present an environmental diagnosis for the area of influence under the proposed enterprise, identify and analyze the potential environmental impacts resulting from the current desalination plant's implementation and operation and suggest the recommended environmental control measures and monitoring.

## 2. Introduction

The state of Ceará is characterized by long cyclical periods of rainfall scarcity, currently facing its seventh consecutive year of rainfall below historical average, as illustrated in the figure below. This peculiarity has been the object of numerous studies that seek a greater understanding of its variability and associated natural mechanisms, but its behavior is not yet fully understood.

Figure 1- Evolution of the State Springs Water Supply.



The interference of today's civilization in environmental changes on a global scale, as evidenced by the consequences of CO<sup>2</sup> emissions, reinforces the concern that human activities may negatively impact the ecosystem, not only on a local sphere. The latter is represented, for example, by the impacts of human action on hydrographic basins, which contribute to increased evaporation and aggradation, while the former is represented by changing global circulation patterns that lead to changes in rainfall regimes, increasing the occurrence of severe events (droughts and floods).

As a strategy to minimize the deleterious effects of this region's characteristic condition, several small, medium and large reservoirs were built over the decades, with Castanhão, Orós and Banabuiú being the largest. Canals and transposition systems that carry water to the main supply system (Jaguaripe Metropolitano) were built as well, as illustrated in Figure 2.

In the current scenario, where new challenges are posed, actions different from those traditionally adopted may complement previous solutions, adding security to the system that did not previously address the present uncertainties. In this perspective, Cagece has been required to provide supply alternatives to strengthen the state's water matrix, especially that of the Metropolitan Region of Fortaleza; it is responsible for the highest demand of water for human consumption and is heavily dependent on water imports from foreign basins.

Figure 2 - Water network that supplies the Metropolitan Region of Fortaleza, with no interconnection to the São Francisco River integration.





Among the available alternatives, seawater desalination has long been discussed as a possible source to diversify the state's water matrix – so much so that, in the Ceará State Water Resources Strategic Plan, prepared in 2009, seawater desalination was embedded at various points in the text, as can be seen below:

When the large and medium-sized buses and the support capacity of the San Francisco interconnection planned for 2020 are exhausted, it is worth asking: what other alternative sources will guarantee water for future generations? Will it be possible to count on the Tocantins Basin interconnection? **Or is it necessary to immediately start studies on**





**the future alternative use of seawater desalination** to supply the inexorable population and industry growth of the Metropolitan Region of Fortaleza and Pecém Port?<sup>1</sup>

In agreement with the aforementioned document, more recently, the Fortaleza 2040 Plan, which establishes strategies to be implemented in the short, medium and long term in urban areas, for mobility, economic and social development of the municipality, to be commenced on 2040, explicitly considers the city's need to rely on this new source to complement its supply.

Table 1 - Plan of Action for Alternative Water Sources Projected in the Fortaleza 2040 Plan.

Quadro 21 – Linha de ação 4 – Mananciais alternativos						
Nº	AÇÃO	META	INDICADORES	PRAZO	LOCAL	EXECUTOR
SH.4.8	Concepção de estudo de análise de viabilidade técnica, econômica e ambiental da dessalinização da água do mar	01 estudo	Estudo realizado	2017	Toda a cidade	SRH/ Cogerh
SH.4.9	Construção e operação de planta de dessalinização	01 planta dessalinizadora	Planta operando	2022	Toda a cidade	Concessionária dos serviços

Source: Fortaleza 2040 Plan

The reasons for this particular interest in the population of Fortaleza and integrated municipalities' water supply are summarized below:

- Desalination produces higher quality water than the potability standard processes, and with high stability;
- It is a worldwide accepted practice for human supply purposes, being easily acceptable;
- It uses an unlimited source, the sea, to produce drinking water, with no interference from climate change;
- Enables a reduction in the use of conventional water resources;
- The proximity of the population served to this new source.

<sup>1</sup> Disponível em: [https://www.srh.ce.gov.br/wp-content/uploads/sites/90/2018/07/PLANO-DE-ACOES-ESTRATEGICAS-DE-RECURSOS-HIDRICOS-CE\\_2018.pdf](https://www.srh.ce.gov.br/wp-content/uploads/sites/90/2018/07/PLANO-DE-ACOES-ESTRATEGICAS-DE-RECURSOS-HIDRICOS-CE_2018.pdf)

### 3. Selection of Alternative Locations

A total of eleven areas were studied for the possibility of desalination plant installation, distributed among the municipalities of Fortaleza and Caucaia as follows:

- Area 01 (Sabiaguaba), located in the Sabiaguaba Beach region, east of the Cocó River;
- Area 02 (Serviluz), which is located in the Praia do Futuro area, more specifically in the Serviluz Community area;
- Area 03 (Mucuripe), located at Ponta do Mucuripe, at Mansa Beach;
- Area 04 (IPLANFOR I), located in the Praia do futuro area, on Hermínia Bonavides street;
- Area 04-A, called Praia do Futuro I-A, located four blocks southeast of the originally proposed land area called IPLANFOR I;
- Area 04-B, called IPLANFOR I-B, which is located one block north of the originally proposed area known as IPLANFOR I;
- Area 05 (IPLANFOR II), located in the Praia do futuro area, on Dr. Aldy Mentor Avenue.
- Area 01 (Cumbuco I), located in the Praia do Cumbuco (Caucaia) area, next to Vila do Cumbuco;
- Area 02 (Cumbuco II), located in the Praia do Cumbuco (Caucaia) area, near Vila Galé hotel;
- Area 01-A (EPC), located near the start of the marine outfall of Fortaleza's Sewage Pretreatment Plant (EPC);
- Area 02-A (Iparana), located near Iparana Beach (Caucaia).

The alternative that presented a better set of favorable attributes to desalination plant installation was the area called Praia do Futuro I-A, which is presented below. Details on the other areas and the selection process can be found in the "Location Alternatives Studies R03".

#### 3.1. Selected Area

The selected area corresponds to an irregular land area formed by two partially unoccupied blocks separated by an unconsolidated street, as shown in following Figure. It is situated at Francesco F. Dângelo Street in the corner that meets Oliveira Filho Street, Praia do Futuro I district, in the city of Fortaleza. The total area corresponds to 2.3 ha, with 2 hectares corresponding to the two blocks.

Figure 3 - Location of Selected Area



Source: Google Earth, 2019

### 3.2. Interconnection with Cagece's System

The interconnection with Cagece's water supply system shall take place at two different sites: the Mucuripe Reservoir, located at Morro Santa Teresinha, the same delivery point originally proposed by the Authorized Company, and the Aldeota Reservoir, located at Chanceler Edson Queiroz Imprensa Square, as shown in Figures 4 to 6.

The Desalination Plant's interconnection to the Cagece System shall be made by HDPE pipes, with diameters of 710mm, 800mm and 1000mm, composing approximately 7.83km.

As presented in Figure 4, the HDPE DN1000mm HDPE piping shall run from Francesco de F. Dângelo Street to Dolor Barreira Ave., in a northbound direction, with an approximate length of 1.343 km.

Starting from José Aurélio Câmara Street, the pipe will be divided into two sections. The first will extend through Dolor Barreira Avenue in HDPE DN710mm piping until the Mucuripe Reservoir, for about 1,2km. The second, approximately 5,3 km long, will extend until the Aldeota Reservoir in a DN800mm HDPE pipe, running through Fausto Cabral, Prisco Bezerra, Amelia Benebien, Julio Azevedo, Vilebaldo Aguiar, Av. Engenheiro Santana Júnior, Av. Santos Dumont, Rondon, Eduardo Garcia, Vicente Leite, General Tertuliano Potiguar and Visconde de Mauá streets.

The Mucuripe Reservoir feeds the distribution network through three separate lines, two working by gravity and one by a pumping system, to satisfy locations with the highest demand. There are two gravity lines: one with a diameter of 550 mm, feeding the Papicu, Varjota and Cidade 2000 districts; and another with a 600 mm diameter, serving the Praia do Futuro, Caça e Pesca, Cais do Porto (Serviluz) and Vicente Pinzon areas. The pumping station deployed adjacent to the supported reservoir serves the highest part of the Dunas District.





In the Mucuripe Reservoir, system interconnection will happen at two points. The first will be directly on the pipeline that serves the most elevated area, therefore nullifying the existing pumping station. The second point shall be placed directly in the reservoir, from where it can supply all other areas.

The Aldeota Reservoir feeds the distribution network of the Aldeota District and surrounding areas through two 700 mm pipes. Its interconnection with the main line from the desalination plant will be directly on the distribution outlet, where measuring equipment will be installed to monitor flow rates.

Figure 4 - Plant Interconnections to the CAGECE System.





Figure 5 - Mucuripe Reservoir Location (Morro Santa Teresinha)



Source: GS Inima, 2018

Figure 6 - Aldeota Reservoir Location (Praça da Imprensa)



Source: GS Inima, 2018



### 3.3. Possible Interferences

Since this is an extremely dense urban area and of industrial use, it is inevitable to observe interferences with several existing networks already existent in its path (water, sewage, gas, fiber optic cabling, drainage and railways).

Figure 7 and Figure 8 show the possible interferences found along the water main that interconnects with the existing Cagece system. Interference with gas pipelines, fiber optic cabling, high traffic routes, railways, drainage galleries, as well as water distribution and sewage collection networks are observed.

From the plant's output until the fork of the line, between Av. Dolor Barreira and Rua José Aurélio Câmara, it is possible to observe interference with fiber optic cables, as well as the water distribution networks.

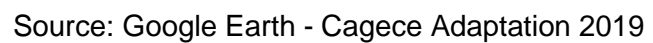
In the section that extends from the bifurcation to the Mucuripe Reservoir, interferences with fiber optic cabling and gas and water distribution pipes are observed.

The most critical stretch is bifurcation that extends to the Aldeota Reservoir. In its path there are several interferences (water distribution and sewage collection networks, gas piping, fiber optic cabling, high traffic streets and railways). Non-destructive road crossings will be required mainly on high traffic avenues (Av. Santos Dumont, Av. Almirante Henrique Sabóia, Av. Senador Vigílio Távora, Av. Padre Antônio Tomás, Av. Desembargador Moreira and Av. Antônio Sales), as well as in the railways parallel to Av. Almirante Henrique Saboia.

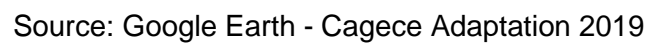
The main interferences with drainage galleries were found in Francesco de F. D'ângelo, Prisco Bezerra, Amelia Benebien, Almeida Prado, Júlio Azevedo and Tomás Rodrigues streets and the intersection between Vilebaldo Aguiar and Valdetário Mota streets.

Possible interferences with the water distribution network are found at the following streets: Dolor Barreira, with DN400 and DN250 pipes; Fausto Cabral, with DN200 pipes; the intersection of Amélia Benebien and Solon Onofre streets, with DN250, DN300 and DN500 pipes; Vilebaldo Aguiar, with DN250 pipes; Engenheiro Santana Júnior Ave., with pipes of DN550; Santos Dumont Ave., with pipes of DN250; at the intersection of Vicente Leite Street with Padre Antônio Tomás Ave., with pipes of DN550, DN250 and DN300; at the intersection of General Tertuliano Potiguara and Barbosa de Freitas streets, with pipes at DN550 and DN250; at the intersection of General Tertuliano Potiguara and Barbosa de Freitas streets, with pipes of DN500 and DN250 and at the intersection of Visconde de Mauá Street with Antonio Sales Ave., with pipes at DN1000 and DN 300.

The main interferences with the sewage system were observed at streets Júlio Azevedo Street, with a reinforced concrete pipe of DN1000; at the intersection of streets Desembargador Lauro Nogueira and Júlio Azevedo, with a reinforced concrete pipe of DN1000; at the intersection of Santos Dumont Ave and Marechal Rondon Street, with a pipe of DN300; at the intersection of Eduardo Garcia and Coronel Jucá streets, with a pipe of DN200 and at the intersection of Vicente Leite and Vicente Linhares streets, with a pipe of DN250.







## 4. Desalination Plant – The Proposed Project

With basis on the “Reference Project”, elaborated from the “Engineering Preliminary Project”, the main information and processes of the proposed Desalination Plant are described as follows. It is important to note that such information serves only to guide the present study, since the basic and executive projects shall still be developed.

### 4.1. Starting Data

#### 4.1.1. Plant Production Capacity

The desalination plant production capacity shall be 1m<sup>3</sup>/s with four lines. The unit capacity per line is 0.24 m<sup>3</sup>/s.

Considering the plant’s internal consumption, a safety factor of FS = 1,03 was added (a 0.3% increase).

The nominal production capacity, therefore, is:

✓ Project production:	86,400 m <sup>3</sup> /day
✓ Number of lines:	4
✓ Production by line:	21,600 m <sup>3</sup> /day

Production capacity, including the safety amount (FS = 1.03), is:

✓ Project production:	86,659 m <sup>3</sup> /day
✓ Number of lines:	4
✓ Production by line:	21,664.8 m <sup>3</sup> /day

Seawater flow to be collected:

✓ Nominal water flow to be collected:	192,576 m <sup>3</sup> /day
✓ Maximum flow during filter displacement:	207,388.8 m <sup>3</sup> /day

Plant Conversions:

✓ RO Conversion:	45%
✓ Global Conversion:	44.86%
✓ Global conversion during displacement:	41.66%

#### 4.1.2. Plant Availability

The plant's desalination equipment requires maintenance for proper operation so that desalinated water production cannot be maintained for 24 hours a day, 365 days a year. Based on previous experience in the operation and maintenance of similar desalination plants, an availability of 95% per year is adequate for proper plant operation, and shall be used for this Project.

#### 4.1.3. Environmental Conditions

The environmental conditions of the city of Fortaleza are detailed below:

- ✓ Maximum annual temperature: 29.9°C
- ✓ Minimum annual temperature: 23.5°C
- ✓ Humidity: 78.3%



✓ Average annual rainfall: 1,642.3 mm

#### 4.1.4. Characteristics of the Water to be Treated

The raw water will come from the coast of Fortaleza.

The considered tidal race is of 4,4 meters, the low tide -1,60 m, and high tide 2.80 m, with the average sea level as reference.

The analysis shown below was made for the projected seawater, chemically balanced so that the anion concentration expressed in mg/L is equal to that of cations.

The Chart below shows the physicochemical parameters of seawater for the proposed design.

Chart 1 - Seawater Physiochemical Analysis

#### Planta de Fortaleza

FOLHA DE ANÁLISE					
CLIENTE			CONTRATO		
LABORATÓRIO			REFERÊNCIA		
TIPO DE ÁGUA			DATA		
DO MAR			November-17		
LUGAR DE AMOSTRAGEM			Costa de Fortaleza		

ANÁLISE FÍSICO-QUÍMICO					
TURBIDEZ	1	U.N.F.	PH	7,90	
COR	1	Pt-Co	CONDUTIBILIDADE	58.846,93	µmhos/cm.
ODOR	0	TON	T.D.S.	39.051,86	mg/L
ASPECTO			ALCALINIDADE	133,85	ppm CO3Ca
TEMPERATURA	27	°C	DUREZAE	6.403,60	ppm CO3Ca

COMPOSIÇÃO IÔNICA					
ELEMENTO	mg/L	meq/L	ELEMENTO	mg/L	meq/L
Ca++	504,55	25,18	SO4=	4.159,73	86,61
Mg++	1.249,42	102,78	Cl-	20.425,10	576,12
Na+	12.110,61	526,75	CO3H-	142,78	2,34
K+	420,00	10,74	F-	0,30	0,02
Ba++	0,02	0,00	Br-	0,00	0,00
Sr++	5,10	0,12	I-	0,00	0,00
Fe++	0,00	0,00	NO2-	0,00	0,00
NH4+	0,30	0,02	NO3-	10,70	0,17
Ag+	0,00	0,00	CO3=	10,04	0,33
Mn++	0,00	0,00	PO4≡	0,00	0,00
Zn++	0,00	0,00	S=	0,00	0,00
Cu++	0,00	0,00	SiO2 (coloidal)	0,20	0,00
Al+++	0,00	0,00	SiO2 (soluble)	8,20	0,14
Fe+++	0,00	0,00	CO2	1,23	0,03
H+		0,00	OH-		0,00
TOTAL	14.290,00	665,59	TOTAL	24.756,85	665,59



OUTRAS DETERMINAÇÕES			
SUBSTÂNCIAS TOXICAS	mg/L	Matéria orgânica e outros	mg/L
Arsênio	0,00	DBO5	2,00
Cádmio	0,00	DQO	5,00
Bário	5,00	Nitrogênio proteico	0,00
Mercurio	0,00	Compostos fenólicos	0,00
Chumbo	0,00	Detergentes	0,00
Selênio	0,00	Oleos e graxas	0,00
Cromo total	0,00	Hidrocarbonetos	0,00
Cromo	0,00	Sólidos em suspensão	10,00

For the project, the maximum and minimum temperatures available were considered.

- ✓ Maximum Temperature: 30 °C
- ✓ Minimum Temperature: 20 °C
- ✓ Average Temperature: 27 °C

#### 4.1.5. Product Water Characteristics

The water produced in the plant by reverse osmosis shall have drinking water quality and comply with Brazilian legislation for drinking water. The limiting factor in legislation refers to a chloride concentration of 250 mg/L.

## 4.2. Project Proposal Description

### 4.2.1. Electromechanical Equipment

#### 4.2.1.1 Seawater Intake

The intake is performed through an intake tower located at a distance of 2500m from the coast and a depth 14.0 m, to collect seawater of appropriate quality for the Reverse Osmosis process, avoiding oils, fats and hydrocarbons. The collected seawater shall be conducted through a high-density polyethylene (HDPE) line to a suction chamber, located on the coast within the plant's boundaries.

Water speed shall be low enough at the intake tower openings to avoid producing strong currents that drag in fish and other marine animals, and so that, in case they swim into the intake tower, they can manage to swim out.

Sulfuric acid and sodium hypochlorite dosages were provided for the intake tower, for the cleaning of its own structure and the piping connecting the tower to the chamber.

At the seawater receiving well inlet, the water shall be conducted through a labyrinth at very low speed, to increase permanence time in the chamber and produce decantation of the fine sands possibly captured, which will be returned to the coast or site approved by the environmental impact study.

#### 4.2.1.2 Seawater Pumping

The seawater pumping unit can supply the plant with up to 8,641 m<sup>3</sup>/h and is composed of 5 (4 + 1) centrifugal pumps, with a unit capacity of 2,293 m<sup>3</sup>/h and TDH of 82 m.

The five seawater pumps shall be installed in parallel, with one established as a reserve.



The pump material in contact with the liquid shall be super duplex stainless steel with PREN < 40, with cathodic protection to prevent corrosion. The regular method to pump raw water shall be with four groups in simultaneous operation. The operational program shall function in a manner to allow all groups to work the same number of hours, alternating at the reserve pump stops.

#### **4.2.1.3 Brine Discharge**

The discharged brine resulting from the process will be discharged back to the sea through a high-density polyethylene (HDPE) discharge pipe, with 1,200 mm in diameter.

A section with diffusers was projected for the last 25 m of the outfall, consisting of eight diffusers, each with 280 mm in diameter.

#### **4.2.1.4 Chemical Pretreatment**

##### **Sodium Hypochlorite Dosage**

The hypochlorite injection into the collection water is performed by three metering pumps (2 + 1), one of which is a reserve, of the positive displacement type. The pump materials are as follows: PVC body and boxes, polyethylene seats, PTFE membranes, viton seals and casting crankcase. The pumps' nominal flow is adjustable between 10% and 100%; regulation is automatic, with control panel operation, for which the metering pumps will be supplied with the corresponding servomotors.

Since hypochlorite shock dosing is projected, a 10-ppm dose of active chlorine was established for the project.

A centrifugal transfer pump with a flow of 90 m<sup>3</sup>/h shall be installed to fill the tank.

##### **Sulfuric Acid Dosage**

A sulfuric acid dosing system has been provided for CIP osmosis cleaning. The addition of sulfuric acid to seawater is also projected to facilitate hypochlorite disinfection and adjust dispersant addition.

The sulfuric acid equipment shall consist of two 12 m<sup>3</sup> storage tanks, made of carbon steel. A centrifugal pump with 60 m<sup>3</sup>/h flow shall be installed for the transfer of sulfuric acid from the transportation medium to the storage tanks.

For this sulfuric acid dosage in seawater, three (2 + 1R) dosing pumps shall be installed, one of which shall be a reserve.

##### **Sodium Metabisulfite Dosage**

A sodium metabisulfite dosing system was designed to reduce residual chlorine before the seawater reaches the membranes, given their low tolerance to chlorine. This substance reacts with chlorine and other oxidants contained in seawater, such as dissolved oxygen, preventing them from reaching and damaging the membranes.

The equipment consists of two GRP 1000-liter capacity accumulation-dissolution tanks, equipped with electric agitators, isolation, safety and check valves, interconnection tubes, accessories and the corresponding 2 + 1 metering pumps, one of which is a reserve.

#### Ferric Chloride Dosage

For the elimination of seawater suspended matter and colloids, a ferric chloride dosage shall be executed. The unit was projected for a dose of 5 mg/L, composed by three metering pumps (2 + 1R), one of which shall be a reserve.

A centrifugal transfer pump with a flow of 60 m<sup>3</sup>/h shall be installed to transfer ferric chloride from the tank to the storage reservoirs.

#### Dispersant Dosage

When seawater is concentrated in the membranes, to avoid precipitation from calcium sulfate, strontium sulfate and calcium fluoride salts, among others, a dispersant shall be injected in a dose of 1 mg/L. Its function is to prevent the formation of crystalline salt networks, maintaining ions in dispersion and allowing the solubility limit of said salts to be exceeded.

The equipment consists of two GRP accumulation-dissolution tanks of 1000-liter capacity, and three metering pumps (2 + 1R), one of which shall be a reserve. They shall be automatically adjustable from 10% to 100% of their maximum capacity through a control panel.

#### Activated Carbon Powder Dosage

A powder activated carbon dose is included in the project. The activated carbon shall be stored in a 1 m<sup>3</sup> capacity silo. Two injectors shall deliver it for the preparation of a solution with service water, which shall be performed in two GRP tanks with a 1000 L capacity each. Each tank shall be equipped with an electric agitator, isolation, safety and check valves, indicator, maximum and minimum level switch with alarms, interconnection tubes and accessories.

This active carbon solution dosage shall be performed by three metering pumps, one of which is a reserve, which will be adjustable from 10% to 100% of their maximum capacity through a control panel.

The shafts and blades shall be built in AISI 316 quality stainless steel.

### 4.2.1.5 Physical Pretreatment

#### Pressure Filters

For the elimination of particles present in raw water, seawater shall be filtered through two stages of sand and anthracite filters, as a filtering means in the appropriate proportion.

The first stage consists of 14 horizontal cylindrical filters that shall be arranged in parallel, so that the flow is distributed among them in the normal operation process. The second stage also has 8 cylindrical filters. In both stages, the filters shall have a 4 m diameter and 22 m length, which is equivalent to an effective filtration surface of 88.43 m<sup>2</sup> per filter.

Each filter houses a support plate over which the filter bed is placed, equipped with diffusing nozzles and projected to make pressure loss minimal. It composes a total of 50 nozzles per square meter of filtering surface, made of seawater resistant plastic.

The filters shall be built in FRP with a chemical barrier of isophthalic resin or ST 44/2 quality carbon steel or similar, and internally coated with a 3 mm thick layer of neoprene or natural rubber, applied by autoclave. The filters shall be externally painted with UV resistant paint. The filter arrangement shall be horizontal cylindrical, pumped at the bottom.

The filters will be equipped with the manholes necessary for inspection and maintenance. They shall also transport drains, vents and corresponding equipment, as well as the set of automatic valves necessary to carry out fully automated washing and commissioning operations. Once a filter's flow drops below 80% of normal operation, it shall be backwashed through the passage of operational flow by other filters in service.

If the operator so wishes, washing can be done semi-automatically, where each of the steps to be performed can be selected from the panel. It is also possible to change washing stage times, operate programming levels and change the washing system.

The filter nozzles are projected to avoid filter leakage and maintain the pressure drop to a minimal. There is a total of 50 nozzles installed per square meter of filtering surface. The nozzles are made of plastic resistant to and not degradable by seawater.

For the first stage, filtration speed shall be a maximum of 6.5 m/h, rising to 7 m/h during washing. The filters will have 3 filter layers with the following characteristics:

✓ 1<sup>st</sup> layer:

Material	Anthracite
Layer height	0,7 m
Material effective size	1,9 mm
Uniformity coefficient	1,4
Material cutoff point	226 micra

✓ 2<sup>nd</sup> layer:

Material	Silex
Layer height	0,4 m
Material effective size	0,6 mm
Uniformity coefficient	1,45
Material cutoff point	93 micra

✓ 3<sup>rd</sup> layer:

Material	Silex
Layer height	0,2 m
Material effective size	2,0 mm
Uniformity coefficient	1,7
Material cutoff point	309 micra



For the second stage, filtration speed shall be a maximum of 10.8 m/h, being increased to 12.4 m/h during washing.

The filters shall present 2 filtrating layers with the following characteristics:

✓ 1 <sup>st</sup> layer: Material	Silex
Layer height	0,5 m
Material effective size	0,3 mm
Uniformity coefficient	1,4
Material cutoff point	46 micra
✓ 2 <sup>nd</sup> layer: Material	Silex
Layer height	0,2 m
Material effective size	2,0 mm
Uniformity coefficient	1,7
Material cutoff point	309 micra

Samples will be installed to measure the water's SDI before and after each filtration stage, to determine filtration efficiency and water quality before it enters the membranes.

### **Closed Pressure Filter Washing**

The filters shall be washed with membrane reject water (brine). For this, three centrifugal pumps (2 + 1R) will be available, one of which is a reserve pump. The set of washing filters shall be placed in the process device.

The pump flow shall be 1,914 m<sup>3</sup>/h at a discharge pressure of 2.3 bar. The material composing the body, rotors and shaft must be made of PREN > 40 Superduplex quality steel. The use of membrane reject water for washing saves energy and chemical products.

In addition to washing water making use of the pumps described, three fans (2 + 1R) of 2,211 Nm<sup>3</sup>/h will be available, one in operation and the other in reserve. The inclusion of blowers helps guarantee an efficient washing, as well as a remarkable saving of washing water. The blowing unit has its corresponding air filter, noise silencer, safety and isolation valves, as well as pipe sections with corresponding pressure gauges and accessories. The water and air washing pipe shall be made of glass fiber reinforced polyester.

The washing water flow shall be controlled by a valve located in the washing water filter collector, only during discharges from the washing water pumps. To measure washing water flow, a flow meter installed in the pump discharge manifold will be available.

Filter displacement, after brine washing, shall be carried out with seawater driven by seawater pumps, and the displacement flow shall be controlled by a control valve.

The first and second stage filters shall not be washed simultaneously.

### **Cartridge Filters**

The filtering process shall consist of 8 cartridge filters, embedded in GRP.



The cartridge filters shall be equipped with polypropylene depth filtration cartridges with a cut-off point rating of 10 absolute and 5 nominal microns, with a particle removal efficiency of 99.6% and a beta ratio of 5,000.

Before and after the cartridge filters, sample sockets will be installed to measure the water's SDI, to determine filtration efficiency and water quality before entering the membranes.

The pipes and filter inlets and outlets shall be made of PN-10 glass fiber reinforced polyester.

#### **4.2.1.6 Reverse Osmosis**

The proposed project corresponds to an osmosis stage with a 45% conversion in four project production lines of 21.665 m<sup>3</sup>/h.

The seawater assessment used to perform membrane projections differs from the raw water analysis shown in the initial data section. The difference between the two analyses is that the membrane water analysis contemplates not only the chemical pretreatment, described in previous sections, but also the mixture of seawater and brine in the pressure exchange systems. The use of pressure exchange systems causes an increase in seawater salinity at the RO system inlets. For these reasons, the method used to perform membrane projections shows a higher concentration of dissolved salts than the one used for the project's raw sea water. The Figure below shows the seawater analysis method used in membrane projections.

Table 2 - Raw Seawater Analysis for Membrane Projections

ANÁLISE DA ÁGUA BRUTA PARA DESENHO DAS MEMBRANAS					
ANÁLISE FÍSICO-QUÍMICO					
TURBIDEZ	0,0	U.N.F.	PH	7,22	
COR	0,0	Pt-Co	CONDUTIBILIDADE	60.269,17	µmhos/cm.
ODOR	0,0	TON	T.D.S.	40.152,66	mg/L
ASPECTO			ALCALINIDADE	125,51	ppm CO <sub>3</sub> Ca
TEMPERATURA	27	°C	DUREZAE	6.583,44	ppm CO <sub>3</sub> Ca
COMPOSIÇÃO IÔNICA					
ELEMENTO	mg/L	meq/l	ELEMENTO	mg/L	meq/l
Ca++	518,72	25,88	SO <sub>4</sub> =	4.283,64	89,19
Mg++	1.284,51	105,67	Cl-	21.002,11	592,39
Na+	12.450,74	541,55	CO <sub>3</sub> H-	148,43	2,43
K+	431,80	11,04	F-	0,31	0,02
Ba++	0,02	0,00	Br-	0,00	0,00
Sr++	5,24	0,12	I-	0,00	0,00
Fe++	0,00	0,00	NO <sub>2</sub> -	0,00	0,00
NH <sub>4</sub> +	0,31	0,02	NO <sub>3</sub> -	11,00	0,18
Ag+	0,00	0,00	CO <sub>3</sub> =	2,26	0,08
Mn++	0,00	0,00	PO <sub>4</sub> =	0,00	0,00
Zn++	0,00	0,00	S=	0,00	0,00
Cu++	0,00	0,00	SiO <sub>2</sub> (coloidal)	0,04	0,00
Al+++	0,00	0,00	SiO <sub>2</sub> (soluble)	8,43	0,14
Fe+++	0,00	0,00	CO <sub>2</sub>	5,99	0,14
H+		0,00	OH-		0,00
<b>TOTAL</b>	<b>14.691,34</b>	<b>684,28</b>	<b>TOTAL</b>	<b>25.456,18</b>	<b>684,28</b>
OUTRAS DETERMINAÇÕES					
SUBSTÂNCIAS TOXICAS	mg/L	Matéria orgânica e outros		mg/L	
Arsênio	0,00	DBO <sub>5</sub>		0,04	
Cádmio	0,00	DQO		0,10	
Bário	5,14	Nitrogênio proteico		0,00	
Mercurio	0,00	Compostos fenólicos		0,00	
Chumbo	0,00	Detergentes		0,00	
Selênio	0,00	Óleos e graxas		0,00	
Cromo total	0,00	Hidrocarbonetos		0,00	
Cromo	0,00	Sólidos em suspensão		0,21	

To determine the production of the osmosis process, membrane projections were made for the two temperatures (22°C and 30°C) in the project, with clean and dirty membranes for both temperatures. The membrane projections are displayed in Attachment 15.3. The project was carried out considering the worst conditions for the membrane projections, both in pressure and water quality, so that the correct operation is guaranteed over the entire temperature range and for any membrane condition.

The project was carried out considering lower permeate flows and higher rejection rates, which could create excessive fouling problems, especially in the first and last module membranes.

### **High pressure pumping, booster pumping, recirculation pumping and energy recovery**

The high-pressure pumping system has the fundamental mission of providing the pressure necessary to overcome the osmotic seawater pressure and system pressure losses.

A group of motor pumps will be installed for each frame. The high-pressure pumps shall be high performance, made of PREN > 40 Superduplex quality steel.

The high-pressure pumping system consists of 04 units of centrifugal pumps with 915 m<sup>3</sup>/h of unitary capacity and a TDH = 542.6 mcl.

Four booster pumps will also be installed for high-pressure pumps, with a speed variation of 915 m<sup>3</sup>/h and TDH = 83.37 mcl, with materials of identical quality used for the booster pumps and the high-pressure pumps.

To recover energy from the brine rejected from the first stage, pressure exchange systems (PES) will be used, as they present the best performance in terms of energy recovery on the market. In this case, each line shall be composed of a pressure exchange system that will consist of 18 exchangers. One of the exchangers will be a backup, even if it is in normal operation, because if one of the 18 exchangers stops working, the system can continue working with 17 without a problem.

In the brine feed collector outlet to the PES, there will be a pressure transmitter and a conductivity meter. A flow meter and a pressure transmitter shall be installed in the low-pressure seawater inlet for the energy recovery systems. The seawater, at the PES outlet, will have acquired a pressure of 57.5 bar, when entering the recirculation pumps suction. A flow meter, a conductivity meter and a pressure transmitter shall be installed at the suction portion of the recirculation pumps.

At the outlet of the energy recovery systems, four recirculation pumps will be installed and equipped with a speed variator, which shall increase the seawater outlet pressure from the PES until the required membrane inlet pressure is reached. The materials used in the recirculation pump shall be equal to those of the high-pressure pump. These pumps will be of high performance and have a unit flow of 1,090.6 m<sup>3</sup>/h with a TDH of 68.5 mcl.

The high-pressure pumps suction tubes must be made of glass-fiber reinforced polyester. The pump discharge pipes, the energy recovery system inlets and the recirculation inlet and outlet pumps must be made of Superduplex PREN > 40 quality steel.

At the suction of each high-pressure motor group of the pump, there will be a low-pressure switch that will produce an alert and register in the control system, stopping the low suction pressure pump. Likewise, a seawater flow transmitter shall be placed at the pump's suction, to record and issue alerts resulting from the pump's eventual low flow production.

A pressure gauge, a check valve, an automatic valve and a pressure transmitter will be available when operating high-pressure pumps.

At the recirculation pump discharge outlet, a pressure transmitter, a check valve and a motorized valve will be installed. This pump's operation will be set off by the high-pressure pump's operation, before it is sent to the Reverse Osmosis' first step inlet.

Regulation of the total seawater flow from the structure's feed shall be carried out by the feed pump to the high-pressure and the recirculation pumps, and for this each pump motor shall be equipped with a speed variator.

The flow meter and conductivity meter sets shall be used to control the operation of energy recovery systems and energy recovery efficiency.

The roller bearings in all pumps, as well as motor windings, shall have temperature probes.

### **Reverse Osmosis Racks**

The Reverse Osmosis process consists of 4 membrane lines of one stage each. Each line contains 12 rows and 20 columns, where 226 pressure vessels will be installed, leaving 14 free spaces for the tubes. Each tube has the capacity to accommodate 7 membranes, so the total number of membranes installed shall be 1582. The membranes shall be fed by horizontal tubes shared by two rows of membranes. Two vertical collectors will supply all horizontal tubes.

The plant was designed considering the installation of aromatic polyamide spiral wound membranes with a 99.75% salt rejection, with 440 feet of active membrane area, and system flow less than 14 lmh.

Seven membranes of this type shall be arranged by container or pressure vessel. The pressure vessels shall be made of GRP, of a brand known and tested in similar plants, and projected according to ASME X. The seawater and brine connections will be multiport.

All pressure vessels shall be installed in a carbon steel structure, painted with epoxy and capable of bearing 230 pressure tubes.

The permeate obtained in each pressure vessel shall be taken to a horizontal collector that transports permeate water to the vertical collectors. The vertical collectors shall be located on the opposite side of the seawater supply connections to the pressure vessels.

The permeate obtained in each pressure tube is taken to a horizontal collector that transports the permeated water to the vertical collectors. The vertical collectors will be located on the opposite side of the seawater supply connections to the pressure pipes.

Finally, the permeate will be sent to the general collector that will transport it to the product water reservoir, having previously passed through the post-treatment.

A system will be installed to perform a flow measurement at the permeate outlet of each pressure vessel. In addition, the salinity of each membrane in the pressure vessels shall be sampled by the introduction of a sampling pressure vessel. These measures shall elucidate the operation status of the membranes installed in the pressure vessels and interconnectors.

On the other hand, a permeate sample shall be installed for each pressure vessel, which shall be taken to a general sampling panel. This panel is to be installed on a side of the corresponding line. Through this panel and quick connections, it will be possible to obtain a measurement of the permeate water quantity conducted by each pressure vessel, a parameter indicative of membrane deterioration or incrustation status.

The RO supply pipes shall be made of PREN > 40 Superduplex stainless steel. The brine outlets shall be made of the same material. The permeate collectors, the pressure tube permeate connectors and the permeate piping shall be made of GRP or PP (depending on the diameter), until they reach the product water tank collector.

The connectors between the pressure pipes and their respective seawater and high-pressure brine pipes shall be of the Victaulic type. The permeate connectors must be screw threaded.

### **Chemical Cleaning and Membrane Displacement Equipment**

When considerable membrane contamination happens, or membrane chemical cleaning is necessary due to of pollution from the raw seawater, this equipment shall be used. The equipment consists of a 110 m<sup>3</sup> accumulator tank in which the appropriate reagent dissolves, in permeate water from the permeate tank, to eliminate the dirt produced. Agitation will be performed by two agitator pumps. The cleaning tank will be equipped with an electric resistance heating element, a temperature gauge and an alarm for maximum and minimum levels. The reservoir shall be built in GRP.

Once the chemical cleaning solution has been made, it will be aspirated by two centrifugal pumps that will send it to one of the osmosis structures, for the chemical cleaning of its membranes. Two centrifugal chemical cleaning pumps shall be installed. The pump materials in contact with water will be made of AISI 316. The pumps shall have isolation and check valves, manometers and GRP interconnection tubes, as well as a flow meter.

The chemical solution will pass through a cartridge filter before it reaches the line, to eliminate small reagent particles that remain undissolved. This filter is the same type as those used in seawater pretreatment, and the filter cartridges shall be interchangeable with those of pretreatment. The filter is equipped with isolation valves and inlet and outlet pressure gauges.

The solution shall be introduced into the feed tube of the corresponding structure, behind its isolation valve, which at this time shall be closed. It passes through the pressure vessels cleaning the membranes at low pressure, and most of the solution will be reject from pressure vessels with dissolved precipitates and small particles that it drags, the dirt from the membranes. This outlet solution is transported back to the cleaning tank.

The permeate line shall leave behind a small amount of chemical solution through a vessel facing the cleaning tank, as a reject, forming a closed cleaning circuit.

When carrying out chemical cleaning, the structure's closed circuit and the cleaning equipment must be isolated, so that valves with limit switches and accessories are available for this purpose.

Periodic cleaning of the membranes is a necessary process for their preservation, as well as the proper process operation.



The chemicals to be used in membrane cleaning are various and depend mainly on two factors, which are the type of dirt that has occurred and the type and manufacturer of membranes installed. Therefore, the concrete instructions and products to be used shall be defined in the construction and test phases, according to the selected membrane manufacturer.

Whenever there is a prolonged stop in any of the Reverse Osmosis lines, it is necessary to displace the seawater and brine with permeate in the high-pressure pumps, recirculation pumps, pressure exchange systems, piping, pressure vessels and membranes. If rinsing is not carried out, the pumping equipment and pipes may be corroded and precipitation may occur in the membranes, leading to significant fouling.

The permeate water destined for this process shall be taken from the permeate water reservoir.

A centrifugal pump with the same characteristics as chemical cleaning pumps shall be used for displacement. The displacement pump and chemical cleaning pumps' suctions will be connected to the cleaning and permeate tanks.

The permeate water tank will be made of GRP and have a 200 m<sup>3</sup> capacity for permeate water. It will be equipped with high and low-level floats, a level transmitter, overflow tubes, drain and permeate water inlet and outlet.

The injection of rinse water in treatment lines is verified in the high-pressure pump and in the recirculation pump suctions, with closing of the corresponding automatic valve in the main line and opening of the access valve to the main line, for the displacement of the line subject to this process.

The mixture of sea water and/or brine with backwashing water will flow from the pressure exchange systems' brine tube to the facility's general drain. The washing process will end when outlet water conductivity is less than 2000 ohms/cm.

#### **4.2.1.7 Post-treatment**

The permeate water at the osmosis rack outlets will be treated through a series of post-treatment processes to achieve quality conditions required, in terms of pH, Langelier Index, chlorine and fluoride levels.

Post-treatment shall consist of the following treatments: CO<sub>2</sub>, calcium hydroxide, sodium fluorosilicate and sodium hypochlorite dosages.

##### **CO<sub>2</sub> Dosage**

The CO<sub>2</sub> dosing equipment consists of two 40-ton capacity storage tanks. The CO<sub>2</sub> shall be stored in liquid form in insulated tanks at -20°C/20 Kg/cm<sup>2</sup>. The storage tank shall be equipped with all level, pressure regulation and safety control devices.

Starting from the tank, the CO<sub>2</sub> will be settled in liquid form, vaporized and brought to room temperature by an electric evaporator. The CO<sub>2</sub> storage tank and vaporizer assembly will be located in an open, fenced compartment.

The vaporized CO<sub>2</sub> shall be connected to the corresponding control panel to allow carbon dioxide expansion, measurement and regulation based on CO<sub>2</sub> dosage flow and the pH of the water to be treated. The control equipment shall consist of an extended steel gas pipeline, valves, expansion reducer, rotameter flow meter, regulating valves, manifold, injection valves, pH meter and CO<sub>2</sub> injection system. The CO<sub>2</sub> shall be injected into the permeate water tube before the calcium hydroxide dosage.

### **Calcium Hydroxide Dosage**

The planned facility for the calcium hydroxide dosage system consists of:

- ✓ Two silos, with a volume of 100 m<sup>3</sup> and an agitation system, for calcium hydroxide storage.
- ✓ Two calcium hydroxide screw feeders with a frequency variator, to regulate the amount of lime to be added to the sludge preparation tank, according to the permeate flow obtained.
- ✓ Two tanks for the preparation of lime slurry with a 7.10 m<sup>3</sup> capacity, to prepare calcium hydroxide at a concentration of 50 g/L continuously, equipped with an electric mixer.
- ✓ 4 + 1 feed lime metering pumps

### **Sodium Fluorosilicate Dosage**

The sodium fluorosilicate dosage is projected to comply with the fluoride content regulation for drinking water.

For this purpose, two fluorosilicate tanks of 1 m<sup>3</sup> each in capacity, built in GRP, equipped with level transmitters, high and low-level switches, drainage, interconnection tubes and other accessories shall be provided.

The fluorosilicate injection is performed by three metering pumps (2 + 1), one of which is a reserve, of the positive displacement type. The pump materials are as follows: PVC body and boxes, polyethylene seats, PTFE membranes, viton seals and casting crankcase. The pumps' nominal flow of the pumps is adjustable between 10% and 100%; regulation is automatic, with operation from the control panel, for which the metering pumps will be supplied with the corresponding servomotors.

The elected pipes for fluosilicate dosage are made of PVC-U.

### **Sodium Hypochlorite Dosage**

Two GFRP 1 m<sup>3</sup> tanks are provided for post-treatment hypochlorite dosing, with level transmitter, high and low-level alarms and other accessories.

The hypochlorite injection in the water is performed by three metering pumps (2 + 1) of the positive displacement type. The pump materials are as follows: PVC body and boxes, polyethylene seats, PTFE membranes, viton seals and casting crankcase. The pumps' nominal flow is adjustable between 10% and 100%; regulation is automatic, with control panel operation, for which the metering pumps will be supplied with the corresponding servomotors.

The hypochlorite dosing pipes adopted are made of PVC-U.

#### **4.2.1.8 Complementary Services**

##### **Instrument and service air system**

Both proportional and complete opening control valves (on/off) shall be supplied with an electric drive, so that the air system is assigned only for instrumentation and services.

Two air compressors for instruments and services will be installed, with a compressed air tank and air cooling, oil separator, automatic purging and dryers. It shall be a double-acting compressor, or threaded with oil, and work at 8 Kg/cm<sup>2</sup> of pressure. It will have an accumulation tank.

The compressors will operate in the following manner:

Both control and everything valves are supplied with electric drive, so that the air system will be designed only for instrumentation and services.

Two air compressors will be installed for instrumentation and services, with a compressed air tank and equipped with air cooling, oil separator, automatic purging and dryers.

The type of compressor is double-acting, or threaded with oil, working at 8 Kg / cm<sup>2</sup> of pressure. It will have an accumulation tank.

The operation of the compressors is as follows:

- ✓ The compressor automatically enters the load when the predetermined low air pressure is reached.
- ✓ The compressor stops automatically when the predetermined high pressure in the accumulator is reached.

The project previews the installation of an instrument and service air system that reaches the necessary points, installing the traps and other accessories necessary for correct facility operation.

##### **Service water system**

To supply service water at the plant, a pressure group consisting of a 10-bar pressurized accumulation tank, with 4 m<sup>3</sup> capacity, AISI 316 L steel parts in contact with water and two (1 + 1) multicellular pumps will be installed. Each pump shall have a flow of 10 m<sup>3</sup>/h at a 6-bar pressure and be built in AISI 316 L. A service water network built in HDPE shall be available throughout the plant.

##### **Lifting and transport equipment**

For the maintenance operations of high-pressure, booster and BAP recirculation pumps, an overhead crane shall be mounted in the Process Building, covering the full-length trajectory of these pumps.

For seawater pumps maintenance operations, a bridge crane shall be installed in the intake building, fully covering the pumps' extension.

In addition, a winch shall be installed to change filter cartridges.

### **Stairs and Platforms**

The necessary platforms and ladders shall be available to access all elements of operation, measurement and control, such as equipment, instruments, valves and others. In particular, any facility site that must be periodically visited by maintenance or operating personnel must have easy and safe access.

The stairs shall have handrails on both sides in places that require it. The platforms must have rails with a minimum height of 1.1 meters, incorporating the elements necessary to make it removable for maintenance, in areas that require it. Air duct intersection, with headroom less than 2.00 m, will be avoided. Stair and handrail structures can be made of FRPV, painted steel or AISI-316.

The Tramex platforms and trays will be made of polyester, galvanized steel or stainless steel and will be divided into sections to allow their disassembly for maintenance.

All necessary supports and fasteners shall be available. All elements will be designed to support the weight of operators, tools and parts of the installation that may be placed during assembly, maintenance and periodic assessments.

### **Fire-fighting system**

The fire-fighting system will consist of a set of fixed extinguishers strategically located on the premises and complemented with portable fire extinguishers in sufficient quantity and quality to attack any fires that may take place.

In addition, the facility shall have a detection system, which will basically consist of central monitoring and control. This central panel shall have different manual buttons, alarm bells and detectors. The latter must be of the appropriate type, according to the location and quality to be observed (smoke, gases, flames or heat), in a way that ensures maximum speed in the detection of a fire. All these measures must be in accordance with applicable regulation and industry requirements.

### **Brine discharge**

The membrane reject brine, after passing through the pressure exchange system, will be conducted to the brine tank, and from there to the sea through the outfall.

### **Laboratory and workshops**

The laboratory and workshops will have the necessary equipment and instruments for correct process supervision and control.

### **Spare Parts**

Recommended replacement parts for one year of operation are included.

## **4.2.2. Effluent and Waste Management**

The pre-treatment selected, with a double filtration stage, uses brine generated in the osmosis process to backwash the filters. In this manner, the energy needed to produce



more filtered sea water that would be used to backwash the filters is reduced. In addition, brine controls bacterial loads on the filter beds, by creating salt stress over the microorganisms present.

Once the brine wash cycles are finished, before the filter is put back in service, it is necessary to remove the brine from their structure. For this, the filter is put in filtration mode, to be filled with seawater and discharge filtered water (mixture of brine and seawater) into the brine storage tank that was used in the filter washing process.

Each filter washing cycle generates a volume of brine loaded with the solids retained in the filter, and another from the seawater and brine mixture (until it is completely disposed); its solid content is low, since the water discarded would be filtered and the brine used for washing would also be free of solids.

The washing water does not contain chemicals, and the solids removed from the filters are those that normally contained in seawater. Eventually, there may be smaller amounts of ferric chloride (used as a coagulant) at the filter inlets, to improve filtered water quality.

It is a common practice to mix these waters with the brine produced and discard the mixture into the sea through a brine discharge pipe. In accordance with existing legislation or EIA recommendations, it is possible to incorporate a system to separate washing water solids to reduce its concentration at discharge.

The chemical solutions used for washing the reverse osmosis membranes are acidic or alkaline formulations with detergents or dispersants made to eliminate solid deposits on the membranes.

The solutions used in this case will be previously neutralized in the chemical cleaning tank, by CIP, before being transported to the brine discharge tank. A recirculation pump draws water and returns it to the same tank. A pH and a Redox meter shall be placed in the suction tube to control the chemical dosage in the recirculation pump discharge tube until the pH and the Redox potential are equal to those of seawater.

After several minutes of a stable pH and a Redox potential within the limits established by environmental agencies, a set of valves allows the tank to be emptied into the brine lagoon and discharged into the sea.

As an additional safety measure, a pH and Redox potential meter shall be installed in the brine lagoon to monitor parameters of the effluent to be released into the sea.

This is how the effluent treatment systems will be projected:

- ✓ Neutralization of reagents from the chemical cleaning tank within the same tank.
- ✓ The mixture of water deriving from closed filter backwashing with brine shall be performed before it is discharged in the sea by the submarine outfall, to reduce the concentration of suspended solids and comply with current legislation. The normal parameters of suspended solid found in seawater when an intake is adopted as proposed in the present study ranges from 10 to 15 ppm. Studies indicate that, with a greater entrance of solids in the intake, such as 20 ppm, the concentration of solids in brine discharge would be 35.5 ppm. These solids, like the dissolved salts,

would be quickly dispersed in the sea without major impacts on the marine environment. The final process definition will depend on recommendations made by the environmental agency (SEMACE), during environmental licensing. Depending on the environmental agency's analysis and requirements, an additional treatment for backwashing water may be considered necessary.

- ✓ It is important to highlight that environmental authorities did not request equipment to treat the brine used in sand filter backwashing in any desalination plant operated by GS INIMA.
- ✓ Plant drains shall be conducted to the brine tank for the discharge section, where a dose of sodium metabisulfite shall be used to neutralize chlorine eventually contained in the drains.
- ✓ Industrial waste: oils, solids, chemical reagents and others will be properly classified and taken to authorized companies for collection and treatment.
- ✓ Wastewater treatment: considering a water consumption of 150 L/person/day, a maximum of 40 people and that 80% of the total water consumed will correspond to wastewater, 8 m<sup>3</sup>/day of domestic wastewater shall be produced during the project's operational phase. They shall be collected and connected to Cagece's public sewage collection and treatment system.

#### 4.2.3. Electrical System

The Desalination Plant power source will be High Voltage, 69 kV, 3 phases and 60 Hz. The battery limit will be the substation entrance in the Desalination Plant's medium voltage input cell. From this point on, all the equipment and elements necessary to supply electricity to the desalination plant consumers will be installed.

A distribution and transformer station will be installed on a single medium-voltage bus, from which the different power transformers shall be fed. The transformation centers and electrical equipment will be provided as close as possible to consumption sites, in order to minimize the BT installations.

The facility will be prepared to operate with an overall power factor greater than 0.98. For this purpose, a reactive power compensation system will be installed through a capacitor bank, automatically regulated.

The electrical system frequency is 60 Hz. The following voltage levels shall be established for electric power installation:

- ✓ Electrical system network supply: high voltage supply line, 69 KV, 3 phases.
- ✓ Medium voltage distribution: shall be carried out at 13.8 kV, with three phases, four wires.
- ✓ Low voltage distribution: shall be carried out at 380/220 V, with a three-phase system, four or five wires (depending on the case) and TT grounding system. The installation must meet at least IEC 60364 standards, considering that the installation will be done in a humid place.
- ✓ Medium voltage cell command and control: the voltage level for the medium voltage command and control circuits shall be 125Vdc, using a battery charger/rectifier.

The harmonic distortion of current and voltage injected into the network shall meet IEEE-Std. 519-1992 requirements, across the system's entire operating range. The project must include the necessary equipment to mitigate harmonics.

### **Desalination Plant Substation**

The desalination plant's Transformation Substation shall consist of a 69 kV to 13.8 kV, 15 MVA substation, which is intended to establish an energy concentration and evacuation site for the desalination plant.

An access road shall be built at the substation entrance. Its perimeter shall be enclosed by a fence, to prevent access to anyone outside the premises during construction, and later, during operation. The substation will be located within the desalination plant sector.

### **Transformers**

Transformer capacity shall be calculated without considering the installation of capacitors to improve their performance, but by the level of harmonics they must support.

Transformer reserve margin shall be at least 20% of maximum simultaneous demand in normal operation.

Transformers shall be designed in accordance with IEC 76, IEC 726 or ANSI C57.12 standards. Noise levels shall conform to the provisions of IEC 551 standard.

Transformers with capacity greater than 4000 kVA will be the oil cooling type; those with lesser or equal capacity shall be the hermetic, dry or oil-filled type (for capacity less than 2500 kVA).

All transformers will be three-phase, 60 Hz, of the Dyn11 connection group. They are suitable for indoor or outdoor operation in saline and tropical environments, providing continuous service at full load.

They shall have 05 (five) voltage regulation sockets covered on the higher voltage side ( $\pm 2.5\%$ ;  $\pm 5\%$ ). Transformers with low voltage output shall have no-load tap changes.

They shall have 05 (five) voltage regulation sockets covered on the higher voltage side ( $\pm 2.5\%$ ;  $\pm 5\%$ ). Transformers with low voltage output shall have no-load tap changes.

### **Other Systems**

The following electrical systems will be included:

- ✓ Medium voltage cells
- ✓ Motor control centers
- ✓ Motors
- ✓ Frequency inverters
- ✓ Grounding mesh
- ✓ Capacitor banks
- ✓ Direct current system
- ✓ Safe direct current system
- ✓ Emergency generator set
- ✓ Indoor and outdoor lighting

- ✓ Power outlets
- ✓ Cables
- ✓ Trays and conduits

#### 4.2.4. Control System

The Process Control System will be executed through a Distributed Control System (DCS). It shall contain different signal concentration offices with I/O cards, distributed throughout the desalination plant, two PCUs with real redundancy, the work sites, associated software and communication networks between various elements.

The equipment must meet all the requirements of electromagnetic compatibility standards IEC 61000-4-2, 61000-4-3, and 61000-4-4.

The proposed supervision and control systems consist of the following levels of control:

- ✓ Level zero, or data acquisition and local control level. This level shall correspond to instrumentation and field control.
- ✓ First level, or the sequential control that corresponds to the plant's logic controllers (PLCs). Its functions are:
  - Data acquisition (analog variables and equipment status reading)
  - To create events and alarms (depending on process inputs analog variable measurements)
  - Interlocks and operating sequences surveillance (with creation of alarms in non-compatible situations)
  - Start/stop, open/close the device. With interlocks surveillance. These commands can be executed according to the PLC's internal program or depending on a command from the central supervision system.
  - Operation loops

This level works autonomously, that is, it works without communication, making its own programmed decisions.

The remaining zone controllers shall be installed as close as possible to the signal transmission elements. The central controller and periphery of the distributed zone communicate via Ethernet, through the fiber optic ring.

- ✓ Second level, or Supervision: this level is executed in the supervisory PCs control room, where the supervision software is located in the Windows operating system. From this level, one can:
  - Visualize all field elements (states, analog values, etc.)
  - Visualize historical data (trends, alarms, etc.)
  - Change data, slogans or process parameters
  - Place remote requests for field staff
  - Create reports
  - Obtain equipment and system information (electrical diagrams, incident sheet, etc.), through a link with the management application.

The facility shall have its own control room, where the operation and engineering stations and servers will be installed.



At the operation and engineering stations, the graphic interface (HMI), created based on specific programs for this purpose, will be available for data visualization, commands, alarms, process control, events, facility maintenance and operation reporting.

The screens will be interactive, based on menus, hierarchically structured, representing the Plant's general level until the points level.

Two (2) redundant servers shall be included for real time data and history data storage. One (1) operating station and one (1) engineering station will be included. Each workstation shall consist of two (2) 27" monitors, optical mouse, keyboard and PC with the latest generation hardware and high-performance Windows operating system. Communications will be made through Industrial Ethernet.

It will include all the software and licenses necessary for the proper operation of each workstation, including: Windows operating system, Microsoft Office (Word, Excel and Access), antivirus programs.

The Process network communication between PLC controllers and the operating stations shall happen through the Ethernet, with optical fiber as a support. Data transmission shall be done by baseband with a minimum speed of 15 Mbits per second. The network protocol will be TCP/IP.

Communication between the main controller and the remote I/O offices will be done through a fiber optic Fieldbus of the PROFIBUS (DP and PA) or Fieldbus Foundation type. The Fieldbus shall allow transmission speeds of up to 12 Mbit per second.

#### **4.2.4.1 Communication Network**

There will be a telephone exchange and an internal telephone network to allow communication between different rooms and areas of the desalination plant. Internal telephones will be installed in the control room, offices, etc. The tone shall be louder considering the noise level of each area. Several telephones shall be distributed to facilitate communication, according to the extension of the workplace.

#### **4.2.4.2 Video Surveillance Network**

A perimeter Video Surveillance Network will be installed on the desalination plant's premises and interior, with recording capabilities (DVR). The main access door shall also have an intercom with a control room with an automatic door.

It also contemplates the installation of a perimeter security system that prevents people outside the plant from trespassing.

## **5. Evaluation of Environmental and Urban Planning Organs**

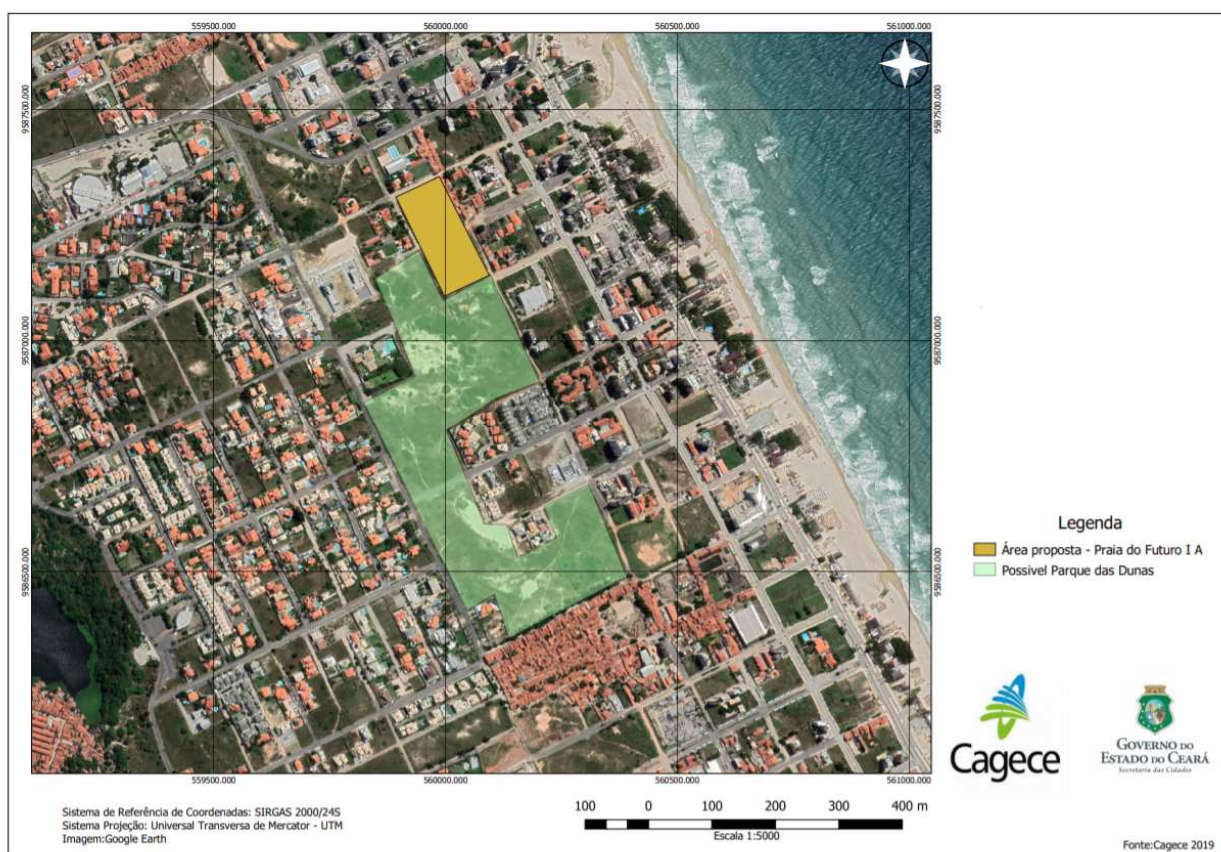
Due to the alterations in the original area for the desalination plant's implementation, a consultation with the environmental and planning agencies was performed regarding the compatibility of the Praia do Futuro I-A area with environmental, social and urban issues.

Cagece has issued Official Letter nº 1/19/SSU/DEN, requesting a prior consultation with the Fortaleza's Planning Institute – Iplanfor, regarding the new areas in Praia do Futuro. Attachment III details Technical Report nº 02/DIPLA/2019, which presents an assessment of the areas and the possibility of occupying the Praia do Futuro IA area (Parque de Dunas), provided that its project provides an effective integration of the future dune park (Figure 9) and that there are considerations to enable its urbanization.

It was requested by Official Letter nr. 08/19/Gemam/DEN that prior consent for the enterprise's location in relation to soil use and occupation is granted by Seuma (see Attachment IV).

As for the State Environmental Superintendence - SEMACE, it was requested through Official Letter nº 9/19/Gemam/SSU, that it provides the evaluation of the proposed new area (Praia do Futuro IA), as well as the respective alteration in the Term of Reference issued at the request of the Preliminary License of the area previously submitted (Praia Mansa), required through process nº 8258663/2018 (See Attachment V).

Figure 9 - Proposed Area for Future Park.



## 6. Environmental Licensing – General Considerations

Environmental Licensing is one of the instruments of the National Environment Policy - Federal Law nº 6.938/1981, which aims to make economic and social development compatible with environmental quality and ecological balance preservation (art. 4, item I).

Environmental licensing is an administrative procedure where the Public Administration, through the competent environmental agency, licenses the location, implementation, expansion and operation of enterprises and activities that make use of environmental resources, considered effective or potentially polluting, or that may cause environmental degradation, considering the legal and regulatory provisions and the technical standards applicable to each case (BRASIL, 1997). Environmental licensing can generate an administrative act of a legally bound nature (the Environmental License) or, where relevant, a legal act of a discretionary nature, with a precarious character (the Environmental Authorization). (MMA, 2016)

It is the procedure in which the government authorizes and monitors the implementation and operation of activities that make use of natural resources, or are considered to be effectively or potentially polluting. It is the entrepreneur's obligation, provided by law, to seek environmental licensing from the competent body, from the initial stages of planning and installation to the effective operation. The Public Administration, in this case, is represented by environmental agencies (FIRJAN, 2004).

It is mandatory for companies with activities that make use of environmental resources and/or may be effective or potential vehicles of pollution or environmental degradation, developed by individuals and legal entities, including entities from the federal, state and municipal public administrations, to obtain environmental licensing (SEMACE, 2010). These respective activities are listed in CONAMA Resolution nº 237, of December 19<sup>th</sup>, 1997 (FIRJAN, 2004).

The National Environmental Council has published CONAMA Resolution nº 237/1997, which establishes the procedures and levels of federal, state and municipal competence, according to the environmental impact extension. The projects and activities must be licensed at a single level of competence.

Currently, due to the various discussions in relation to the entity responsible for licensing, especially those present in coastal regions, federal and state laws have been published reporting the theme. In Federal Law nº 6938/81, which deals with the National Environment Policy, environmental licensing competence would belong to the state. This understanding has evolved since the amendment of CONAMA Resolution nº 237/1997 (Art. 4), to distribute this responsibility based on the scope of the impact; that is, projects with local impact would be licensed by the Municipality, those with impact over two or more municipalities, by the State, and when the impact affects more than one state, by the Federal Union. This resolution also delegates to the federal sphere, among others, the licensing of activities carried out in territorial waters.

To avoid endless discussions and divergences deriving from CONAMA Resolution n° 237/1997, Complementary Law n° 140, of December 8<sup>th</sup>, 2011, was enacted, establishing in its Article 7 caput, Item XIV, Subheading “h”, among the enterprises and activities subject to licensing by the federal sphere, the typology edited by an Executive Power act, considering the size, polluting potential and nature of the activity or enterprise. Subsequently, Decree n° 8.437, of April 22<sup>nd</sup>, 2015, regulated the provisions of the Article 7 caput, Item XIV, Subheading “h” of Complementary Law n° 140/2011, as well as the sole paragraph of this law, which states that:

“The licensing of activities whose location concurrently include land and sea areas of the coastal zone shall be the Union’s responsibility exclusively in the cases provided in a typology established by an act of the Public Administration, based on the National Tripartite Commission proposal, ensuring the participation of a National Environment Council (CONAMA) member and considering size, polluting potential and activity or enterprise nature criteria”.

The project called ‘seawater desalination plant’, on this project’s object scope, is considered pioneering in Brazil. Since it is not currently contemplated in classifications of offshore projects or activities or in the land-to-sea transition zones of the coastal areas contained in Decree n° 8.437/2015, the definition of administrative competence for its environmental licensing shall be analyzed by the Public Administration.

As a result of the need to assess licensing competences, IBAMA was consulted in 2018 through the Activity Characterization Form - *FCA* n°: 146603/2018, regarding the competence for this enterprise’s environmental licensing in the Praia Mansa area (previously evaluated), giving rise to the reply to Official Letter n° 3/2019 / DTAPE / COMIP / CGTEF / DILIC-IBAMA, as described below:

*“In relation to Activity Characterization Form n° 146603/2018 (SEI 3906733), referring to the Desalination Plant project, I inform you that said FCA was analyzed through Technical report 156/2018-DTAPE / COMIP / CGTEF / DILIC ( SEI n° 4077283), which concluded that the environmental licensing of the enterprise in question is not a federal competence, since it does not fit into any paragraph stipulated in item XIV, article 7 of Complementary Law n° 140/2011, nor in Decree n° 8.437 / 2015 . In view of the information mentioned above, I inform you that the procedures related to environmental licensing must be carried out by the state or municipal environmental agency”.*

Based on IBAMA’s response, doubts or questions regarding competence were elucidated, and according to Cagece’s experience with past licensing for water and sewage supply activities, it is assumed that the desalination plant’s licensing process now under analysis shall be a state responsibility.

Due to the need to formalize a new *FCA* for the proposed area, IBAMA was consulted again through Official Letter n° 147811/2019 (Process n° 02001.025096 / 2019-52). Thus, on September 17<sup>th</sup>, 2019, IBAMA expressed its response through Official Letter n° 206/2019/DTAPE/COMIP/CGTEF/DILIC, as described below:



“With my best regards and in response to Activity Characterization Chart FCA n° 147811/2019 (5832512), concerning the project named "Desalinated Water Supply System of the Integrated Water Distribution Macrosystem of Fortaleza and Metropolitan Region", I inform that aforementioned FCA was analyzed through Technical Report n° 96/2019-DTAPE / COMIP / CGTEF / DILIC (5961212), which concluded that "the environmental licensing management of the enterprise in question is not IBAMA's responsibility". In this manner, the state or municipal environmental agency shall be contacted to execute environmental licensing for the respective project”.

Therefore, the procedures recommended by the state environmental agency shall be presented in this report. In the State of Ceará, the Environmental Licensing Process - *PLA*, is an attribution of the State Environmental Superintendence - SEMACE, an independent agency created by State Law n° 11,481 of December 28<sup>th</sup>, 1987, linked to the Environment Secretary - SEMA.

SEMACE shall proceed with the licensing process after all requirements established in the checklist available in the Natuur system at <http://natuur.SEMACE.ce.gov.br/> are met.

## 7. Environmental Licensing – Required Procedures

The works, activities and enterprises subject to environmental licensing at SEMACE, as well as their respective sizes, Pollutant Degrading Potential - *PPD* and the analysis costs are detailed in COEMA Resolution nº 02, of April 11<sup>th</sup>, 2019, published in the State Official Gazette on May 17<sup>th</sup>, 2019, expressly revoking COEMA Resolution nº 10/2015.

Environmental licensing is a single procedure, normally executed in three different phases: Preliminary License, Installation License and Operation License.

Due to the procedural and criteria updates established by COEMA Resolution nº 02/2019, the following modality was added: Installation and Operation License - *LIO*, Installation and Expansion License - *LIAM*, Installation and Expansion Readjustment License - *LIAR*, Single Environmental License - *LAU*, Environmental License by Adhesion and Commitment - *LAC* and the Preliminary and Installation License - *LPI*. Each of these phases has stages, whose regulation is established in COEMA Resolution nº 02, of April 11<sup>th</sup>, 2019.

The environmental licensing application protocol, in any of its phases, must be previously scheduled electronically, which the user can perform it exclusively on the SEMACE website ([www.SEMACE.ce.gov.br](http://www.SEMACE.ce.gov.br))

To start the environmental licensing process, the entrepreneur must access the Natuur website (<http://natuur.SEMACE.ce.gov.br/login.faces>) and register. After completing registration, the entrepreneur must first identify if the activity or enterprise of interest is on the list of activities subject to environmental licensing, according to COEMA Resolution nº 02/2019. In this list it is possible to identify the activities subject to environmental licensing in the State of Ceará, which are organized into groups and classified according to their pollutant-degrading potential, in Less than Micro (< Mc); Micro (Mc); Small (Pe); Medium (Me); Large (G) and Exceptional (Ex).

Step-by-step manuals and videos are available for consultants and entrepreneurs to assist navigation on the Natuur website, explaining and illustrating the portal's steps and functions.

Figure 10- Natuur System Environmental Licensing Platform



Source: SEMACE, 2019

After verifying the environmental licensing requirement for the enterprise or activity, the interested party must: complete the online application according to the activity or enterprise framework regarding size, provide the required documents in the specific “check list” for each type of license and activity, as well as the environmental projects and studies necessary to start the licensing process. All documents must be uploaded to the Natuur system for protocol sector analysis. For that, the following documentation will be required from the entrepreneur, when requesting a Preliminary License:

I - Technical Responsibility Report (*ART*) – it accompanies the georeferenced plant and must designate the geoprocessing/georeferencing services for the service in question; it must contain the signatures of the contracted professional and contracting client, as well as be paid for or approved. NOTE: The professional responsible for the *ART* sent must be the same professional involved in the georeferenced plan sent.

II - Updated City Hall permission stating that the location and type of enterprise or activity are in compliance with the municipal legislation applicable to land use and occupation, indicating, specifically, its location the in urban or rural area;

III - City Hall Certificate for Sanitary Sewage Systems – it is a certificate issued by the City Hall, regarding project location and the discharge site for the treated effluent in relation to the water intake site for public supply (upstream or downstream), under the terms of the CONAMA Resolution nº 237/97, art. 10, §1º. Certificates that do not have an issuance date or have expired will not be accepted. Certificates with no expiration date are considered valid for up to 180 days after the date of issue;

IV - Proof of Address – must have been issued in the previous 60 days (water, electricity or telephone bills in the name of the interested party, among others, except for credit card bills). In the case of a Legal Entity, present Proof of Address of the Owner(s), Director(s) and/or legally constituted representative. Note: if the proof of address is not in the name of the interested party, it must submit a declaration proving its domicile.

V - General Conception and General Memorial Conception of the project and descriptive memorial, containing: general description of the enterprise area and its surroundings, activities to be developed, objective, equipment, generation and destination of waste and effluents from the proposed activity, location, access, construction process and other relevant aspects;

VI – Documentation of the Interested Party – for physical persons: Physical Person Registration (CPF) and photo identification document (RG, CNH, OAB, CREA, etc.). NOTE: If the interested party is a rural producer, it must present a document to prove this condition.

For Legal Entities: updated copy of the National Registration of Legal Persons (CNPJ); Copy of the Articles of Association accompanied by its last amendment, as well as the amendment that appoints the company's administrator (if there has been a change), or a copy of its Bylaws accompanied by the Meeting Minutes in which the company's administrator was appointed, or a copy of the *Requerimento de Empresário Individual* (Individual Entrepreneur's Request).

NOTE: for companies that have changed their corporate name, please submit a copy of the amendment stating the change). For public entities/agencies: present proof of registration with updated CNPJ; appointment decree of the organ's administrator(s) OR instrument of investiture; the administrator(s) identification document and the updated law approving the organ's creation.

Obs. 1: For public bodies already registered, submit the ADM/DOC protocol. NOTE: In case of ownership change, present documentation belonging to the old and new license holders.

Obs. 2: when requesting an Operating License - LO / 2<sup>nd</sup> Single Environmental License - LAU / Installation and Operation License - LIO, the CNPJ and social contract / bylaws / individual entrepreneur application must contemplate the activity requested in the license.

If the interested party is represented by an attorney, it must attach the power of attorney together with an official photo identification document (RG, CNH, OAB, CREA, etc.) from the grantor and the grantee. Private powers of attorney must be notarized. In case of Public powers of attorney, it is not necessary to attach the grantor's photo identification document.



VII - Publication – a newspaper publication of the License application, according to the standard model available on the SEMACE website;

VIII - shapefile and display file on Google Earth Present Shapefile (".SHP" and its derived extensions ".SHX", ".DBF", ".PRJ") and display file on Google Earth (KML or KMZ) informing limits and land area, according to the data contained in the property registration document, locating where the enterprise, activity or interference area will be implemented; deforestation area (when applicable); Legal Preservation area; existing and/or projected internal structures; existing natural and/or artificial resources (water courses, weirs and dams); hydrographic basin and permanent preservation areas. Note: the shapefile file must be in SIRGAS 2000 (South American Geocentric Reference System) and UTM (Universal Transverse Mercator) coordinate system - Zone 24 South.

According to the Environmental Systems Research Institute (ESRI), the shapefile (.shp) "is a vector data storage format for storing the location, shape and attributes of geographic features". Thus, it is necessary to know that there are three types of vector layers, which are:

Point: characterized by a single vertex (pair of coordinates);

Line: must have at least two vertices (represents elements that have a linear extension);

Polygon: must have at least three vertices generating elements that represent areas and perimeter.

It should be noted that every vector layer must contain attributes that can be viewed in a table associated with the properties of the graphic element. To avoid errors in the analyses, and, consequently, in the results obtained, it is necessary that the professional responsible understands cartographic data processing and representation, also mastering the tools, such as the Geographic Information System (GIS). To create a shapefile, we recommend the QGIS software, which is a free GIS program licensed by the General Public License (GNU). QGIS has a simple graphic interface, which allows users to analyze vector and matrix data. Through this software, it is also possible to export a shapefile file to kml extension (file designed for use with Google Earth).

IX - Soil Absorption Test for Sewage Systems – it is a test for soil absorption and determination of the water table level in the case of final treated effluent discharge in the soil, or when the treatment involves waste stabilization ponds and/or buried equipment.

X- Planialtimetric Survey accompanied by Declaration - for projects on land that have height differences in its topography, a Planialtimetric Survey of the polygonal area of intervention and water bodies near the project must be presented, accompanied by a statement from a qualified professional, informing if the project implantation area is subject to floods or flash floods. If so, its maximum quota must be informed.

XI - ME and MEI - Must present the National Single Annual Declaration – *DASN* for Individual Microentrepreneurs – *MEI*, and the Declaration of Socioeconomic and Tax Information - *DEFIS*, for the microenterprises, both relating to the last fiscal year, as proof

of this condition. NOTE: Companies that are not in this situation must submit a statement displaying that they do not qualify as a Microenterprise or Individual Microentrepreneur.

XII – Permission for the Use or Discharge of Water Supply Systems – it is a protocol to request a Permission for Water Use issued by the competent agency (SRH, ANA). For Sanitary Sewage Systems, it must be a Request Protocol for the Discharge of Treated Effluents in lotic water resources or in the soil.

XIII - Georeferenced Plan – it must be in UTM coordinates, DATUM SIRGAS 2000 of the property's polygonal, informing limits and land area, according to the data contained in the property registration document; informing the site where the enterprise, activity or interference area will be implemented, deforestation area (when applicable), Legal Conservation area, existing and/or projected internal structures, existing natural and/or artificial resources (water courses, weirs and dams), hydrographic basin and permanent preservation areas, as well as indicating when the enterprise is inserted in special areas (Conservation Areas, indigenous lands, among others).

XIV - Registration with the Rural Environmental Registry - CAR - for projects located in rural properties (rural area), submit a registration receipt to the Rural Environmental Registry - CAR ([www.car.gov.br](http://www.car.gov.br)). If the receipt has already been presented, please present the copy.

All documents required above must be uploaded to SEMACE's Natuur system within a maximum period of 48 hours, to keep the requirement valid and enable assessment by SEMACE's technical staff. Once the documentation is approved, a DAE – State Collection Invoice is generated to fund process analysis. After the DAE is paid for, a process number is generated for the interested party, and the process shall later be sent for analysis by the licensing sector.

It is noteworthy that, in the specific case of the Seawater Desalination Plant Project under analysis, it is not necessary to present a Permission for Water Use, since seawater is not subject Government permission, as it is not included in Article 12 of Law nº 9.433/1997, which institutes the National Water Resources Policy. There shall be no need to present a CAR either, due to the project site location, in a consolidated urban area.

After the process is open, technicians with the necessary qualifications will be assigned to analyze its requests.

During this process, a responsible technician shall schedule a technical inspection at the project or activity site. After the inspection, the SEMACE technician will issue a statement justifying the need for an Environmental Impact Study/Environmental Impact Report - EIA/RIMA or another study provided for in environmental legislation. If an environmental study is required, the technician will prepare the respective Term of Reference, which shall be sent electronically to the interested party through the Natuur system.

The EIA/RIMA will be required in the following cases: a) the project is among any of the cases provided for in environmental legislation, in particular CONAMA Resolution nº 01/86, and b) it is verified through the SEMACE technical analysis that the project characteristics and/or shall result in a significant environmental impact.

The requirement of any environmental study is specific to the environmental licensing phase, which is why its requirement cannot be extended to the following phases. When SEMACE's technical analysis concludes that an environmental study will not be necessary due to a small impact, pollutant degradation potential or size, a broad environmental knowledge available for the area or other relevant motivation, it should adequately justify such circumstances in the statement supporting the Preliminary License.

In cases of preliminary licensing of an enterprise for which an Environmental Impact Study - EIA and its respective Environmental Impact Report - RIMA have been required, the study must be delivered to the SEMACE protocol sector in five copies (three printed and two soft copies) accompanied by proof of publication in a widely circulated newspaper. During the EIA/RIMA analysis process by SEMACE, public hearings are scheduled to be held in the region where the project will be implemented.

It should be noted that the environmental study must be carried out by legally qualified professionals and paid by the entrepreneur. These professionals shall be responsible for the information presented, subject to administrative, civil and criminal sanctions. The documents must be signed and accompanied by the respective Professional Class Council Registrations (SEMACE, 2010).

When an EIA/RIMA is required, a multidisciplinary team of at least seven technicians is composed at SEMACE for the environmental study analysis. The Technical Report prepared by the team is then submitted for assessment by the Environment State Council - COEMA. The COEMA permission generates a draft resolution that, after being published in the State Official Gazette, results in the approval and release of the environmental license. If the environmental license is denied by COEMA, the creation Technical Council may be requested to reevaluate the project, which shall be submitted once again to the council's appreciation. If the environmental license is irrevocably rejected, the process is filed, the entrepreneur is notified via official letter and the decision published in by SEMACE in the State Official Gazette. (Brazilian Environmental Licensing Procedures - MMA, 2016)

It is important to consider that, when the project location is in a municipality whose territory contains indigenous or *quilombola* reserves or is in the process of defining its boundaries, the Preliminary License will only be issued with consent from National Indian Foundation - FUNAI and *Fundação Cultural Palmares*, respectively. A consultation shall also be made with the National Historical and Artistic Heritage Institute - IPHAN, in order to avoid damage to historical, cultural and archaeological heritage.

If the project affects a conservation unit or its buffer zone, an authorization must be obtained from the agency responsible for the Conservation Unit – UC management. In the case of a federal conservation unit, the Environmental Licensing Authorization Application - REALA, provided for in Normative Instruction nº 5, of September 2<sup>nd</sup>, 2009 must be filled out with the Chico Mendes Institute for Biodiversity Conservation - ICMBio. If UC management is under SEMA's (state conservation unit) responsibility, before the licensing technical analysis, the process shall be sent by SEMACE to the Environmental Secretariat Biodiversity Coordination - SEMA for approval, if necessary, for the intended intervention.

Such a procedure is not necessary for the Desalination Plant Project, since it is not located in a conservation area or buffer zone of a fully protected or sustainable use UC.

The Installation License authorizes the implantation or construction of the enterprise, work or activity according to the specifications contained in the approved projects, environmental studies, plans, programs and proposals, including the environmental control measures and other conditions. Because of the alteration in COEMA Resolution nº 10/2015, that previously regulated all three categories (LP, LI and LO) in sanitation activities, but has now been revoked by COEMA Resolution nº 02/2019, that regulates Environmental Sanitation activities, there is now a requirement for the Preliminary License and Installation Operation License - LIO, code 27.04 - Water Supply System with Conventional ETA. See Figure 11.

Figure 11- Pollutant Degradation Potential, According to Size and Activity.

SISTEMA DE ABASTECIMENTO DE ÁGUA COM ETA CONVENCIONAL I (ATIVIDADE 27.04)			POTENCIAL POLUIDOR-DEGRADADOR
			MÉDIO
Vazão de Adução Máxima Prevista (L/s)	Mc	≤ 5	E
	Pe	> 5 ≤ 20	F
	Me	> 20 ≤ 80	H
	Gr	> 80 ≤ 250	L
	Ex	> 250	N

Atividade sujeita a Licença Prévia e Licença de Instalação e Operação (LIO).

1 Ficam dispensadas do licenciamento ambiental: 1-ampliação de redes já licenciadas, desde que não haja aumento da vazão de adução máxima prevista (L/s); 2-substituição de redes já existentes e licenciadas.: 1 - ampliação de redes já licenciadas, desde que não haja aumento da vazão de adução máxima prevista (L/s); 2-substituição de redes já existentes e licenciadas.

Source: COEMA Resolution nº 02/2019

Therefore, the Installation License shall be part of the merger between the project's installation and operation, and the entrepreneur must comply with all conditions established in the Preliminary License phase, with the requirement of the following documentation for attainment of the Installation and Operation License - LIO:

I - DNIT or SOP Authorization - DNIT or SOP Authorization (VIABILITY CERTIFICATE) for projects located on Federal or State Highway, respectively;

II - Federal Technical Registration – CTF, Regularity Certificate with the Federal Technical Register - CTF for activities that are potentially polluting and/or make use of natural resources, issued by IBAMA;

III - Proof of Address - issued in the last 60 days (water, electricity or telephone bills in the name of the interested party, among others, except for credit card bills). In case of a Legal Entity, present Proof of Address from the owner(s), director(s) and/or legally constituted representative. Note: if the proof of address is not in the name of the interested party, a declaration attesting the address must be submitted.

IV - Conditions – the submission of documents proving compliance with the conditions established in the previous license.

V - Documentation of the Interested Party – for physical persons: Physical Person Registration (CPF) and photo identification document (RG, CNH, OAB, CREA, etc.). NOTE: If the interested party is a rural producer, it must present a document to prove this condition.





For Legal Entities: updated copy of the National Registration of Legal Persons (CNPJ); Copy of the Articles of Association accompanied by its last amendment, as well as the amendment that appoints the company's administrator (if there has been a change), or a copy of its Bylaws accompanied by the Meeting Minutes in which the company's administrator was appointed, or a copy of the *Requerimento de Empresário Individual* (Individual Entrepreneur's Request). NOTE: For companies that have changed their corporate name, please submit a copy of the alteration stating the change).

For public entities/agencies: present updated proof of registration with CNPJ; appointment decree of the organ's director(s) OR minutes of investiture; the administrator's identification document; updated law that created the organ. OBS: For public agencies already registered, submit the ADM / DOC protocol.

Obs. 1: In case of ownership change, present the documentation of the old and the new license holder.

Obs. 2.: when requesting an Operating License - LO / 2<sup>nd</sup> Single Environmental License - LAU / Installation and Operation License - LIO, the CNPJ and social contract / bylaws / individual entrepreneur application must contemplate the activity requested in the license.

If the interested party is represented by an attorney, it must attach the power of attorney together with an official photo identification document (RG, CNH, OAB, CREA, etc.) from the grantor and the grantee. Private powers of attorney must be notarized. In case of Public powers of attorney, it is not necessary to attach the grantor's photo identification document.

VI - Property Registration or Certificate - issued by the Property Registry Office, in the applicant's name (notarized and issued within 90 days of the license application date). If the applicant is not the property owner, he also present the owner's authorization to use the property or enter into a lease or rent contract or public deed, purchase and sale agreement, among others, or a certificate of inexistent registration of the property, accompanied by a document proving property ownership (ownership document must be in the name of the interested party). Example: water, electricity, landline, IPTU, among others; or Occupancy Certificate (SPU) for maritime lands; or a public utility decree for social interest for land undergoing an expropriation process;

VII - ME and MEI - the Single National Annual Declaration – DASN must be presented in the case of Individual Microentrepreneurs – MEI, as well as the Declaration of Socioeconomic and Tax Information - DEFIS, for Micro Businesses, both relating to the previous fiscal year, to proof of this condition. NOTE: companies that are not in this situation must submit a statement denoting that they do not qualify as a Micro Business or Individual Microentrepreneur;

VIII - Descriptive Memorial containing the management of construction waste that shall result from the construction works;

IX – Permission for Water Use or Discharge in Water Supply Systems - the Permission for Water Use shall be issued by the competent agency (SRH, ANA); for Sanitary Sewage Systems, a Permission for Treated Effluent Release in lotic water bodies or soil must be attained.

X - Basic project - complete with a descriptive/justification memorial of the project, accompanied by the ART of the person in charge;

XI - Publication – publication of the License Application in a newspaper, according to the standard model available on the SEMACE website;

XII – A treated water Sampling and Analysis Request for water supply systems, to be conducted by the SEMACE laboratory personnel. Sampling and Analysis Requests for treated effluent for sanitary sewage systems, as long as there is discharge in a water source or soil, to be carried out by the SEMACE laboratory personnel.

The Installation and Operation License can only be issued at a later time or, at least, simultaneously with the environmental deforestation authorization that the enterprise needs to start interventions in the area. It shall also be required that the entrepreneur proves full compliance with the conditions set out in the project's Preliminary License, among which there will certainly be project details regarding environmental control measures and constant monitoring programs in the environmental study.

Considering the nature of this project and its need for an EIA/RIMA, the LIO shall only be issued after the signing of the Environmental Compensation Commitment - *TCCA*. If the project is concluded, its effective operation shall only take place after the entrepreneur attains a proof of discharge from obligations undertaken and a Term of Acquittal from the *TCCA*.

After the positive evaluation, the Installation and Operation License will be issued, which authorizes the installation and operation of the enterprise or activity to start, according to the specifications contained in the approved executive plans, programs and projects, including the environmental control measures and other conditions. It is worth noting that the LIO phase will contemplate the project's implementation and operation stages concomitantly.

To renew this license, if the work is already completed, an operating license renewal shall be requested, and the following documentation must be produced:

I - Federal Technical Registration – a CTF (Certificate of Regularity in the Federal Technical Register) issued by IBAMA for an activity that is potentially polluting and/or makes use of natural resources;

II – Proof of Address – must have been issued in the previous 60 days (water, electricity or telephone bills in the name of the interested party, among others, except for credit card bills). In the case of a Legal Entity, present Proof of Address of the Owner(s), Director(s) and/or legally constituted representative. Note: if the proof of address is not in the name of the interested party, a declaration attesting the address must be presented.

III - Conditions – the submission of documents proving compliance with the previous licensing conditions.

IV – Interested Party's Documentation - for individuals: Physical Person Registration (CPF) and photo identification document (RG, CNH, OAB, CREA, etc.).

NOTE: If the interested party is a rural worker, he must present a document proving this condition.

For Legal Entities: an updated copy of Legal Person Identification (CNPJ) document; copy of the Articles of Association, accompanied by its last amendment as well as the one that appoints the company's administrator (if there has been a change); or a copy of the bylaws accompanied by the Minutes of the assembly that appointed the company's administrator, or yet a copy of the *Requerimento de Empresário Individual* (Individual Entrepreneur's Request). NOTE: For companies that have changed their corporate name, please submit a copy of the amendment related to the change.

For public entities/agencies: present updated proof of registration with CNPJ; appointment decree of the organ's director(s) OR minutes of investiture; the administrator's identification document; updated law that created the organ. OBS: For public agencies already registered, submit the ADM / DOC protocol.

Obs. 1: In case of ownership change, present the documentation of the old and the new license holder.

Obs. 2.: when requesting an Operating License - LO / 2<sup>nd</sup> Single Environmental License - LAU / Installation and Operation License - LIO, the CNPJ and social contract / bylaws / individual entrepreneur application must contemplate the activity requested in the license.

If the interested party is represented by an attorney, it must attach the power of attorney together with an official photo identification document (RG, CNH, OAB, CREA, etc.) from the grantor and the grantee. Private powers of attorney must be notarized. In case of public powers of attorney, it is not necessary to attach the grantor's photo identification document.

V - ME and MEI - the Single National Annual Declaration – DASN must be presented in the case of Individual Microentrepreneurs – MEI, as well as the Declaration of Socioeconomic and Tax Information - DEFIS, for Micro Businesses, both relating to the previous fiscal year, to proof of this condition. NOTE: companies that are not in this situation must submit a statement denoting that they do not qualify as a Micro Business or Individual Microentrepreneur;

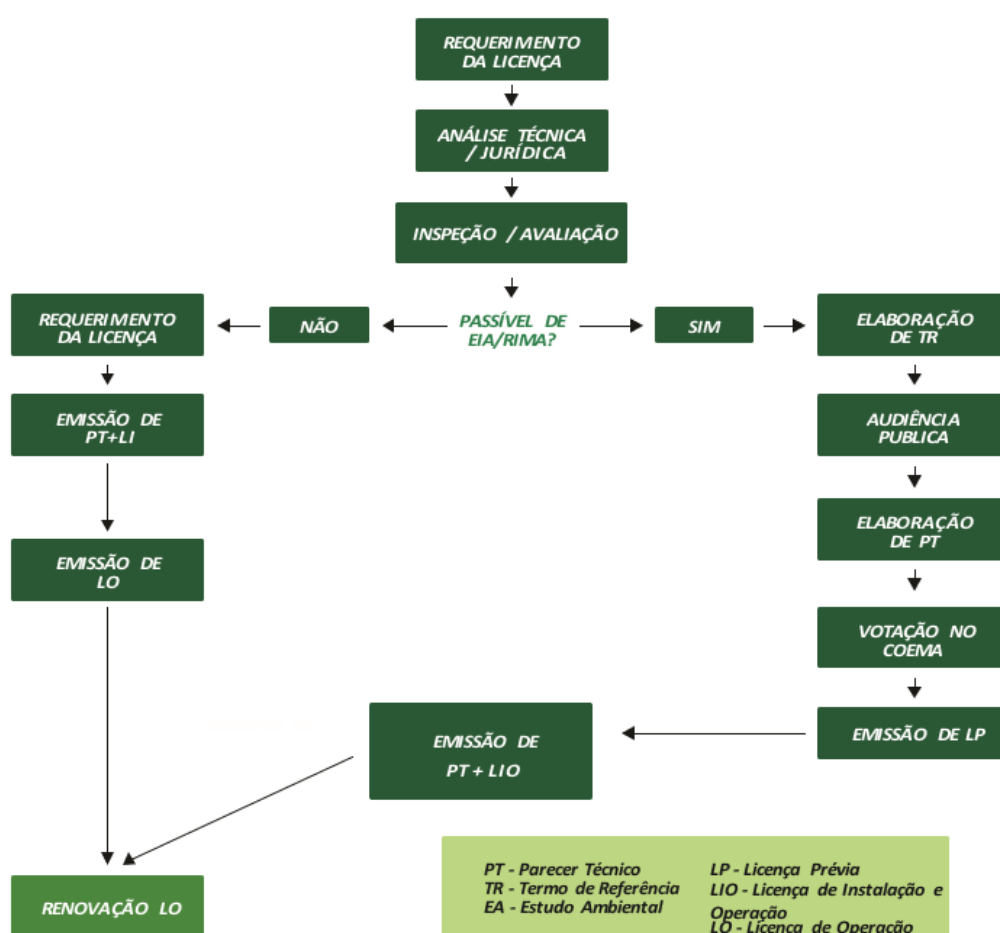
VI - Permission for Water Use or Discharge in Water Supply Systems - the Permission for Water Use shall be issued by the competent agency (SRH, ANA); for Sanitary Sewage Systems, a Permission for Treated Effluent Release in lotic water bodies or soil must be attained.

VII - Publication – publication of the License Application in a newspaper, according to the standard model available on the SEMACE website;

VIII – a Request for Collection and Analysis of treated water for water supply systems and a Request for Collection and Analysis of treated effluent for the sanitary sewage system, if the discharge is to be done in water resources or in the soil. Both shall be carried out by SEMACE's laboratory.

The figure below displays SEMACE's general licensing flow chart, covering the Preliminary, Deployment and Operation phases. For the desalination plant process, as already described above, there will be no separate application for LI and LO, since the process has been unified as a LIO.

Figure 12 - SEMACE's Licensing Process Flow Chart.



Source: Fiec/SEMACE 2019 - Adaptação Cagece

## IPHAN Report

The consultation to be carried out with IPHAN - National Historical and Artistic Heritage Institute aims to ascertain whether there is a need to prepare an archaeological diagnosis of project areas, as required by IPHAN Normative Instruction nº 001/2015. The first step to be taken in this process is the submission, by the entrepreneur, of an Activity Characterization Form - FCA (model available on the IPHAN website -





[http://portal.iphan.gov.br/uploads/ckfinder/arquivos/NOVA-FCA\\_VERSAO\\_2017\\_25\\_final.xlsx](http://portal.iphan.gov.br/uploads/ckfinder/arquivos/NOVA-FCA_VERSAO_2017_25_final.xlsx)). It must be formally sent to IPHAN by the environmental licensing agency, which in this case is SEMACE.

Based on the information contained in the *FCA*, IPHAN will issue, in a maximum period of 15 days, a Specific Term of Reference – *TRE* applicable to the projects, and send it to the licensing agency. The aforementioned Term of Reference will present the minimum content necessary for the performance studies that aim assess the ventures' impact on cultural assets under federal protection. IPHAN's analysis and all administrative procedures that must be observed for the attainment of an environmental licensing report by this organ must comply with IPHAN Normative Instruction nº 001/2015.

If the nationally protected assets are detected in the enterprise's Direct Influence Area, except for archaeological heritage, the Impact Assessment Report on Protected, Valued and Registered Cultural Assets must be prepared. For the archaeological heritage identified outside protected areas and its surroundings, the procedures shall vary according to the framework provided by IPHAN, based on the impact of works that include earth movements (Levels I to IV or Does Not Apply). For this purpose, the following procedures may be required:

- ✓ Exemption from the performance of archeological studies in enterprises for which, initially, IPHAN does not require the application of IPHAN Normative Instruction nº 001/2015, without prejudice to Law nº 3.924, of 7/26/61.
- ✓ Projects classified as Level I (low earth movement), shall only be required to present the Entrepreneur's Commitment Term - *TCE*, committing to the immediate work suspension in the event of random archaeological finds in the enterprise area, while adopting the measures recommended in IPHAN Normative Instruction nº 001/2015 (see Art. 15);
- ✓ Projects classified as Level II (low to medium earth movement) shall undergo archaeological monitoring over the project's works as required by IPHAN, done by an archeologist duly authorized by it, who shall be responsible for the management of the archaeological heritage eventually identified (see Articles 16 and 17 of IPHAN Normative Instruction nº 001/2015);
- ✓ Projects classified as Level III (medium to high earth movement) shall provide an Archaeological Heritage Impact Assessment Project (research project) approved by IPHAN, whose execution in the field must be previously authorized by the publication of an IPHAN Ordinance in the Federal Official Gazette, adopting the procedures contained in Articles 18 and 19 of IPHAN Normative Instruction 001/2015). After the conclusion of the field assessments, the Archaeological Heritage Impact Assessment Report must be prepared, and then submitted to IPHAN's approval for Preliminary License emission. IPHAN procedures for analysis and approval of the Research Project and the Archaeological Heritage Impact Assessment Report require approximately 60 days each;
- ✓ Projects classified as Level IV (medium to high earth movement and without precise definition of the location of the works) shall be required by IPHAN to prepare an Archaeological Heritage Potential Impact Evaluation Report, whose execution must

be previously authorized by the publication of an IPHAN Ordinance in the Federal Official Gazette, adopting the procedures contained in Articles 21 and 22 of IPHAN Normative Instruction nº 001/2015). After the conclusion of the field studies, the Archaeological Heritage Impact Assessment Report must be prepared and submitted for IPHAN's approval for Preliminary License emission. IPHAN procedures for analysis and approval of the Research Project and the Archaeological Heritage Potential Impact Evaluation Report require 30 to 60 days each;

If IPHAN requires archaeological studies to be carried out for the emission of Preliminary Licenses for any project, the instructions contained in IPHAN Normative Instruction nº 001/2015 and Technical Information nº 080/11-DIVTEC/IPHAN/CE must be followed. It establishes the procedures for the conduction for studies related to historical, cultural, archaeological and paleontological heritage in enterprises areas subject to an EIA/RIMA in the State of Ceará.

It is noteworthy that the Archaeological Diagnosis' field assessment has its beginning conditional to IPHAN' approval of the research project (Archaeological Heritage Impact Assessment Project), presented by an archeology team with subsequent publication of such authorization, in maximum period of 60 days, in the Federal Official Gazette. Only after the completion of this procedure, the archeology team can start field assessment. In addition, the Archaeological Diagnosis must be presented through a specific report (Archaeological Heritage Impact Assessment Report), which must be submitted by the coordinating archaeologist for IPHAN's approval to obtain a Preliminary License, with the latter procedure also demanding about 60 days.

### **FUNAI Report**

Consultation with FUNAI – *Fundação Nacional do Índio* (National Indian Foundation), must also be carried out in compliance with current legislation (FUNAI Normative Instruction nº 02/2015), by completing an Activity Characterization Form (FCA) and forwarding it to this institution through the competent environmental agency, which in this case is SEMACE.

### **Palmares Cultural Foundation Report**

*Fundação Cultural Palmares* should also be consulted, as required by the current environmental legislation (PALMARES Normative Instruction nº 1/2015), by completing an Activity Characterization Form (FCA) and forwarding it to this institution through the competent environmental agency, which in this case, is SEMACE.

It should be noted that, as of August 2018, licensing requests to SEMACE may be made entirely through the internet, through the electronic licensing process, which will allow interested parties to enter and monitor the process from any internet connected computer, 24 hours a day, dismissing the need for physical presence during SEMACE's opening hours. Documents required from interested parties can be uploaded virtually. SEMACE's notifications regarding pending issues can be accessed in real time, favoring analysis and processing speed. The platform is available at the following electronic address: <http://natuur.SEMACE.ce.gov.br>.

## 8. Relevant Environmental Legislation

The development policy that has been practiced by the State of Ceará requires that the government plans and projects consider the effects of environmental degradation resulting from their implementation and operation. For this end, knowledge of the existing legal instruments at federal, state and municipal levels is of utmost importance, since the enterprise must comply with them, aiming to protect the environment related to its area of influence.

Summaries of the legal aspects that govern the current environmental legislation are presented below:

### 8.1. Constitutional Precept

- ✓ Article 225 of the Federal Constitution: establishes that everyone has the right to an ecologically balanced environment, an asset for common use by the population and essential to a healthy quality of life, imposing the duty to defend and preserve it on the Public Administration and community, for the present and future generations;
- ✓ Article 259 of the State Constitution: establishes that a balanced environment and a healthy quality of life are inalienable rights of the people, imposing the duty to defend and preserve it on the State and community;
- ✓ Organic Law of the municipality of Fortaleza.

### 8.2. National Environmental Policy

- ✓ Law nº 6,938, of August 31, 1981: establishes the National Environmental Policy, its purposes, formulation and application mechanisms, defining general guidelines for environmental conservation, while making the development of economic activities compatible with environmental preservation. It also institutes environmental licensing. Amended by Laws 7.804/1989, 8.028/1990, 9.960/2000, 9.966/2000, 9.985/2000, 10.165/2000, 11.105/2005, 11.284/2006, 11.941/2009, nº 12.651/2012 and nº 12.856/2013 and by LCP nº 140/2011. Regulated by Decrees nº 97.632/1989, nº 99.274/1990, nº 4.297/2002 and nº 5.975/2006.

### 8.3. State Environmental Policy

- ✓ State Law nº 11.411, of December 28<sup>th</sup>, 1987: establishes the State Environmental Policy and creates the State Environmental Superintendence (SEMACE) and the State Environment Council (COEMA);
- ✓ State Law nº 12.274, of April 5<sup>th</sup>, 1994: changes the text of articles it specifies from Law nº 11.411, of December 28<sup>th</sup>, 1987, adds others among other measures;
- ✓ State Law nº 12.910, of June 9<sup>th</sup>, 1999: amends Article 3, its sole paragraph and Article 4 of Law nº 11.411, of December 28<sup>th</sup>, 1987, and makes other provisions.

### 8.4. Environmental Licensing

- ✓ Decree nº 99.274, of June 6<sup>th</sup>, 1990: regulates Law nº 6.938, of August 31<sup>st</sup>, 1981, which defines the National Environmental Policy and establishes, in chapter IV, the

- criteria for licensing activities that modify the environment;
- ✓ CONAMA Resolution nº 001, of January 23<sup>rd</sup>, 1986: establishes definitions, responsibilities, basic criteria and general guidelines for the use and implementation of the Environmental Impact Assessment, as an instrument of the National Environmental Policy. It has been amended by CONAMA Resolution nº 011/1986, which included item XVII in its Article 2, and by CONAMA Resolution nº 237/1997, which has revoked Articles 3 and 7;
  - ✓ CONAMA Resolution nº 006, of January 24<sup>th</sup>, 1986: institutes and approves models for the publication of license applications, their renewal and respective concession;
  - ✓ CONAMA Resolution nº 011, of March 18<sup>th</sup>, 1986: changes and adds items in the
  - ✓ CONAMA Resolution nº 009, of December 3<sup>rd</sup>, 1987: regulates public hearing matters in the licensing process;
  - ✓ CONAMA Resolution nº 002, of April 18<sup>th</sup>, 1996: determines the implementation of a public domain conservation unit, and the indirect use, preferably, of an Ecological Station. It must be required in the environmental licensing process of enterprises with considerable environmental impact, serving as a reparation for the possible environmental damage caused by the destruction forests and other ecosystems. It revokes CONAMA Resolution nº 10/87;
  - ✓ CONAMA Resolution nº 237, of December 16<sup>th</sup>, 1997: regulates the procedures and criteria used in environmental licensing, establishing a list of activities subject to it; determines in Article 14 that the environmental agency responsible for the analysis of environmental studies will have a maximum period of 12 months to comment on the study assessed. It revokes articles 3 and 7 of CONAMA Resolution nº 001/86;
  - ✓ Complementary Law nº 140, of December 8<sup>th</sup>, 2011: under the terms of items III, VI and VII of the caput and the sole paragraph of Article 23 of the Federal Constitution, it sets standards for cooperation between the Union, States, Federal District and Municipalities for administrative actions arising from common jurisdiction regarding the protection of notable natural landscapes, the environment, the combat against all forms of pollution and the preservation of forests, fauna and flora. Amends Law nº 6,938, of August 31<sup>st</sup>, 1981;
  - ✓ Decree nº 8,437, of April 22<sup>nd</sup>, 2015: regulates the provisions of Article 7, caput, item XIV, line “h”, and sole paragraph of Complementary Law nº 140, of December 8<sup>th</sup>, 2011, to establish the characteristics of undertakings and activities whose environmental licensing shall be the Federal Union’s responsibility;
  - ✓ COEMA Resolution nº 02, of April 11<sup>th</sup>, 2019: regulates the procedures, criteria, parameters and costs applied to the environmental licensing and authorization processes within the scope of the State Environmental Superintendence - SEMACE.
  - ✓ COEMA Resolution nº 22, of December 3<sup>rd</sup>, 2015: authorization for the purposes of environmental licensing of projects that may affect state conservation units and their buffer zones;
  - ✓ Ministry Ordinance MMA nº 60, of March 24<sup>th</sup>, 2015: establishes the administrative procedures that govern the activity of federal public administration bodies and entities in environmental licensing processes, under IBAMA’s jurisdiction;



- ✓ COEMA Resolution nº 10, of September 1<sup>st</sup>, 2016: approves the alteration of COEMA Resolution nº 22, of December 3<sup>rd</sup>, 2015, on authorization for environmental licensing by the organ responsible, to be granted by the administration of Preservation Units (UC) for projects with different degrees of environmental impact;
- ✓ Ordinance nº 104/2019: establishes criteria to limit the validity terms and condition for the renewal of environmental licenses under current legislation, among other measures.

## 8.5. Environmental Compensation

- ✓ Law nº 9985, of July 18<sup>th</sup>, 2000: Regulates art. 225, § 1 and items I, II, III and VII of the Federal Constitution, establishing the National System of Natural Conservation Units, among other measures.
- ✓ Decree nº 4341, of August 22<sup>nd</sup>, 2002: regulates some articles in Law nº 9.985, of July 18<sup>th</sup>, 2000, which provides the National System of Nature Conservation Units - SNUC, and makes other provisions.
- ✓ COEMA Resolution nº 09, of May 29<sup>th</sup>, 2003: institutes, within the scope of Ceará State Environmental Policy, a commitment to environmental compensation for damages caused to the environment and the use of environmental resources. It establishes norms and criteria regulating Environmental Compensation amount and payment methods, as well as the use of these resources for the management, inspection, monitoring, control and protection of the environment within the State of Ceará;
- ✓ Conama Resolution nº 371, of April 5<sup>th</sup>, 2006: establishes environmental agency guidelines for the calculation, collection, application, approval and control of resource expenditures arising from environmental compensation, in accordance with Law nº 9.985, of July 18<sup>th</sup>, 2000, establishing the National System of Natural Preservation Units – SNUC, among other measures.
- ✓ Law nº 14.950, of June 27<sup>th</sup>, 2011: establishes the Ceará State System of Preservation Units - SEUC, among other measures.
- ✓ Decree nº 30.880, of April 12<sup>th</sup>, 2012: regulates articles 3 and 19 of Law 14.950, of June 27<sup>th</sup>, 2011, which regulates the Ceará State System of Preservation Units - SEUC, and among other provisions.
- ✓ COEMA Resolution nº 11, of September 4<sup>th</sup>, 2014: it creates, within the scope of the State of Ceará, the methodology to calculate the degree of environmental impact to establish environmental compensation percentage amount;
- ✓ COEMA Resolution nº 26, of December 10<sup>th</sup>, 2015: it changes, in the scope of the State of Ceará, the methodology used to calculate the degree of environmental impact to establish environmental compensation percentage amount.
- ✓ COEMA Resolution nº 06, of April 6<sup>th</sup>, 2017: changes the provisions of COEMA Resolution nº 09, of May 29<sup>th</sup>, 2003 and makes other provisions;
- ✓ Decree nº 32.310, of August 21<sup>st</sup>, 2017: amends State Decree nº 30.880, of April 16<sup>th</sup>, 2012, which regulates articles 3 and 19 of Law nº 14.950, of June 27<sup>th</sup>, 2011, related to the Ceará State System of Preservation Units - SEUC, discourses about

the Ceará State System of Preservation Units - SEUC, and makes other provisions.

- ✓ COEMA Resolution nº 04, of June 7<sup>th</sup>, 2018: it alters, in COEMA Resolution nº 26, of December 10<sup>th</sup>, 2015, the competence to perform the environmental compensation calculation, to become SEMACE's jurisdiction.

## 8.6. Comprehensive Environmental Protection

- ✓ Decree nº 84.426, of January 24<sup>th</sup>, 1980: concerns the erosion, use and occupation of soil, water and soil pollution.
- ✓ Ministry Ordinance nº 917, of June 6<sup>th</sup>, 1982: provides measures for land mobilization, water, air and soil pollution;
- ✓ Federal Law nº 7.347, of July 24<sup>th</sup>, 1985: regulates public civil action establishing liability for damages caused to the environment, consumer, goods and rights of artistic, aesthetic, historical, touristic and landscaping value, and other measures;
- ✓ Law nº 9.605, of February 12<sup>th</sup>, 1998: it is referred to as the "Environmental Crimes Law". Provides for criminal and administrative sanctions derived from conduct and activities harmful to the environment;
- ✓ Federal Decree nº 6.514, of July 22<sup>nd</sup>, 2008: discourses about administrative infractions and sanctions related to the environment; establishes the federal administrative process for the investigation of such infractions, among other measures.
- ✓ Federal Decree nº 6.686, of December 10<sup>th</sup>, 2008: alters and adds provisions to Decree nº 6.514, of July 22<sup>nd</sup>, 2008, which establishes administrative infractions and sanctions towards the environment and determines the federal administrative process to be used to investigate these infractions.
- ✓ Federal Decree nº 7.640, of December 9<sup>th</sup>, 2011: Amends article 152 of Decree nº 6.514, of July 22<sup>nd</sup>, 2008, which discourses about administrative infractions and sanctions towards the environment, establishing the federal administrative process to investigate these infractions.
- ✓ Federal Decree nº 9.760, of April 11<sup>th</sup>, 2019: amends Decree nº 6.514, of July 22<sup>nd</sup>, 2008, which discourses about administrative infractions and sanctions towards the environment, establishing the federal administrative process to investigate these infractions.
- ✓ SEMACE Ordinance nº 117, of June 22<sup>nd</sup>, 2007: provides administrative procedures applicable to conducts and activities harmful to the environment within SEMACE's jurisdiction.
- ✓ SEMACE Normative Instruction nº 003/2017: regulates the procedures for the investigation of administrative infractions for conduct and activities harmful to the environment, related sanctions, the defense or impugnation, the appeal system, the collection of fines and their conversion into recovery, preservation and improvement of environmental quality services within SEMACE's jurisdiction.

## 8.7. Protection of Water Resources

- ✓ Federal Decree nº 24,643, of July 10<sup>th</sup>, 1934: determines the Water Code;
- ✓ Decree nº 28.481, of December 7<sup>th</sup>, 1940: concerns water pollution;



- ✓ Decree nº 30.877, of June 20<sup>th</sup>, 1961: provisions about the dumping of toxic or oily residues in the country's deep or coastal waters among other measures;
- ✓ State Law nº 10,147, of December 1, 1977: disciplines land use aiming at the protection of water resources;
- ✓ Law nº 10,148, of December 2, 1977 (regulated by Decree nº 14,535, of 6/2/81): disciplines the preservation and control of water resources in the State among other measures;
- ✓ Ministry Ordinance nº 124, of August 20, 1980: standards regarding the prevention of water pollution;
- ✓ State Law nº 12,522, of December 15<sup>th</sup>, 1995: defines springs, water holes and the natural surrounding vegetation as protected areas, among other measures;
- ✓ Law nº 9,433, of January 8, 1997: institutes the National Water Resources Policy and creates the National Water Resources Management System. Not applicable to marine waters;
- ✓ Law nº 9,966, of April 28<sup>th</sup>, 2000: Provisions on the prevention, control and inspection of pollution caused by the discharge of oil and other harmful or dangerous substances in waters under national jurisdiction other measures;
- ✓ Decree nº 4,136, of February 20<sup>th</sup>, 2002: Provisions on the specification of sanctions applicable to the violations of rules regarding the prevention, control and inspection of pollution caused by the release of oil and other harmful or dangerous substances in waters under national jurisdiction, provided in Law nº 9.966/2000, and other measures;
- ✓ SEMACE Ordinance nº 151, of November 25<sup>th</sup>, 2002: provisions on technical and administrative standards necessary for the execution and observation of self-monitoring of industrial liquid effluents. Amended by COEMA Resolution nº 02, February 2<sup>nd</sup>, 2017, which revoked paragraphs 1 and 3 of its Article 9;
- ✓ CONAMA Resolution nº 357, of March 17, 2005: provisions on the classification of water bodies and environmental guidelines for their classification, as well as conditions and standards for the discharge of effluents, and other measures. - Date of legislation: 03/17/2005 - Publication DOU nº 053, of 03/18/2005, pages 58-63 - Amended by Resolutions nº 370, of 2006, nº 397, of 2008, nº 410, of 2009, and nº 430, of 2011. Complemented by Resolution nº 393, 2007;
- ✓ CONAMA Resolution nº 430, of May 13<sup>th</sup>, 2011, which provides for the conditions and standards for effluent discharge, complements and amends CONAMA Resolution nº 357, of March 17<sup>th</sup>, 2005;
- ✓ State Law nº 14.844, of December 28<sup>th</sup>, 2010: provisions on the State Water Resources Policy and institutes the Integrated Water Resources Management System (SIGERH) in the State of Ceará, which is in charge of the Water Resource Management Company (COGERH). Repeals State Law nº 11.996, of July 24, 1992;
- ✓ COEMA Resolution nº 20, of October 28<sup>th</sup>, 2010: establishes procedures for the water use permission document requirement during the environmental licensing process promoted by SEMACE;
- ✓ Ordinance nº 2.914, of December 12, 2011: provisions on the control and surveillance procedures for the quality of water for human consumption and its

potability standards. Countersigned by Attachment XX of Consolidation Ordinance nº 5, of September 28, 2017;

- ✓ State Decree nº 31.076, of December 12<sup>th</sup>, 2012: regulates Articles 6 to 13 of Law nº 14.844 / 2010, in the part referring to the concession of the right to use water resources and to perform water interference works and services;
- ✓ State Decree nº 31.077, of December 12, 2012: regulates Law nº 14.844 / 2010, which gives provisions on the Water Resources State Policy, regarding groundwater conservation and protection in the State of Ceará, among other measures;
- ✓ CONERH Resolution nº 2, of April 9, 2013: approves the table of fees for the analysis and emission of the permission to use water resources and for the execution of works and services with water body interferences;
- ✓ State Decree nº 32.032, of September 2, 2016: provisions on the charges related to the use of superficial and underground water Resources in the State of Ceará or the Union, by delegation of competence, and makes other provisions;
- ✓ State Law nº 16.033, June 20, 2016: provisions on the water reuse policy;
- ✓ State Law nº 16.096, July 27, 2016: provisions on advertising of licenses for the use of water resources;
- ✓ State Law nº 16.103, September 2, 2016: creates the tariff chart for the use of water resources in water scarcity periods;
- ✓ CONERH Resolution nº 1, of January 10, 2017: sets the chart of fees for the analysis and emission of the permission to use water resources and to perform water interference works and services, among other measures;
- ✓ COEMA Resolution nº 02, of February 2, 2017: provisions on standards and conditions for the discharge of liquid effluents generated by polluting sources. Revokes SEMACE Ordinances nº 154, of July 22, 2002 and nº 111, of April 5, 2011, and changes SEMACE Ordinance nº 151, of November 25, 2002;
- ✓ State Decree nº 32.159, of February 24, 2017: amends Decree nº 32.044 / 2016 that regulates the tariff for the use of surface and underground water resources owned by the State of Ceará, in the form of an emergency water tax;
- ✓ State Decree nº 32.160, of February 24, 2017: provisions on charges for the use of surface and underground water resources owned by the State of Ceará or the Union by delegation of competence, among other measures.

The Water Use Permission System, contemplated by Decree nº 31.076/2012, as previously mentioned, is under SRH - Secretary of Water Resources responsibility, depending on the previous permission granted by this Secretary for the use of State public waters that involves supply intake and discharge of effluents into water bodies. The request for a water use permission must be sent to SRH by completion of the standard form provided by it, which must contain information on water destination, source, maximum intended flow, type of intake, equipment and complementary works, as well as additional information for request approval.

When the grant involves water supply works or services subject to a SRH Preliminary License (dams, transposition of raw water, derivation dam or regularization of water level and wells), as provided for in Decree nº 31.076 / 2012, it will be mandatory to present it,





making use of the data and information already obtained for licensing whenever possible.

According to the National Water Agency - ANA, the use of sea water (intake, work execution or discharge of effluents) is not subject to a permission by the Government, as it is not included in Article 12 of Law nº 9.433, of January 8<sup>th</sup>, 1997, which institutes the National Water Resources Policy.

## 8.8. Flora and Fauna Protection

- ✓ Law nº 5.197, of January 3<sup>rd</sup>, 1967: establishes fauna protection measures;
- ✓ Decree nº 89.336, of January 31<sup>st</sup>, 1984: provisions on ecological preservation land and relevant ecological interest areas, among other measures;
- ✓ Law nº 7.754, of April 14<sup>th</sup>, 1989: establishes measures for the protection of forest surrounding water springs;
- ✓ Law nº 6.902, of April 27<sup>th</sup>, 1991: provisions on the creation of ecological stations and areas of environmental protection;
- ✓ Law 12.488, of September 13<sup>th</sup>, 1995: provisions on the Ceará State Forest Policy;
- ✓ State Decree nº 24.221, of September 12<sup>th</sup>, 1996: regulates Law nº 12.488, of September 13<sup>th</sup>, 1995, which provides for the Ceará State Forest Policy;
- ✓ Federal Law nº 9.985, of July 18<sup>th</sup>, 2000 (regulated by Decree nº 4.430, of 08/22/02 and amended by Decree nº 5.566, of 10/26/05): regulates Art. 225, paragraph 1, items I, II, III and VII of the Federal Constitution, institutes the National System of Nature Conservation Units and establishes criteria and rules for the creation, implantation and management of conservation units;
- ✓ CONAMA Resolution nº 303, of March 20<sup>th</sup>, 2002: provisions on parameters, definitions and limits of Permanent Preservation Areas. It revoked CONAMA Resolution nº 004, of September 18<sup>th</sup>, 1985. It was amended by CONAMA Resolution nº 341/2003, which in turn was revoked by CONAMA Resolution nº 369/2006, regarding the use and occupation of dunes.
- ✓ Decree nº 4.340, August 22<sup>nd</sup>, 2002 (amended by Decrees nº 5.566/2005 and nº 6.848/2009): regulates several articles of Law nº 9.985/2000, including the specific article on environmental compensation;
- ✓ Decree nº 5.566, of October 26<sup>th</sup>, 2005: alters the text in the caput of Article 31 of Decree nº 4.340 / 2002, which regulates articles of Law nº 9.985 / 2000, which gives provisions on the National System of Nature Conservation Units - SNUC;
- ✓ CONAMA Resolution nº 369, of March 28, 2006: provisions on exceptional cases of public utility, social interest or low environmental impact, which enable the intervention or removal of vegetation in a Permanent Preservation Area - APP;
- ✓ Decree nº 6.848, of May 14, 2009: alters and adds provisions to Decree nº 4.340 / 2002, to regulate environmental compensation. Establishes a minimum percentage of 0.0% and a maximum of 0.5% for environmental compensation, with the calculation made over the total costs expected for enterprise implementation, after deducting the investments related to the plans, projects and programs required for environmental impact licensing, as well as the charges and costs incurred on the project's financing;



- ✓ CONAMA Resolution n° 428, of December 17, 2010: disciplines, within the scope of environmental licensing, the authorization of the organ responsible for Conservation Unit (UC) administration, which is discussed in Paragraph 3 of Article 36 of Law n° 9.985 / 2000, as well as the knowledge of the organ responsible for UC administration in the case of environmental licensing of undertakings not subject to EIA-RIMA and other measures ". Amended by CONAMA Resolution n° 473/2015 (amends §2 of art. 1 and item III of article 5.) Revokes CONAMA Resolutions n° 10/1988, n° 11/1987, n° 12/1988, n° 13/1990 and amends Resolutions n° 347/2004 and 378/2006;
- ✓ State Law n° 14.950, of June 27, 2011: institutes the Ceará State System of Preservation Units - SEUC, among other measures;
- ✓ Law n° 12.651, of May 25, 2012: provisions on the protection of native vegetation, among other measures. Amends Laws 6.938 / 1981, 9.393 / 1996 and 11.428 / 2006. Repeals Laws 4.771 / 1965 and 7.754 / 1989 and Provisional Measure n° 2.166-67 / 2001;
- ✓ Law n° 12.727, of October 17, 2012: amends Law n° 12.651, of May 25, 2012, which discourses about the protection of native vegetation. Amends Laws 6.938 / 1981, 9.393 / 1996 and 11.428 / 2006. Revokes Laws 4.771 / 1965 and 7.754 / 1989, Provisional Measure 2.166-67 / 2001, Item 22 of Section II of Article 167 of Law n° 6.015 / 1973 and Paragraph 2 of Article 4 of Law n° 12.651 / 2012;
- ✓ Law n° 9.949, of December 13, 2012: declares the gray porpoises of the *Sotalia guianensis* species as a natural patrimony of the Municipality of Fortaleza, among other measures;
- ✓ CONAMA Resolution n° 473, of December 14, 2015: extends the deadlines provided for in Paragraph 2 of Article 1 and Item III of Article 5 of CONAMA Resolution n° 428/2010;
- ✓ Law n° 16.810, January 8, 2019: amends provision of Law n° 16.064, of July 25, 2016, which establishes, within the scope of the State of Ceará, the limits determined in art. 4, item ii, line "b", of Law n° 12.651, of May 25, 2012, which discourses about native vegetation protection, establishing criteria for the determination of permanent preservation areas located in urban perimeters.

## 8.9. Air Quality and Noise

- ✓ CONAMA Resolution n° 005, of June 15, 1989: provisions on the National Air Pollution Control Program - PRONAR. Complemented by CONAMA Resolutions n° 03/1990, n° 08/1990 and n° 436/2011;
- ✓ CONAMA Resolution n° 01, March 1990: provisions on noise emission criteria and standards for industrial activities;
- ✓ CONAMA Resolution n° 08, of December 6, 1990: provisions on air quality standards from PRONAR.
- ✓ CONAMA Resolution n° 491, of November 19, 2018: Provisions on air quality standards.

## 8.10. Solid Waste Disposal Control

- ✓ CONAMA Resolution n° 307, of July 5, 2002: establishes guidelines, criteria and procedures for the management of construction waste;
- ✓ CONAMA Resolution n° 313, of October 29, 2002: provisions on the National Inventory of Solid Industrial Waste;
- ✓ CONAMA Resolution n° 362, of June 23, 2005: collection and disposal of used or contaminated lubricating oil;
- ✓ CONAMA Resolution n° 358, of April 29, 2005: provisions on the treatment and final disposal of waste from health services and other measures;
- ✓ Federal Law n° 12,305, of August 2, 2010: institutes the National Solid Waste Policy. Amends Law n° 9,605, of February 12, 1998 among other measures;
- ✓ Resolution n° 448, of January 18, 2012: changes the Arts. 2nd, 4th, 5th, 6th, 8th, 9th, 10th and 11th of CONAMA Resolution n° 307/2002;
- ✓ Normative Instruction n° 13, of December 18, 2012: provisions on the Brazilian List of Solid Waste, which will be used by the Federal Technical Registry of Potentially Polluting Activities or Using Environmental Resources, by the Federal Technical Registry of Environmental Defense Activities and Instruments and by the National Registry of Hazardous Waste Operators, as well as by future IBAMA computerized systems that may deal with solid waste.
- ✓ Normative Instruction IBAMA n° 01, of January 25<sup>th</sup>, 2013: regulates the National Registry of Hazardous Waste Operators - CNORP and makes other provisions;
- ✓ CONAMA Resolution n° 469, of July 29<sup>th</sup>, 2015: amends CONAMA Resolution n° 307/2002, which establishes guidelines, criteria and procedures for the management of construction waste;
- ✓ Fortaleza Municipal Law n° 10,340, of April 28, 2015: establishes norms and responsibility for the handling of waste produced in large amounts, or of specific natures, among other measures. Amends Articles 1 to 33 of Law n° 8,408, of December 24<sup>th</sup>, 1999, among other measures.
- ✓ State Law n° 16,032, of June 20<sup>th</sup>, 2016: institutes the State Policy for Solid Waste within the state of Ceará. Repeals State Law n° 13,103, of January 24<sup>th</sup>, 2001.

## **8.11. Soil Use and Occupation**

- ✓ Law n° 6.766, of December 19, 1979: provisions on the subdivision of urban land, among other measures;
- ✓ Complementary Law n° 062, of February 2, 2009: establishes the Participative Master Plan of the Municipality of Fortaleza – PDPFOR, among other measures.
- ✓ Complementary Law n° 236, of August 11, 2017: deals with the regulation of the Participative Master Plan of the Municipality of Fortaleza - PDPFOR regarding land subdivision, use and occupation;
- ✓ Complementary Law n° 0250, of July 3, 2018: modifies Complementary Law n° 062, of February 2, 2009, that institutes the Participative Master Plan of the Municipality of Fortaleza. It transforms Urban Requalification Zone 2 - ZRU 2, corresponding to the old Jangurussu landfill into an Environmental Recovery Zone (ZRA Jangurussu)

and parts of the Environmental Interest Zones - ZIA Cocó and ZIA Praia do Futuro into an Environmental Preservation Area *Dunas da Praia do Futuro / Cidade 2000* (ZPA 4 - *Dunas Praia do Futuro / Cidade 2000*) in the form defined in Attachment 04 of this law.

## 8.12. Coastal Management

- ✓ Law 7.661, of May 16<sup>th</sup>, 1988: determines the integrated planning of the use of natural resources, with the aim to organize the occupation of coastal spaces (National Coastal Management Plan Law);
- ✓ Decree n° 5.300 of December 7, 2004: regulates Law n° 7.661, of May 16, 1988, which institutes the National Coastal Management Plan - PNGC, determines rules for the use and occupation of coastal zone areas and establishes criteria for the management of seafront, among other arrangements;
- ✓ COEMA Resolution n° 01, of February 24, 2005: provisions about the geoenvironmental units and geographical accidents of the Coastal Zone of the State of Ceará for purposes of coastal management and environmental licensing within SEMACE's scope, among other measures;
- ✓ Law n° 13.796, of June 30, 2006: institutes the State Policy for Coastal Management, including the set of definitions, objective principles, guidelines, instruments and activities aimed at conditioning governmental action and society regarding the sustainable use of environmental resources in the coastal area of the State of Ceará.
- ✓ Ordinance n° 461, of December 13<sup>th</sup>, 2018: approves the list of municipalities covered by the land strip of the Brazilian Coastal Zone.
- ✓ Ordinance n° 76, of March 27<sup>th</sup>, 2018: institutes the Coastline Conservation National Program.

## 8.13. Historical and Cultural Patrimony Protection

- ✓ Decree-Law n° 25, of November 30<sup>th</sup>, 1937: regulates the protection of the National Historical Heritage, including natural monuments, as well as sites and landscapes that should be preserved and protected for their remarkability, endowed by nature or managed by human action;
- ✓ Decree-Law n° 4.146, of March 4, 1942: provides for the protection of fossiliferous deposits;
- ✓ Law n° 3.924, of July 26, 1961: provisions on the protection of archaeological and prehistoric monuments;
- ✓ Law n° 7.347, of July 24<sup>th</sup>, 1985: disciplines the public civil action of liability for damages caused to the environment, the consumer, goods and rights of artistic, aesthetic, historical, touristic and landscape value, among other measures;
- ✓ SPHAN Ordinance n° 07, of December 1, 1988: establishes the necessary procedures for research and excavations in archaeological sites;
- ✓ IPHAN Ordinance n° 230, of December 17<sup>th</sup>, 2002: establishes the procedures for the attainment of environmental licenses in reference to the assessment and monitoring of archaeological research in the country;





- ✓ DNPM Ordinance nº 542, of December 18<sup>th</sup>, 2014: establishes the procedures for prior authorization and communication for fossil extraction;
- ✓ Normative Instruction IPHAN nº 001, of March 25<sup>th</sup>, 2015: establishes administrative procedures to be observed by the National Historical and Artistic Heritage Institute in the environmental licensing processes in which it participates;
- ✓ PALMARES Normative Instruction nº 001, of March 25<sup>th</sup>, 2015: establishes the administrative procedures to be observed by *Fundação Cultural Palmares* in the environmental licensing processes in which it participates;
- ✓ FUNAI Normative Instruction nº 2, of March 27<sup>th</sup>, 2015: establishes administrative procedures to be observed by the *Fundação Nacional do Índio - FUNAI* in the environmental licensing processes in which it participates.

The penalty for non-compliance with the legislation pertaining to the aforementioned prehistoric heritage is provided for in the Brazilian Penal Code (Special part, Title II - Crimes against heritage, Chapter IV - Damage).

## 8.14. Federal Patrimony

- ✓ Decree Law nº 9.760, of September 5<sup>th</sup>, 1946: provisions on Union properties, among other measures. It includes, among Union property, marine land and its additions;
- ✓ Law nº 9.636, of May 15, 1998: provisions on the regularization, administration, approval and sale of real estate owned by the Union. Amends provisions of Decree-Laws nº 9.760 / 1946, and nº 2.398, of December 21, 1987, regulates § 2 of art. 49 of the Transitional Constitutional Provisions Act, and makes other provisions. Revokes articles 65, 66, 125, 126 and 133 and items 5, 8, 9 and 10 of art. 105 of Decree-Law nº 9.670, of September 5, 1946; Decree-Law nº 178, of February 16<sup>th</sup>, 1967; Article 195 of Decree-Law nº 200, of February 25<sup>th</sup>, 1967; art. 4 of Decree-Law nº 1.561, of July 13<sup>th</sup>, 1977, Law nº 6.609, of December 7, 1978; Article 90 of Law nº 7.450, of December 23, 1985; art. 4 of Decree-Law 2.398, of December 21, 1987 and Law 9.253, of December 28<sup>th</sup>, 1995;
- ✓ Law nº 11.481, of May 31<sup>st</sup>, 2007: alters the text in provisions of Law nº 9.636, of May 15, 1998, nº 8.666, of June 21, 1993, nº 11.124, of June 16, 2005, nº 10.406, of January 10, 2002 - Civil Code, nº 9.514, of November 20, 1997, and nº 6.015, of December 31, 1973, and Decree-Laws nº 9.760, of September 5, 1946, nº 271, of February 28, 1967, nº 1.876, of July 15, 1981, and nº 2.398, of December 21, 1987. It provides measures aimed at land tenure regularization for social interests in Union property, among other measures. Revokes articles 6, 7 and 8 of Decree-Law nº 9.760 / 1946; art. 3 of Decree-Law nº 1.876 / 1981 and art. 93 of Law nº 7.450 / 1985;
- ✓ SPU Ordinance 404, of December 28, 2012: establishes rules and procedures for processes aiming at the concession of physical spaces in public waters and sets parameters for the calculation of the due public tax, as retribution to the Union.
- ✓ Law nº 13.240, of December 30, 2015 - regulates the administration, sale and transfer of Federal Government property management and its use for the

constitution of funds; amends Law nº 9.636, of May 15, 1998, and Decree-Law nº 3.438, of July 17, 1941, nº 9.760, of September 5, 1946, nº 271, of February 28, 1967, and nº 2.398, of December 21, 1987 and revokes the provisions of Law nº 13.139, of June 26, 2015;

- ✓ Law nº 13.465, of June 11, 2017: provisions on rural and urban land regularization, the acquittal of credits granted for land reform settlers and land regularization within the Legal Amazon. It institutes mechanisms to improve the efficiency of Federal Government property sale procedure. Amends Laws nº 8.629, of February 25, 1993, nº 13.001, of June 20, 2014, nº 11.952, of June 25, 2009, nº 13.340, of September 28, 2016, nº 8.666, of June 21, 1993, nº 6.015, of December 31, 1973, nº 12.512, of October 14, 2011, nº 10.406, of January 10, 2002 (Civil Code), nº 13.105, of March 16, 2015 (Code of Civil Procedure), nº 11.977, of July 7, 2009, nº 9.514, of November 20, 1997, nº 11.124, of June 16, 2005, nº 6.766, of December 19, 1979, nº 10.257, of July 10, 2001, nº 12.651, of May 25, 2012, nº 13.240, of December 30, 2015, nº 9.636, of May 15, 1998, nº 8.036, of May 11, 1990, nº 13.139, of June 26, 2015, nº 11.483, of May 31, 2007 and nº 12.712, of August 30, 2012, Provisional Measure nº 2.220, of September 4, 2001 and Decree-Laws nº 2.398, of December 21, 1987, nº 1.876, of July 15, 1981, nº 9.760, of September 5, 1946 and nº 3.365, of June 21, 1941. Revokes provisions of the Complementary Law no 76, of July 6, 1993 and Law nº 13.347, of October 10, 2016 among other measures.

Conceptually, marine land is an area at a depth of up to 33 (thirty-three) meters, measured horizontally in its coastal part, from the Mean Lower Low Water Mark (MLLW) of 1831, and classified in the following situations: a) Those located on land, on the seacoast and banks of rivers and lagoons, as far as tidal influence can be of influence, and b) Those around islands located in areas where the tidal influence can be felt.

They are land with water sources that have been created, naturally or artificially, besides the sea, rivers or lagoons, along maritime land. In other words, they are portions of land that were previously covered by the sea (ponds) or mangroves, beaches or marine canals, which were embanked after the reference year to determine the MLLW. The Mean Lower Low Water Mark is an administrative procedure, declaratory of ownership, defined in Decree nº 9.760 / 1946. Such delimitation is carried out by the Union Patrimony Secretary (SPU), through technical studies based on plants, maps, historical documents, wave and tidal data.

It should be noted that the rights to make use of the Union's property, whether composed of buildings, land, water or public forests, can be granted by the Union's Heritage Secretary (SPU) to public or private agents, aiming to promote the social and environmental function of this heritage site, in harmony with the strategic programs for the nation.

There are different instruments for the execution of this transfer of rights (tenure, alienation, authorization for use, assignment of use, free of charge, designation of onerous use, assignment under special conditions, temporary designation, etc.). The decision depends on the potential of each property for the city where it is inserted, and on public interest in the use proposed by public and private agents.



In the specific case of the Desalination Plant in the Metropolitan Region of Fortaleza, where the 1831 Mean Lower Low Water Mark and the Coastal Land Line are demarcated, it reveals that the development area, located at Praia do Futuro I, named Praia do Futuro IA, is not inserted in a marine land area, but the plant's intake and discharge structures shall occupy underground spaces owned by the Union; thus, SPU authorization is required, as determined by Law n° 13,465 / 2017 described below.

"Art. 18. ....

§ 8º. A destination that has as beneficiaries public or private entities, concessionaires or delegates for the provision of intake, treatment and drinking water distribution and sanitary sewage services and the final destination of solid waste may be carried out without a bidding process and without cost.

§ 9º. In the events provided in § 8 of this Article, if there is underground and underwater piping that allows parallel use, the destination shall be granted through authorization of passage, in the terms of the act of the Secretariat of the Patrimony of the Union (SPU)." (NR)

## 8.15. Maritime Safety

- ✓ Law n° 9,537, of December 11<sup>th</sup>, 1997: provisions about the safety of waterway traffic in waters under national jurisdiction, among other measures;
- ✓ Decree-Law n° 2,596, of May 18<sup>th</sup>, 1998: regulates Law n° 9,537, of December 11, 1997, which gives provisions on waterway traffic safety in waters under national jurisdiction;
- ✓ Law 10,233, of June 5<sup>th</sup>, 2001: provisions on water and land transport restructuring, creates the National Transport Policy Integration Council, the National Land Transport Agency, the National Water Transport Agency and the National Department of Transport Infrastructure, among other measures;
- ✓ NORMAM-11/DPC – Brazilian Navy (1st Review in 2017): establishes procedures to standardize the request for a Report to enable the execution of works under, on and around the margins of Brazilian Jurisdictional Waters (AJB), regarding the waterway space attainment and navigation security;
- ✓ Ordinance n° 308/DPC, of October 30, 2017: approves the Maritime Authority's Standards for works, dredging, research and mineral mining under, over and around the margins of Brazilian Jurisdictional Waters – NORMAM - 11/DPC (1st Revision - 2017).

The performance of public or private works (hereinafter referred to as "works") located under, on and around the margins of Brazilian Jurisdictional Waters, shall depend on the emission of a Maritime Authority Report issued through the Port Authority, and will not exempt the interested party from other administrative and legal obligations before other bodies responsible for controlling the activity in question, when applicable, whether at the federal, state or municipal level.

Works to be executed on rivers, lakes, lagoons, dams and other water bodies considered non-navigable roads or in non-navigable waterway sections are exempt from obtaining this report. In this case, the requests shall be responded by the Maritime Authority as “exempt from report”. In some non-navigable or non-mapped sections, the establishment of warning signs or special markings shall be done by those responsible to alert boat drivers, who eventually makes use of water bodies, about the existing dangers and obstacles. The party interested in executing works in Brazilian Jurisdictional Waters may schedule a previous meeting with the Port Authority to clarify questions and obtain additional information on the procedure to be followed before filing the documentation required in NORMAM-11 / DPC.

In the specific case of desalination plant works, where discharge through a marine outfall is expected in Brazilian Jurisdictional Waters, the entrepreneur must submit, to the Captaincy of Ports, that has jurisdiction over the work location, two original copies of the following documents:

- a) Application with the Captaincy of Ports, Delegate or Agent (according to the model contained in Attachment 2-B of NORMAM-11 / DPC). The application must be signed by the owner of the works or a legal representative, and in this case, a copy of the power of attorney or Social Contract (in the case of a company) must be attached;
- b) Location plan, on paper;
- c) Situation plan, on paper, and if possible, in digital format compatible with CAD systems (DXF, DWG, etc.);
- d) Descriptive memorial of the intended work, containing the description of the adopted signage system, if applicable, as recommended in the Regulations of the Maritime Authority for Navigation Aid - NORMAM-17 / DHN;
- e) Annotation of Technical Responsibility (ART) of the Engineers responsible for the work that the interested party intends to execute; and
- f) Federal Fee Collection Document (GRU) with the due payment receipt (simple copy), in the amounts set out in Attachment 2-A of NORMAM-11 / DPC, in reference to the process analysis service and emission of a report and/or site inspection in Brazilian Juridical Waters, if the Port Authority deems it necessary.

In this case, the GRU and the aforementioned payment receipt referring to the work inspection must be presented by the interested party to the Port Authority only when the need for inspection is confirmed, so that it can be attached to the process. After process analysis, the application will be sent back to the interested party with the Maritime Authority's report. The party shall meet, in the event of a favorable opinion, the following requirements, in addition to others possibly established:

- ✓ Inform the start and end of services to the Captaincy of Ports for evaluation and disclosure in Notices to Seafarers and/or Radio Nautical Notices. It is important to note that only works under and over water in progress, located in areas mapped by the Hydrography and Navigation Directorate - DHN and with dimensions greater



than 20m, shall be an object of dissemination in the Nautical Radio Notices and/or Navigator Notice; and

- ✓ Present to the Captaincy of Ports, after the end of the works, the Final Situation Plan in digital media and georeferenced in relation to the nautical chart, in a format compatible with CAD systems (DXF or DWG), exclusively for works with dimensions greater than 20 m, according to the instructions in Attachment 1-A of NORMAM-11 / DPC. The Final Situation Plan with the submarine pipeline trajectory under the body of water, must contain the coordinates of the points next to the margins and the inflection points, if applicable.

Both the location and the situation plans and the descriptive memorial must observe the definitions contained in Chapter 1 of NORMAM-11 / DPC. The scale to be used in the plants must be sufficient to allow an easy and clear interpretation of the information represented. These documents must be signed by a Mapping Engineer, Geodesy and Topography Engineer, Geographer Engineer, Civil Engineer, Electrical Engineer, Electronic Engineer, Computer Engineer, Control and Automation Engineer, Telecommunications Engineer, Mechanical Engineer and a Metallurgical Engineer or Materials Engineer, according to the nature of the work. The full name of the person in charge and his/her registration with CREA must be included, and no corrections may be made to alter its originality.

The Port Captaincy is allowed to request additional information and documents from the entrepreneur that may be identified as necessary for its report conclusion, as well as the execution of inspections at the construction site.

## 8.16. Other Legal Devices

At the municipal level, the organic law of the municipality of Fortaleza appears as a legal provision, since the enterprise is based within its territory. The city's Participative Master Plan (PDPFOR) and its respective basic legislation should also be consulted. It is also worth mentioning, although not constituting legal provisions, the following normative instruments:

- ✓ Integrated Management Plan for the Coast of the Municipality of Fortaleza, prepared around 2006, through an agreement signed by the Environment Ministry with the Government of the State of Ceará and the Municipality of Fortaleza. Currently, reviews and updates of this plan are carried out by the Fortaleza City Hall;
- ✓ Complementary Law nº 0270, of August 2, 2019, which discourses about the City Code and other provisions. (It revokes the contrary provisions, and in particular, Municipal Law nº 5,530 / 1981 - Code of Works and Standards, Article 18 of Municipal Law nº 10,350 / 2015 and Municipal Law nº 10,741 / 2018).
- ✓ Fortaleza 2040 Plan prepared in mid-2017 by the Planning Institute of Fortaleza - IPLANFOR;

There are no conflicts involving project implementation and other government programs; on the contrary, the work constitutes an action by CAGECE, which aims to overcome the scarcity of water resources in the municipality of Fortaleza, guaranteeing its economic

development and an improvement in the quality of life of its inhabitants. The project is compatible with the Water Resources Management Policy implemented by the State Government.

The project's evaluation, considering its conception, objectives, components and implementation, indicates that, in general, there must be compliance with the legal provisions in force, since it is being developed taking into account environmental issues since its conception.

However, the need to proceed with the desalination plant's environmental licensing is emphasized, in addition to the implementation of works that consider the various environmental laws related to the enterprise. It is also necessary to consult with the Municipal Secretary of Urbanism and Environment – SEUMA, to make the proposed project compatible with the restrictions recommended by the Coastal Management Plan and the Fortaleza 2040 Plan for the Praia do Futuro area. The project, according to PDPFOR, is located in an Environmental Interest Zone - Praia do Futuro, which was also established as a technological center. A possibility to adapt the project to the urban dynamism of Fortaleza would be the adoption of urban and architectural parameters compatible with the proposed planning for the region surrounding the project area, together an environmental education program, which must include opening of the plant's facilities for visitation. Additionally, it is suggested that the public authorities, in partnership with the private sector, create a dune protection area, aiming to stop real estate speculation around the area proposed for the desalination plant, and this area can be conceived as an urban park for recreational use by the local population, according to recommendations given in Technical Report 02 / DIPLA / 2019 of IPLANFOR (ATTACHMENT III).

Due to the nature of this project, compliance with IPHAN Normative Instruction nº 001/2015 must be observed, contemplating the preparation of an Activity Characterization Form - FCA, and should probably be classified by IPHAN as Level III (medium and high interference on the prevailing soil conditions, large areas of intervention, with limited or nonexistent flexibility for site and layout alterations), for which it is required to prepare an Archaeological Heritage Impact Assessment Project, to be previously authorized by IPHAN. However, IPHAN shall be responsible for this assessment, considering all aspects described in the project, its interferences and extension.

Regarding interferences with traditional populations, consultations with FUNAI and Fundação Cultural Palmares to be carried out by SEMACE shall be a mere protocol, since the plant's surroundings are not home to indigenous or traditional communities.

The consultations to be carried out by SEMACE with the bodies responsible for the administration of conservation units in the municipality of Fortaleza, too, will be a mere protocol, since the nearest conservation unit is located within a 3km radius, called Parque Estadual do Cocó.

In short, it can be said that the proposed project meets the precepts recommended in relevant environmental legislation for this type of work, missing only the implementation mitigation and environmental control measures recommended in the scope of this study and in more detail in the EIA/RIMA.

## 9. Environmental Licensing – Main Licenses and Authorizations

The Environmental License, as defined in CONAMA Resolution nº 237/97, is the “administrative act by which the competent environmental agency establishes the conditions, restrictions and measures of environmental control that must be obeyed by the entrepreneur, individual or legal entity, to locate, install, expand and operate enterprises or activities that use environmental resources considered effective or potentially polluting, or those that, in any form, may cause environmental degradation”.

Environmental licensing is the instrument that formalizes the entrepreneur’s proactive role, guaranteeing license holders public recognition that their activities will be carried out with an aim to promote environmental quality and sustainability. Environmental licensing in Brazil takes place in three distinct phases, relevant to project planning, implementation and operation, as defined in Article 8 of CONAMA Resolution nº 237/97.

It thus covers the emission of three different types of licenses, which establish conditions and measures for environmental control, which must be observed by the entrepreneur. It also includes procedures for monitoring the licenses already granted, through periodic inspection and verification carried out by the environmental agencies. The environmental licenses established in Decree nº 99.274 / 90, which regulates the National Environment Policy (Law nº 6.938 / 81), and detailed in CONAMA Resolution nº 237/97 are:

### 9.1. Preliminary License – LP

It constitutes the first phase of environmental licensing, and must be requested in the development or activity’s preliminary planning phase. It is granted through the analysis and approval of the development’s location and design, attesting its environmental viability and establishing basic requirements and conditions to be fulfilled in the next licensing stages.

It also requires compliance with the municipal, state or federal regulations for the area covered by the project and/or activity. It is emphasized that, at this stage of licensing, the beginning of works is not yet authorized.

In projects with a significant environmental impact, an Environmental Impact Study – *EIA*, and the corresponding Environmental Impact Report - *RIMA* will be required, as conditions for attainment of the Preliminary License. These instruments were regularized by CONAMA Resolution nr. 001/86 and Resolution nr. 237/97.

As it is a process subject to the preparation an EIA / RIMA, a public hearing must be held, as recommended by Conama Resolution nº 09/1987. The hearing must happen 45 days after the EIA / RIMA is made available for public consultation.

### 9.2. Installation license – LI

Corresponds to the second phase of environmental licensing. It is granted through the elaboration, analysis and approval of the Executive Projects, plans for environmental control measures and the monitoring recommended in the Environmental Studies developed.

It authorizes the installation and operation of the project or activity according to the specifications contained in the approved plans, programs and projects, including the environmental control measures and other established conditions. It is noteworthy that, due to the alteration to COEMA Resolution nr. 02/2019, the installation and operation of the project is not authorized in this licensing stage.

### **9.3. Operation license – LO**

It authorizes the activity or project operation renewal, after verification of effective compliance with the conditions required in previous licenses (LP and LI), as well as the proper operation of the environmental control measures, pollution control equipment and other conditions determined for operation.

Licenses may be issued separately or successively, according to the nature, characteristics and stage of the project or activity. CONAMA shall define, when necessary, specific environmental licenses, observing, also in this case, the nature, characteristics and peculiarities of the activity or project, as well as the compatibility of the licensing process with the planning, implementation and operation stages.

It must be emphasized that the environmental licensing does not exempt the entrepreneur or agent responsible for the activity from obtaining other legally required licenses, as determined by Law nr. 6.938/81, in Article 10, with the text provided by Law nr. 7.804/89.

#### **Legal Terms**

Licenses may be issued separately or successively, according to the nature, characteristics and phase of the enterprise or activity. CONAMA shall define, when necessary, specific environmental licenses, also observing the nature, characteristics and peculiarities of the activity or enterprise, as well as compatibility of the licensing process with the planning, implementation and operational phases.

The time periods for the emission and expiration of each license may vary according to the type of license and current federal and state law. Article 18 of CONAMA Resolution nr. 237/1997 already establishes guidelines and considerations for the determination of validity periods for licenses in general. In the State of Ceará, however, COEMA Resolution nr. 02, of June 11<sup>th</sup>, 2019 establishes the deadlines for license emission, as described below:

Preliminary License - LP: The validity term for the License must be, at least, what is established by the chronogram for the elaboration of the plans, programs and projects related to the project or activity; however, it cannot exceed 5 (five) years.

It should also be noted that environmental licensing does not exempt the entrepreneur or person responsible for the activity from obtaining other legally required licenses, as determined by Article 10 of Law n° 6.938/81, with the text given by Law n° 7.804/89.



The terms for issuing and validating each license may vary according to the type of license and current federal and state rules. Article 18 of CONAMA Resolution n° 237/1997 already establishes guidelines and considerations that determine term periods for all licenses.

In the case of the State of Ceará, however, endorsed by the Environmental State Council - COEMA (COEMA Resolution n° 02/2019), other types of environmental licenses are provided, with maintenance of the initial Preliminary License and, subsequently, the Installation and Operation License, denominated LIO. According to COEMA Resolution n° 02/2019, the LIO will be granted after emission of the Preliminary License, for implementation of agricultural projects, irrigation, cultivation of flowers and ornamental plants (floriculture), cultivation of medicinal, aromatic and condiment plants, fish farming in tanks and small scale shrimp farming under the terms of COEMA Resolution n° 12/2002, as well as within the parameters defined in Attachment III of this Resolution. The license validity period shall be established in the operational schedule, not exceeding a 6-year (six) period.

It is worth noting that the LIO phase will contemplate the implementation and operation stages of the enterprise simultaneously. To renew this license, if the work is already completed, the enterprise will be required to renew its operating license.

Licensing terms were defined in the terms of Ordinance n° 104/2019, according to the size and the pollutant-degrading potential of the activity or enterprise, as specified below:

Figure 13 - Environmental License Validity Terms Under SEMACE.

ANEXO I  
Prazos, em anos, das licenças ambientais

	LP1	LI2	LPI3	LIO4	LAU5	LIAM6	LO7
BAIXO	5	6	6	6	6	5	10
MÉDIO	5	5	5	5	5	5	8
ALTO	4	4	4	4	4	4	6

<sup>1</sup>Licença Prévia / <sup>2</sup>Licença de Instalação / <sup>3</sup>Licença Prévia e de Instalação / <sup>4</sup>Licença de Instalação e Operação / <sup>5</sup>Licença Ambiental Única / <sup>6</sup>Licença de Instalação e Ampliação / <sup>7</sup>Licença de Operação.

Prazos, em anos, estabelecidos pela Lei Estadual n° 16.605, de 18 de julho de 2018.

LP1	LI2	LIO3	LIAM4	LIAR5
3	3	5	5	3

<sup>1</sup>Licença Prévia / <sup>2</sup>Licença de Instalação / <sup>3</sup>Licença de Instalação e Operação / <sup>4</sup>Licença de Instalação e Ampliação / <sup>5</sup>Licença de Instalação e Ampliação para Readequação.

Source: SEMACE, 2019

Thus, the Preliminary License and the Installation and Operation License - LIO will be valid for up to 05 (five) years, while the Operation License shall be valid for a period up to 08 (eight) years.

As for the analysis deadlines for license application by the environmental agency, SEMACE follows the provisions of CONAMA Resolution n° 237/1997, Article 14, which states that: "The competent environmental agency may establish different analysis periods for each license modality, depending on the particularities of the activity or enterprise, as well as for the formulation of complementary requirements, provided that the maximum period of 6 (six) months from application filing until its approval or rejection is respected".



There is an exception for cases that require an EIA / RIMA and/or Public Hearings, when the maximum time period shall be up to 12 (twelve) months. It is worth mentioning that article 12 of COEMA Resolution nº 02, of April 11<sup>th</sup>, 2019 also reports these deadlines.

The term period for license application analysis will be suspended when SEMACE requests complementary environmental studies or clarifications by the entrepreneur, with the count returning from the date after the requested items are delivered. The term predicted for delivery of the complementary environmental studies and/or clarifications by the entrepreneur shall depend upon the nature of the request, with its determination under the Environmental Agency's criteria. It should be noted that failure to meet the stipulated deadlines will result in process abandonment, which will not prevent the submission of a new license application, which must obey the established procedures, upon new payment of the analysis expenses.

In the environmental licensing process, SEMACE shall consider the technical examination performed by the municipal environmental agency, in which the activity or enterprise is located, as well as, when appropriate, the opinion of the other competent organs of the Union, State and Municipality involved in the licensing process.

Therefore, the environmental licensing procedure must also contain, mandatorily, the municipality's authorization declaring the conformity of the location and type of project or activity with current legislation for soil use and urban occupation.

Furthermore, according to IPHAN Normative Instruction nr. 001, from March 25<sup>th</sup>, 2015, for environmental licensing processes conducted by a federal, state or municipal environmental agency, the National Historical and Artistic Heritage Institute - IPHAN should be previously consulted, with the aim to stop the project or activity in the licensing process from impacting or destroying historical, cultural and archaeological assets.

The project's licensing process with IPHAN starts with the completion the Activity Characterization Form (FCA), which must be submitted to this institute's analysis, serving as a parameter for the project's classification (Levels I through IV and Not Applicable) and definition of the archaeological studies to be developed. Only projects classified under levels III or IV require the execution of archaeological studies and the establishment of an effective licensing process with IPHAN.

To obtain the Preliminary License for projects classified at levels III and IV, the Archaeological Heritage Impact Evaluation Project (research project) is required. Approval by IPHAN is a precondition for the subsequent elaboration of the Archaeological Heritage Impact Evaluation Report. The Archaeological Rescue Project must be carried out according to the results obtained in this last report, and it can be carried out before or simultaneously with the works. In addition to these projects, the work should be monitored by an archaeologist, authorized by IPHAN. The only requirement in the specific case of projects classified as Level I and II, which would be the first case, is the presentation of the Entrepreneur Commitment Agreement - *TCE*, whereas archaeological monitoring for the project implementation works is required in the second case.

A consultation with the Native Indian National Foundation - FUNAI, in compliance with the legislation in force (Normative Instruction FUNAI nr. 02/2015), which also requires an Activity Characterization Form (FCA) and its referral to the aforementioned institution by the competent environmental agency, in the desalination plant's case, is a mere formality, since the IMPLEMENTATION AREA does not have indigenous communities in its territory. A consultation with the Palmares Cultural Foundation, also required by the current legislation (PALMARES Normative Instruction no 01/2015), is under the same situation, representing a mere convention, since the project area does not have any *quilombola* communities in its territory.

## **10. Environmental Diagnosis of Areas Influenced by the Project**

### **10.1. Identification of the Project's Areas of Influence**

For the identification of areas influenced by the project, factors such as geographical and environmental characteristics of the planned location, nature, characteristics, size and potential for environmental modification, relevant land use and occupation and environmental legislation were considered.

The Indirect Influence Area (AII) covers all areas indirectly affected by the implementation and operation of the proposed venture. Its socioeconomic environment is the municipality of Fortaleza, where the enterprise's works shall be partly distributed, increasing the demand for jobs, construction materials and economic development, provided by the enterprise's operation (job offers, regular water supply, attraction of investments, etc.).

For physical and biotic means, the AII territory encompassed the entire seafront area (from the coastline to the supratidal zone), comprised between Titanzinho jetty and the Cocó River mouth. Its aquatic limit considered the entire Praia do Futuro coast to the Cocó River mouth.

As for the physical and biotic means of the Direct Influence Area, it is comprised by the irregularly shaped land plot located at Rua Comendador Francisco di Ângelo, on the corner with Rua Oliveira Filho, with an area of 2.29 ha. Finally, its marine environment covers the Praia do Futuro area in a linear direction of approximately 1.5 km in the plan, encompassing the intake and effluent discharge systems.

The socioeconomic Direct Influence Area shall mainly comprise the Praia do Futuro I, De Lourdes and Vicente Pinzón districts, due to their greater proximity to the desalination plant area. It also considers the stretches surrounding main line interconnection to the Cagece system, which intercept, in addition to the previously mentioned districts, the Papicu, Aldeota, Cocó and Dionísio Torres areas.

The Directly Affected Area, on the other hand, is the land area where relevant engineering works for the desalination plant shall be executed, including interconnections to the Cagece system and the intake and the brine discharge outfall systems to be developed in the Praia do Futuro marine environment. It also covers the construction sites.

## 10.2. Characteristic of the Enterprise's Areas of Influence

### 10.2.1. Physical – Terrestrial Environments

#### 10.2.1.1 Geological and Geomorphological Aspects

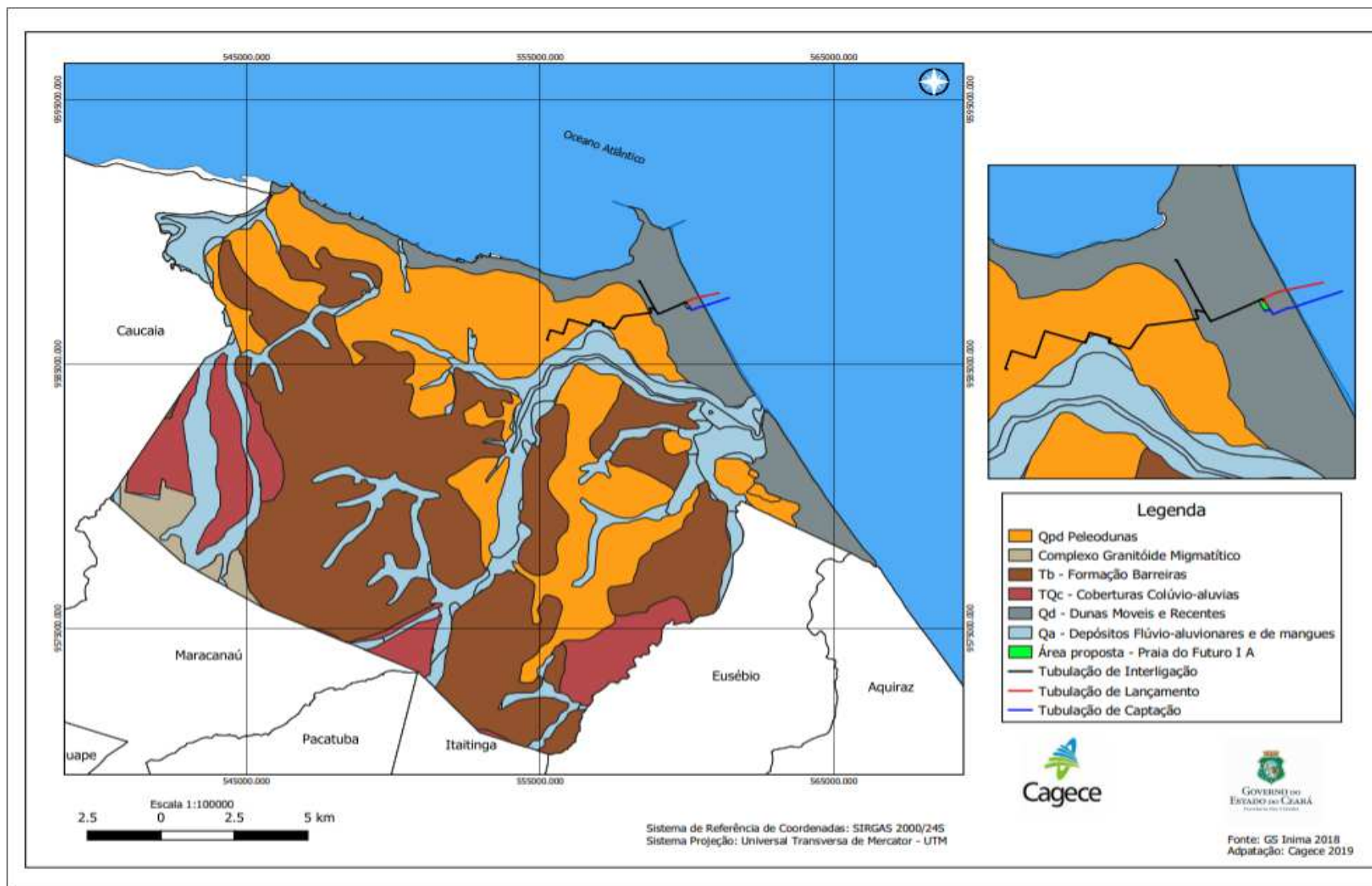
Geologically, the municipality of Fortaleza is characterized by the presence of Cenozoic covers, with a predominance of sandy-clay sediments from the Barreiras Formation, which cover a wide area of this urban nucleus. Overlapping the pre-coastal plains of the Barreiras Formation, edaphic or paleodunes can be found, composed of fine to medium grained sand, which are dissipated to urbanized areas and fixated by a vegetation carpet in areas of demographic voids. Beach strips and mobile dune fields form a continuous chain parallel to the coast line (Figure 14).

Fluvial-alluvial deposits form narrow bands along the natural drainage network, composed by sand, silt and clay. They present a greater geographical expression along the Cocó, Ceará and Maranguape / Siqueira rivers. The estuarine environments of the Cocó, Ceará and Pacoti rivers display silty-clay deposits which are rich in organic matter and support mangrove vegetation.

In the coastal areas with implementation potential for the desalination plant, the prevalence of dissipated dunes and beach strips was verified.



Figure 14- Geological Map of the Municipality of Fortaleza.



### 10.2.1.2 Coastline Erosion / Sedimentation Processes

The waves that approach the coast of the Metropolitan Region of Fortaleza come from the east and northeast quadrants, creating a transport or coastal drift, predominantly from east to west and southeast to northwest. Secondly, the waves also occur from the north quadrant (swell waves) and are characterized by a higher erosive power. CASTRO et al (1992) estimated a sediment transport rate of around 600,000 m<sup>3</sup> / year.

In Fortaleza, the construction of a set of jetties, from the Mucuripe Port to the mouth of the Ceará River, has interrupted the flow of sediments by coastal drift and increased the erosive power of waves in the sectors lateral to these structures. These works, totaling 15, were designed from the main one (the Titã jetty at Mucuripe Port), in a sequenced attempt to stop the erosive action effects that were established downstream of each of jetty (Figure 15).

The Mucuripe Port Jetty was built in the 1940s, without execution of the necessary studies to understand the oceanographic and sedimentological processes that operate in this area. The objective of this work would be to protect the port basin against the direct attack from the waves, and to prevent the transport of sediments from silting the port.

Figure 15 - Mucuripe Port protection works - Titã and Titanzinho jetties.



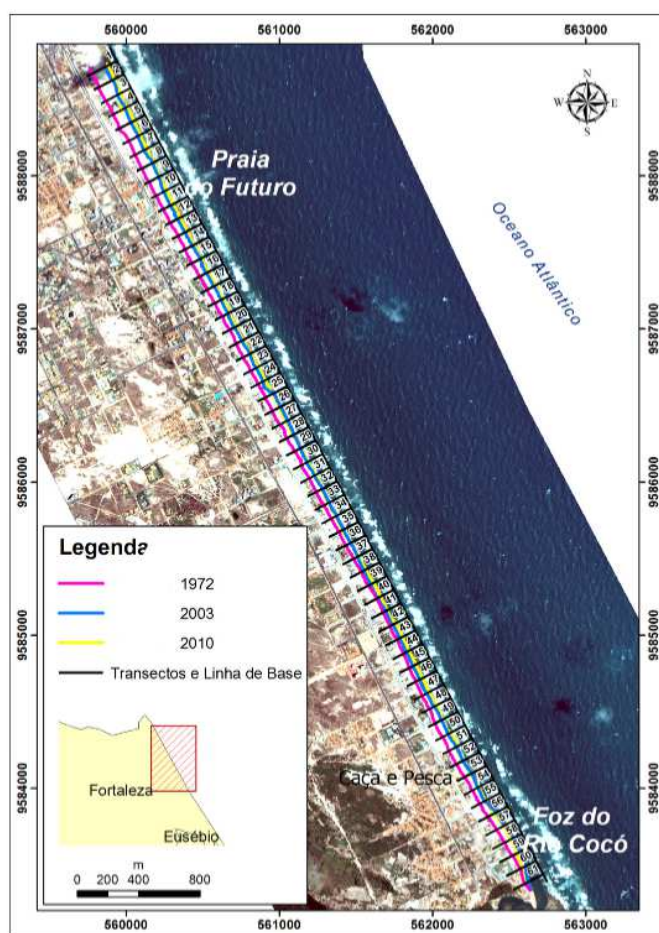
Source: Google Earth, 2018. Source: Google Earth, 2018

According to MARINO & FREIRE (2013), the whole Praia do Futuro area presents a generalized tendency for coastline regression along its entire length, presenting a linear and exposed coastline, with a backshore strip associated with sand accumulation by wind action. It has small dunes related to the bulkheads caused by the presence of beach huts,

hotels, inns and residences. Around the mouth of the Cocó River, there are sand banks and strips (sediment deposition from waves and tides).

The authors measured recession rates and obtained average results of 1.49 m/y ( $\pm 0.61$ ) and 1.43 m/year ( $\pm 0.58$ ) for the analyzed inter decade periods (1972 to 2010 and 1972 to 2003). This recession proved to be quite significant, with 54.44 m ( $\pm 22.12$ ) and 46.14 m ( $\pm 19.00$ ) for the period of 38 years and 31 years, respectively. On the interannual scale, the rate of change was 1.02 m/y ( $\pm 1.86$ ), with a minimum of -3.96 and a maximum of +3.59; coastline variation showed a regression in the order of 25.11 m in 7 years, with a standard deviation of  $\pm 13.05$  (Figure 16 and Figure 17).

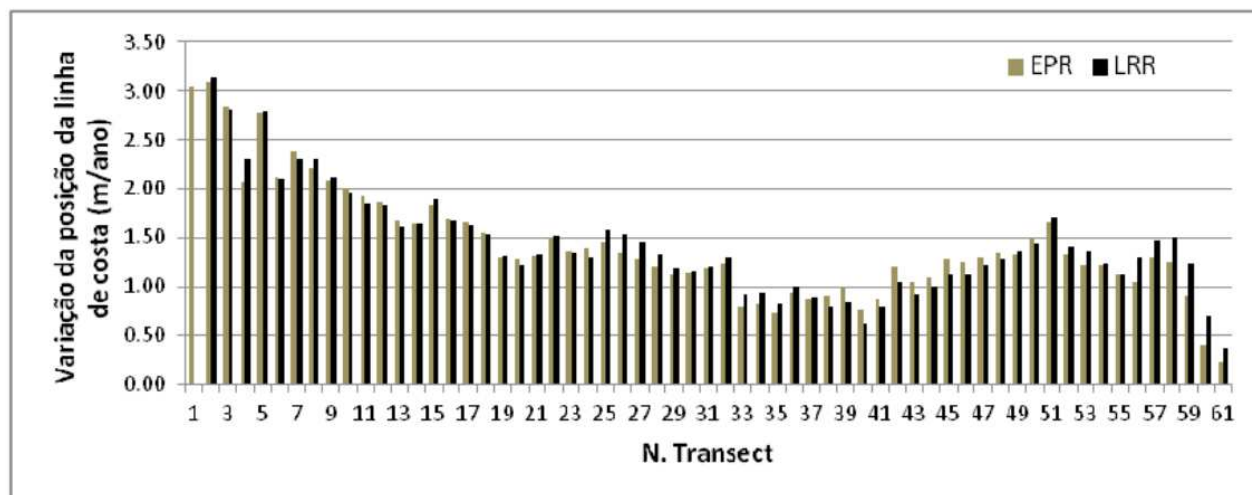
Figure 16 - Results of DSAS Tool Application in the Coastal Region Between the Cocó River Mouth and Praia do Futuro.



Source: Marino & Freire (2013)

This strongly recession trend in Praia do Futuro may be associated with the main dynamic agents in the coastal zone of Fortaleza, such as waves, currents and winds. Maia (1998) argues that, in the short term, a series of interannual variations is associated with the El Niño phenomenon, strongly affecting the region's climate through a decrease in average precipitation, intensification of wind speed and, therefore, a significant increase in wave height and coastal drift current speed.

Figure 17 - Coastline variation rates in the stretch between the Cocó River mouth and Praia do Futuro (negative values indicate erosion).



Source: Marino & Freire (2013)

Sabiaguaba Beach, in turn, presents a linear and exposed coast, with the presence of discontinuous chains of beachrock along its entire length, which function as energy dissipators for waves, providing a greater backshore and tidal shore development. It is possible to observe paleodune and mobile dunes fields in the section corresponding to the Sabiaguaba Dunes Natural Municipal Park, with the latter functioning as the current sediment bypass zone for coastal drift in the coastal zone of Fortaleza, since Praia do Futuro dunes were decharacterized by urbanization.

#### 10.2.1.3 Soil Classification and Aptitude

Yellow and red clay soils predominate in the Fortaleza municipality territory, which are characterized as medium deep to deep, generally well drained, porous and with texture varying from medium to clay. They have low natural fertility, strong acidity and are highly susceptible to erosion, especially when devoid of vegetation cover. They occur in areas of flat to gently undulating terrain, in the Barreiras Formation sediment area.

In the coastal region, the occurrence of quartzenic neosols is observed, associated with the areas of edaphic dunes, mobile dunes fields, deflation plains and beach strips. It is a deep soil, excessively drained, strongly acidic and of low natural fertility. It has a sandy texture and its agricultural use is quite restricted.

The Fluvic Neosols occur along the plains of the main rivers in the city, sometimes forming associations with the Natric Planosols. They are moderately deep to very deep, of various textures, moderately to imperfectly drained, with a pH between moderately acidic to slightly alkaline and high natural fertility. They are subject to periodic flooding during the winter season.

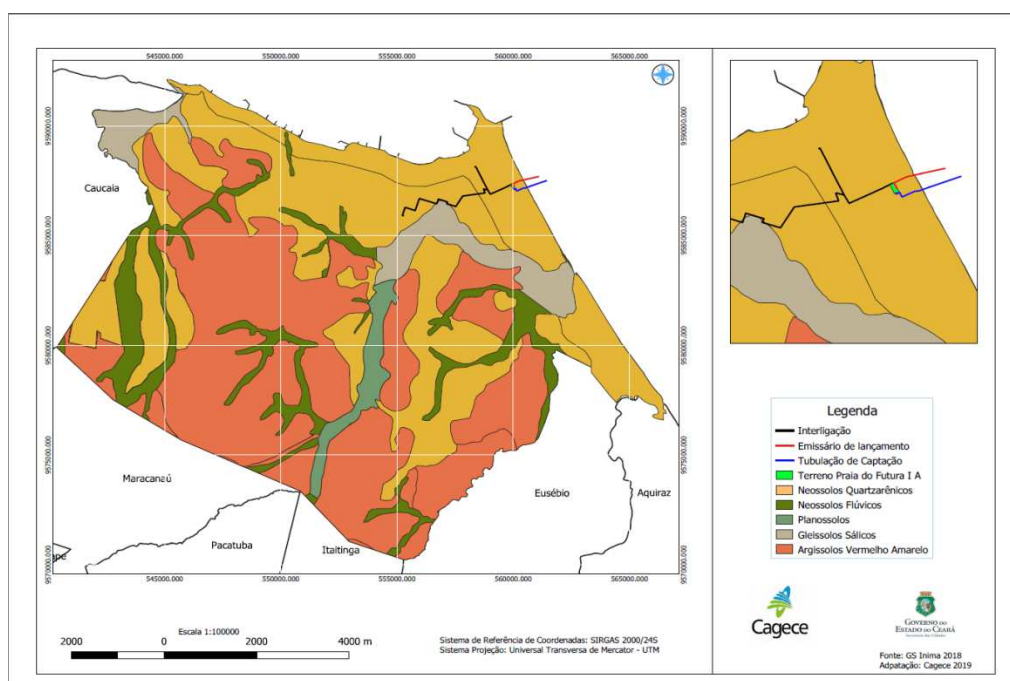
Nitric planosols are saline, shallow, imperfectly drained and very susceptible to erosion. They present waterlogging problems during the rainy season and dryness / cracking in the dry season, with no potential for agricultural use.



Salic gleisols occur at the Cocó, Ceará and Pacoti river mouths, in the stretches where they are influenced by the tides. They are gley soils, slightly or undeveloped, very poorly drained, with a high content of salts from seawater and sulfur compounds that form in these lowland sedimentary areas. They have no agricultural potential and are covered by mangrove vegetation.

In the Praia do futuro area, where the desalination plant will be placed, there is a predominance of quartzenic neosols, which are characterized by quartz-rich sands, with low base saturation and low natural fertility. Figure 18 shows the distribution of the predominant soils within the Fortaleza territory, highlighting the area of the enterprise currently under analysis.

Figure 18 - Fortaleza Pedological Map



#### 10.2.1.4 Climate

The climate predominant in the studied area is hot and stable, with high temperatures and reduced thermal amplitudes, a marked insolation rate, strong evaporating power and irregular rainfall regime, with poor rain distribution over time and area. According to the Köppen classification, the territory of the municipality of Fortaleza is entirely contained in the Aw climatic zone, presenting a tropical, hot and humid climate with summer rains and maximum rainfall in the fall. The region's rainfall regime is characterized by temporal heterogeneity, with precipitation concentrated in the first half of the year and a rate variation in alternate years.

Usually the rainy season starts in January and continues until June. The rainiest quarter is March/May, accounting for 55.6% of annual rainfall. In the January/June semester, this index exceeds 86.0%. The average annual rainfall reaches 1,642.3 mm.

The average annual temperature ranges from 25.7° C to 27.3° C. Due to the proximity to the Equator, annual thermal oscillation does not exceed 2°C. The months of June, July and

August have lower temperatures, while the highest occur in the period of October through February. The average minimum temperature reaches 23.5° C, while the average maximum reaches 29.9° C.

Air relative humidity presents its highest values in the wet quarter, when it exceeds 80.0%, reaching values close to 85.0%. In the dry season, the rates decrease, reaching values around 75.0%. In average terms, the area's relative air humidity in the order of 78.0%.

The average annual insolation is around 2,694.3 hours, which would, in theory, correspond to approximately 61.5% of the days in a year, with direct sunlight. In the rainiest months, values fall to around 6.0 hours per day, while at the highest point of the dry season, it can rise to 8.0 hours per day.

Cloud cover, defined as the fraction of the sky obscured by clouds, shows maximum values in the wettest months, reaching 7.0 tenths. In the dry season, the values fluctuate between 4.0 and 5.0 tenths.

The winds have an average annual speed of 3.6 m/s, predominantly blowing East. During the summer and autumn, interference from the Intertropical Convergence Zone (ITCZ) provides the beginning of the rainy season, resulting in a sudden change in wind direction, which converges towards the Southeast. The highest speeds occur in the dry season, when average values range between 3.5 and 4.9 m/s. Meanwhile, in the first half of the year, before the peak of rainy season begins, the speeds are fairly reduced, reaching 2.3 m/s in April.

Average annual evaporation is around 1469.0 mm, with the drought period (July through December) accounting for 63.5% of the annual total, presenting, in the peak months, average rates of 6.0 mm / day.

The seasonal water balance, according to the Thornthwaite & Mather method, reveals that water deficiency starts in July and continues until January in Fortaleza's coast, with rates between 600 and 750 mm per year. In the humid quarter, water surpluses are observed, generally below 100 mm, while the Fortaleza coast shows rates close to 400 mm.

#### **10.2.1.5 Surface Water Resources**

The Fortaleza city's territory has two main hydrographic basins, the Cocó/Coaçu and the Ceará/Maranguape Systems, in addition to the Maritime Basin, composed of coastal strips with diffuse runoff, and the Pacoti Basin, which presents only a small portion of its area inserted within the city of Fortaleza (Figure 19).

The desalination plant's site shall be inserted in the Maritime Basin, more specifically in sub-basin A-7.

#### **Maritime Basin**

The Maritime Basin, located in the north and east portions of the municipality of Fortaleza, is subdivided into 07 (seven) sub-basins and characterized by a high degree of urbanization. It drains an area of 34.54 km<sup>2</sup>, comprising the strip of land located between the Ceará and Cocó river mouths, with a topography favorable to water flow directly to the ocean. Its main water bodies are the Lagoa do Mel, Jacarecanga, Pajeú, Maceió and

Papicu streams, which drain completely urbanized areas, in addition to the Mel and Papicu lagoons, linked to the same watercourses.

### **Cocó/Coaçu System**

The Cocó River drains an area of 304.6 km<sup>2</sup>, of which 70.9% (215.9 km<sup>2</sup>) runs through in the Fortaleza territory, where it forms the largest hydrographic basin, draining the East, South and Central sectors of this urban core. Its main macrodraining axis includes, in addition to the Cocó River, the Coaçu River, which is its main tributary, and the Tauape, Jardim América and Aguanambi canals.

The Cocó Basin has lower demographic density when compared to the Ceará - Maranguape and Maritime Basins. However, it is one of the areas within the city with the greatest potential for urban fabric expansion and consequent increased population density. It is predominantly occupied by the middle and high-income population, with an occasional presence of slum areas.

The Cocó River runs in the south - north direction for a long stretch of its course, forming, towards its mouth, a sharp southwest to east curve, flowing into the ocean between the beaches of Caça e Pesca and Sabiaguaba. Its confluence with the Coaçu River, its main tributary, is very close to the coast, making these practically behave as independent basins.

All water courses in the basin are intermittent, remaining dry for the majority of the year (6 to 7 months), except near the coast, where the Cocó and Coaçu rivers become perennial. In its low and medium course, the presence of perennial and intermittent lagoons can be observed, with emphasis on the Coaçu with the Precabura, Sapiranga and Messejana lagoons, along the Cocó river, with the Maraponga, Itaoca, Opaia, Porangabuçu and Papicu lagoons, all located in Fortaleza's urban center. The Cocó River is influenced by the tides, which enter its bed for approximately 13.0 km, forming an elongated and narrow estuary, composed of 210.0 ha of mangroves.

The storage level in the Cocó River basin is relatively developed, being responsible for a portion of the RMF water supply through the Gavião reservoir (29.5 hm<sup>3</sup>), located in the municipality of Pacatuba. Within the urban fabric of the city of Fortaleza, it is important to note the Osmani Machado, Uirapuru, Walter Peixoto de Alencar, Soldado and José Pires weirs; however, they are all small and do not contribute to the perpetuation of the basin's water courses, nor to flood lamination.

The degradation of riparian forests, which contribute to the silting of drainage beds, combined with increasing soil impermeability and the indiscriminate occupation of watercourse banks by favelas, has caused flooding in the peak rainfall periods. Flooding from the Cocó River has left countless families homeless, and to remedy this problem, in the middle of 2017, the State Government implemented a flood lamination dam along the Cocó River, in the Cocó State Park area, with a maximum capacity of 6.4 million cubic meters. The implementation of this dam eliminated around 14 risk areas threatened by floods in Fortaleza districts, such as Jangurussu, Mata Galinha, Jardim das Oliveiras, Dias Macedo, Aerolândia and Alto da Balança, among others.

Due to the interception of densely populated areas the Cocó River, presents high levels of pollution, receiving around 1511.12 L/s of sanitary effluents, with Fortaleza's urban area as its major contributor (1,339.46 L/s). According to MAVIGNIER (1992), the Cocó River presents increasing BOD values from its mouth to upstream, acquiring open sewer characteristics close to Timbó, where the concentrations reach 570 mg/L. In terms of fecal coliforms, the Cocó waters reach concentrations of up to 234,000 NMP/100ml.

In addition to sanitary and industrial effluents discharged directly into its channels or carried by the rain drainage network, another source of significant pollution in the Cocó River is the Jangurussu Landfill leachate. Although it has been deactivated and contemplated with a recovery project, the old landfill continues to contribute directly the leachate supply to the Cocó River, due to the lack of maintenance and the depredation of its infrastructure by vandals, among other causes.

### **Ceará/Maranguape System**

With a rectangular spatial configuration, the Ceará / Maranguape river basin drains an area of 555.9 km<sup>2</sup>, of which only 15.2% (84.73 km<sup>2</sup>) runs into Fortaleza territory. In the other hand, the Cocó/Coaçu System has a single significant tributary, the Maranguape or Siqueira River. It joins the main river near its mouth, not expressing much influence on the basin's fluvimetry as a whole, behaving like an independent basin. The Maranguape or Siqueira Basin is located in the western part of the urban core, with very high demographic densities. It is characterized by populated neighborhoods, in general, occupied by middle and low-income populations.

Comprised of intermittent water courses which flow only during the rainy season, the Ceará / Maranguape System presents perennial fluvimetry in the Ceará River stretch only, undergoing injection from tides and forming an estuary composed of 640 ha of mangrove vegetation. There are numerous lagoons in the low-lying region, especially the Parangaba, Mondubim and Genibaú lagoons, all located within Fortaleza's urban area.

The Ceará / Maranguape System storage levels have little representation, being almost entirely composed of small and medium-sized reservoirs, which do not allow the perpetuation of its water courses or flood lamination. Within Fortaleza's urban areas, only the Agronomia and José Lopes weirs should be noted.

The Maranguape or Siqueira Basin area, more densely populated, presents more risk areas subject to flooding during the harshest winters, and are mainly distributed in the following districts: Genibaú, João XXIII, Autran Nunes, Granja Portugal, Quintino Cunha and Antônio Bezerra, among others. To remedy this problem, in March 2012, the Maranguapinho Dam was built with a maximum storage capacity of 9.3 million cubic meters, with the function of laminating floods from this water body, benefiting communities in risks areas positioned downstream.

The Maranguape River area presents high levels of pollution as well, receiving in its medium/low course region, more specifically from the Integrated System (ETE) of Maracanaú's Industrial District (SID), a considerable supply of industrial and sanitary effluents, given the greater urban density in this region.

According to the physicochemical and bacteriological analyzes of the Maranguape River waters performed in the mid-2011/2012 by DINIZ et al (2014), the Maranguape River proves to be quite polluted, particularly by thermotolerant coliforms. At some sites of its medium/low course regions, it can reach concentrations of up to 16,000 NMP/100ml. In this stretch, the levels of Biochemical Oxygen Demand (BOD) oscillate between 12.0 and 60.0 mg/L, with a value increase observed from upstream to downstream. The Water Quality Index (WQI) oscillates between acceptable and bad.

### **Pacoti Basin**

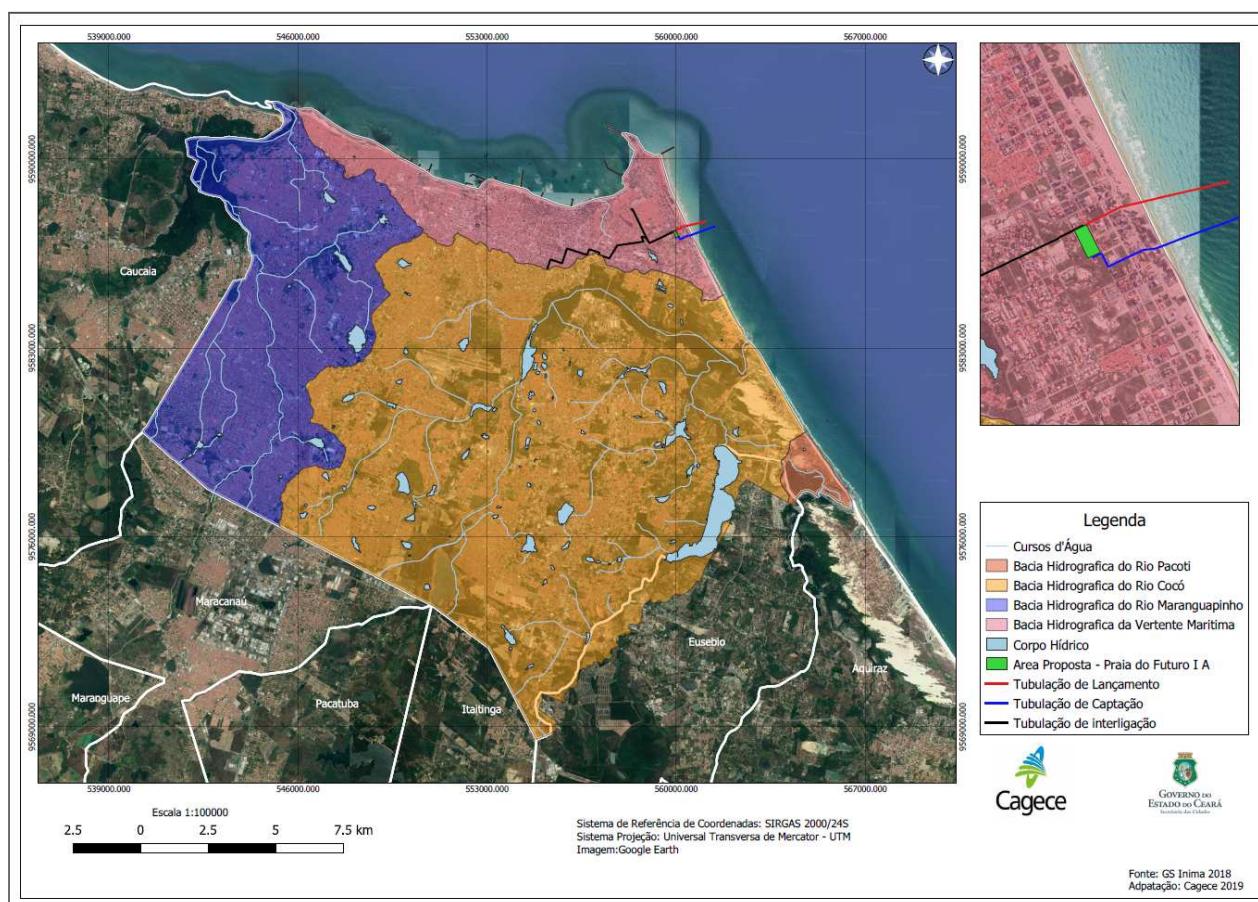
Draining an area of 1,257.5 km<sup>2</sup>, the Pacoti River has its spring in the north-eastern direction of the Baturité Massif, covering a length of 112.5 km, generally, in the southwest/northeast direction, until it flows into the Atlantic Ocean, in municipality of Fortaleza. The Pacoti Basin occupies the extreme Southeast of Fortaleza, draining only 1.3% of its territory.

Without any significant inflow through the right bank, Pacoti has two major contributors on the left bank, the Baú and Água Verde streams. The presence of perennial and intermittent lagoons also occurs in its lower course. All watercourses in the basin have intermittent fluviometry, with the exception of the Pacoti River which is influenced by the tides. It presents an estuary composed of 160 ha of mangrove, a large part of which is located in the municipality of Fortaleza.

As for the storage level, the supply of surface water bodies in the Pacoti Basin is made by a set of reservoirs monitored by COGERH, which stand out for their large size and for representing part of the RMF's water supply, with the Pacoti dams (380,0hm<sup>3</sup>), Riachão (46.95hm<sup>3</sup>) and Acarape do Meio (31.5 hm<sup>3</sup>).



Figure 19 - Hydrographic Basins of the Municipality of Fortaleza



## 10.2.2. Physical Environment - Marine

### 10.2.2.1 Morphology and Sedimentology of the Inner Continental Shelf

According to data from the Basic Environmental Plan for the Fortaleza Port Deepening Project, the Coastline Monitoring Report (DOCAS/LABOMAR, 2011a), the sediment from the Praia do Futuro's inner shelf, up to the 12-meter isobath, is of a sandy textural class granulometry, with sparse gravel sediments.

The coastal plain in which Praia do Futuro is located has terrestrial sediments of different classes, from the low tide line to the depth of 20 m, however, with a predominance of quartz sand. (Albuquerque, 2008). The author informs that the coastal sedimentary strip consists of sediments from the Barreiras Group. The beach area near the desalination plant is unimodal with a predominance of fine sand, mainly in the surf zone; however, it has a relatively significant fraction of medium sand in the overflow area, whose degree of selection fluctuates between moderately to well sorted. In the region's beach profile, the grains become finer with increased distance from the coast (Albuquerque, 2008). The same author also mentions that, due to the significant local wind transport, fine sediments promote accumulations in the backshore area.

Regarding the bottom morphology of the inner shelf (shoreface zone), some conditions must be taken into account when installing seawater intake and effluent discharge pipes

after the desalination process. LAYTON (1976) explains that the shallow platform, where the intake and discharge pipes will be installed, needs to be relatively smooth and not steep, without high inclination angles. In order to avoid damage caused by waves, the surf zones, which extend more than 300.0 m, should be avoided.

Detailed studies of coastal geomorphology will be necessary for the environmental licensing process, given the dynamism of the environment's sedimentary balance, including sedimentological characterization, transportation, evaluation of beach profiles, identification of the beach's closure depth and risk of erosion processes.

#### **10.2.2.2 Physical Oceanography Aspects (Hydrodynamics)**

As pointed out in the study prepared by the Authorized Company during the PMI phase, it is necessary to have knowledge of oceanographic conditions that govern marine hydrodynamics such as currents, waves and tides, the environment where the desalination plant will be installed and its surroundings and the diffuser outlets for effluent discharge (LAYTON, 1976).

Currents play an important role in effluent dispersion into the receiving body, acting as one of the main effluent plume transport and dilution mediums. Understanding current intensity and direction, as well as their formation factors and occasional inversion, also associated with the water column's (occasional stratification of the water body) salinity and temperature, are essential to this enterprise, since they reflect directly on eventual impacts.

Wind patterns, wave climatology and tidal conditions are also important to make the project suitable to the local hydrodynamics, maintaining the integrity of the effluent diffusion pipes.

According to SILVA et al. (2017), with data from November 2011 and April 2012, periods with wind and currents measured simultaneously, Fortaleza's eastern sector hydrodynamics is characterized by a strong influence of trade winds, which direct coastal currents predominantly to the west, following the coastline. The numerical modeling performed by SILVA et al. (2017) also considered the influence of waves on coastal currents existent on the beaches in the studied area. At Praia do Futuro, longitudinal currents frequently change direction in April. The authors point out that, in April, Praia do Futuro's coastal currents have a south-southeast direction, different from what happens to offshore coastal currents, which have a north-northwest direction. In November, coastal currents are weaker and tend to follow the trend of coastal currents on the continental shelf.

In November, the currents closest to the coastal zone are directed in the same direction as the currents leaning offshore, that is, north-northwest, following as the coastline.

Also, according to the authors, this divergent behavior between the two semesters occurs due to the presence of waves coming from the East (E) and East-Southeast (ESSE), which are more frequent throughout the year, between the months of April to December, and generate the currents that run north. Praia do Futuro's southern currents, on the other hand, are generated due to the presence of waves coming from the Northeast (NE) and East-Northeast (ENE), which, upon breaking, influence this change in direction.

Based on the model presented by SILVA et al. (2017) the speed of coastal currents is more intense in April, with a variation of 0.1 to 0.6 m/s on the continental shelf adjacent to Praia



do Futuro. These speeds decrease in November, varying from 0.1 to 0.4 m/s. The coastline also has divergences in current speed among its own areas, considering the time of the year, according to the results presented by the authors. However, in the Serviluz region, at Praia do Futuro, there is no significant difference in speed between April and November, with values around 0.15 m/s. In the Praia Mansa region, on the other hand, there is a difference in speed used by marine hydrodynamics. In April, the current variation is from 0.1 to 0.35 m/s, while in November this interval drops to 0.1 to 0.2 m/s.

Considering the need to understand effluent dispersion processes into the receiving body, it is necessary that effluent discharge studies endorse the discharge site, with the implementation of a model that is validated and adjusted to the surrounding conditions.

The hydrodynamic model presented by the Basic Environmental Plan for the Fortaleza Port Deepening Project (DOCAS / LABOMAR, 2010) emphasizes this current flow and water mass behavior, influenced by the jetties at Ponta do Mucuripe. The study of current regimes in Mucuripe Port's navigation channels showed, in the five times it was performed, a predominant direction between 270° and 315° NM. Such results corroborate with the model already mentioned, as the current flow north of Ponta do Mucuripe reaches the W-NW navigation channel.

According to MORAIS (1980), tidal regimes in Fortaleza and throughout the coast of Ceará can be characterized as mid-tides with semi-hard periodicity. MAIA (1998) verified, in the period from May 1995 to June 1996, that maximum tidal amplitude was 3 m, and minimum was 0.75 m. MAIA (1998) also points out that, during the months of June and December, tidal amplitude increases, in quadrature and syzygy, and that the opposite occurs in the months of September to March, according to the data from Mucuripe Port's tidal station (SILVA et al., 2017). Such data shows that the tide does not exceed 3.5 m at maximum, and that minimum was below zero only in the month of November.

According to DOCAS / LABOMAR (2011a), wave conditions of the month of November, 2011, were characterized predominantly as the Swell, with closing depth at 3.9 m. For this work, two sandbars were arranged in a sequential longitudinal fashion, with a distance among them, measured by their crest, of approximately 100.0 m. Probably these sandy bars are responsible for a different wave breaking regime at Praia do Futuro, configuring two surf zones along the entire length of the beach, from the Titanzinho jetty to the right bank of the mouth of the Cocó River.

This nearshore condition must be well evaluated regarding environmental and constructive matters for the installation of the intake and discharge pipes in Praia do Futuro.

DOCAS / LABOMAR (2011a) points out that the main changes recorded in the data collected, between September 2010 and February 2011, were verified in the backshore and foreshore areas, with a reduction of 1.0 m. According to the work, this occurs due to the spreading of the swells, with increased energy, eroding the beach's upper shoreface.

Contrary to what happens in the Praia do Futuro and Sabiaguaba regions, the waves break in the direction of the protection jetty in Fortaleza basin. MAIA (1998) has reported an

average wave height of 1.15 m and a mode of 1.14 m, presenting a more frequent wave period of 5.7 seconds, associated with significant height, and an average of 5.89 seconds in the Mucuripe Port area. The author identified a predominance of sea waves, representing 94.2% in relation to swell waves.

### **10.2.2.3 Salinity and Sea Spray**

Regarding thermohaline, or sea water density conditions due to temperature and salinity variation, FREITAS (2015) states that the variation in surface temperature is governed by seasonality. According to the author, the wind, with greater intensity in the second semester, contributes to greater water column mixing and heat dissipation from the ocean to the atmosphere. The bottom temperature, according to the work of FREITAS (2015), showed little variability along the inner shelf, with temperatures around 28° C and 27°C in the first and second semesters, respectively.

Salinity, however, according to the author, has significant variation between the two semesters. The first semester is characterized by lower surface salinity, with minimum and maximum values of 24 and 25.8°C, where the minimum values are mainly due to the Jaguaribe, Pacoti, Cocó, Ceará and Acaraú river flows, which form of a strip of lower salinity near the coast. The second semester, on the other hand, presented higher salinity, with minimum and maximum values of 36.2 and 36.5°C, as a result of lower rainfall indexes and estuary flow, as well as high evaporation rates in the period due to the intensity of winds along the continental shelf.

FREITAS (2015) shows that the behavior of the salinity field on the shelf's bottom presented a behavior similar to that of the surface.

FREITAS (2015) also points out that, in general, the shelf presents greater uniformity in its thermohaline field during the second semester, probably due to the greater intensity of the winds and shelf mixing process, in addition to a lower injection of fresh water, a factor that results in stratification.

Regarding the distribution along the RMF coastal zone, for the first and second semesters, the temperature and salinity variations, considering surface and bottom, are practically homogeneous.

It is worth mentioning that Fortaleza, and in particular, Praia do Futuro, is considered a critical region regarding sea spray, or dispersion of aerosols with saline load, given the association of forcing agents such as wind direction and intensity, seawater salinity and spraying by breaking waves. Properties in Praia do Futuro suffer the impacts of the sea spray more intensely, the opposite of what happens in the coastal area between the Ceará River mouth and Ponta do Mucuripe. According to studies by the Eletrobrás Research Center (CEPEL), Fortaleza has one of the highest rates of saline pollution in the world (Paiva, Ricardo Alexandre. "The impacts of tourist urbanization on the coast of Fortaleza: fragmentation and socio-spatial differentiation." XI National Association Seminar for Research and Graduate Studies in Tourism, Ceará State University, Fortaleza, 2014).



The theme is so relevant that it motivates studies, such as the Master's Thesis presented to the Postgraduate Program in Civil Engineering at the Federal University of Ceará, entitled: "Study of the Aggressiveness of the Atmospheric Air in Fortaleza" (Campos, 2016). The author deals with the degradation of concrete in environments under the influence of chlorine present in sea spray, indicating that the aggressive action takes place differently various city areas, where Praia do Futuro presented much superior rates, in relation to other cities in Brazil as well as of the world.

It is worth considering this theme not only regarding concrete or metallic structures, but in the general plant studies, considering cathodic protections, coatings, pipe exposure and useful life of exposed electronic equipment.

#### **10.2.2.4 Other marine or coastal issues**

The environmental impact study should address important issues associated with the coastal environment, not only to comply with the Term of Reference - TR issued by the environmental agency, but also to provide comfort for decision making. Other physical issues should be part of the diagnosis, such as assessment of beach dynamics, coastal drift, coastal geomorphology processes and plume dispersion, in addition to an updated bathymetric survey.

#### **10.2.3. Biotic Medium**

##### **10.2.3.1 Terrestrial Environment - Flora**

The phytoecological units present in the municipality of Fortaleza are part of the Coastal Vegetation Complex (tableland, dune, mangrove and riverside forest vegetations). However, there is a predominance of anthropic vegetation in its territory, resulting from the accelerated expansion of the urban network.

The tableland vegetation covers the Barreiras Group sediments, and is very degraded by the anthropic action, being restricted to small remnants in isolated areas. They occur with greater geographical expression in demographic voids located in the southern region of the urban core. It is characterized as a medium-sized, dense vegetation, presenting, as main components, the caraíba (*Tabebuia caraíba*), pau d'arco roxo (*Tabebuia avellanedae*), arapiroca (*Pithecellobium foliosum*), freijó (*Cordia trichotoma*) and angelim (*Andira retusa*). Urban expansion in these areas has caused significant changes in primary vegetation cover.

In the dune fields, the areas located closest to the sea are characterized by pioneering vegetation, where grasses and several creeping species predominate as fixing agents against wind deflation. Representative species include the salsa-de-praia (*Ipomoea pes-caprae*), breda-da-praia (*Iresine portulacoides*), capim-da-praia (*Paspalum vaginatum*), liana (*Remirea maritime*) and oró (*Phaseolus poduratus*), in addition to shrub species such as murici (*Byrsonima cericea*). In the edaphic dunes, the presence of an arboreal vegetal covering is observed, having as main representative species such as João-mole (*Pisonia tormentosa*), pau d'arco roxo (*Tabebuia avellanedae*), tatajuba (*Chlorofloratinctoria*) and cashew (*Anacardium occidentale*), among others. It is noteworthy, however, that most of the former dune fields currently have their forms dissipated, being occupied by the urban



network. Therefore, dune vegetation is largely restricted to areas that have not yet been urbanized.

Along the fluvio-marine plains of the Cocó, Ceará and Pacoti rivers, where the effects of tidal influence are felt, the presence of mangroves is evident, and its floristic composition is represented by species such as red mangrove (*Rhizophoramangle*), white mangrove (*Laguncularia racemosa*), siriúba mangrove (*Avicennia shaueriana*), canoé mangrove (*Avicennia nitida*) and, to a lesser extent, the botão mangrove (*Conocarpus erecta*). Although they suffer constant aggression due to anthropic action, the mangroves of the Cocó, Ceará and Pacoti rivers still have extensive relatively preserved areas.

Finally, on the river plains of water courses, riparian forests are composed of species such as the carnaúba (*Copernicia cerifera*), mulungu (*Erythrina velutina*), juazeiro (*Zizyphus joazeiro*), oceicica (*Licania rigida*) and ingá-bravo (*Lonchocarpus sericeus*). They present greater geographical expression along the Cocó and Maranguape rivers, although they are practically eradicated in several stretches along these water courses.

The floristic diagnosis of the Desalination Plant Project's Direct Influence Area identified remnants of sandbank vegetation in the region. The information presented about this floristic survey is the result of an *in situ* survey, with aid of secondary reference data.

The sandbank vegetation cover can be found on beaches and dunes, sandy strands, and associated with depressions. In the sandbank, the successional stages differ from the ombrophile and seasonal formations, occurring noticeably slower due to the substrate, that does not favor the initial establishment of vegetation, mainly due to dissection and absence of nutrients. The different types of vegetation occurring in Brazilian sandbanks vary from herbaceous to shrub formations, open or closed, reaching forests whose canopy varies in height, generally not exceeding 20 meters (Silva, 1988).

From the point of view of biodiversity, it can be considered that the coastal zone is home to natural, particular areas of high wealth and ecological relevance, which qualifies them as important sources for the environment (IBGE, 1996). Despite the ecological importance of sandbanks, the Northeast only has initial information on this ecosystem when compared to studies in the Southeast, where about 1,300 species have already been listed (Pereira and Araújo, 2000).

Fortaleza, like most Brazilian cities, suffers from disorderly growth. The forms of land use at Praia do Futuro are quite diverse. In the dune fields, functional impairment of ecosystems is verified due to the advancement of real estate speculation with low and high-income housing. In the beach area, the main tourist attraction are the beach shack restaurants, with a large flow of users.

The development area is degraded and uncharacterized from its original phytophysognomic aspect. The vegetation observed in the enterprise's development area is predominantly composed of the following species:

1. *Ipomea asarifolia* (Salva-brava);
2. *Cyperus maritimus* (Tiririca-da-praia);

3. *Ricinus communis* (Mamona);
4. *Jatropha gossypifolia* (Pião-roxo);
5. *Calotropis procera* (Cíume).

Currently, no endemic, rare or endangered floristic species of economic, medicinal or scientific interest were identified.

Figure 20 - Photographic Record of the Species Identified in the Project Area



*Presença de Calotropis procera*



*Presença de Jatropha gossypifolia.*



*Presença de Ipomea asarifolia.*



*Vista geral vegetacional na área.*



### 10.2.3.2 Terrestrial Environment - Fauna

Fauna characterization in the plant area includes species from the backshore and fixed dunes environments, even in face of the high degree of anthropization of the surroundings. It is possible that the territory of the directly affected area does not have a diversity compatible with other less anthropized areas, since it is a fenced land plot, implying a restriction in fauna movement and with some degree of local intervention. However, the unoccupied dune fragments surrounding the area can still function as a refuge or diversity bank for the region, which shall be preserved and not occupied.

The fauna associated with the sandbank ecosystem is characterized by relatively low richness and endemism when compared to other environments (Freire 1990; Cerqueira 2000; Rocha 2000). Marine influence, extreme temperature variations, high soil salinity and water stress are factors that restrict the diversity of life in these environments. For some groups, such as mammals, the low vegetation, which is poorly extracted and less complex, could justify the richness of species (Cerqueira et al., 1993, *apud Estudo Ambiental do Sistema de cabo Submarino do Atlântico Sul – Angola Cable*). The study mentions that in the best studied stretches of the Brazilian coast, there is a great geographical variation in endemism rates.

Some backshore animals can occur in the area, such as the *Ocypode quadrata* (maria-farinha), insect larvae and terrestrial mollusks. The reptile fauna is represented, in general, by species adapted to human presence, with emphasis on lizards, (*Hemidactylus* sp.), geckos (*Tropidurushispidus* and *Cnemidophorusocellifer*) and snakes. The absence of freshwater courses or springs can be pointed out as one of the causes of the lack of amphibians in this region.

The ornithofauna is the most diverse group in the region, with dozens of species occurring in sandbank and dune environments, such as doves (*Columbina talpacoti* and *Columbina squammata*), guira cuckoos (*Guira guira*), domestic pigeons (*Columbalivia*), the burrowing owl (*Athene cunicularia*), white-naped jays (*Cyanocorax cyanopogon*), red-cowled cardinals (*Paroaria dominicana*), white-winged swallow (*Tachycineta albiventer*) and rufous-tailed jacamar (*Galbula ruficauda*), among others.

As for mastofauna, it is possible that not much more than domestic and synanthropic species occur, with the presence of rodents.

Despite this, some reptiles (four species of lizards, two amphibians and a snake), amphibians (five species of anurans), mammals (two rodents), insects (a hymenopteran and a coleopteran) and a species of endemic sandbank bird are known. (Rocha et al., 2005; Costa et al., 2014).

As verified in the flora study, notwithstanding the project's Direct Influence Area, the sandbank herbaceous area naturally presents reduced associated terrestrial fauna, due to the size of the vegetation and proximity to the sea; the sand strip is almost completely devoid of vegetation. In addition, the surroundings of the Directly Affected Area constitute a consolidated urban area, with buildings, public roads and pavements replacing sandbank physiognomies.



The degradation of habitat fragmentation and urbanization in the enterprise area result in a reduction in the richness of animal species, which may lead to an increase in the populations of those more generalists species, or those that develop synanthropic habits, as well as the invasion of exotic species (Shochat et al., 2010).

The fauna survey carried out in 2015 by Algar Telecom, in the same area as the SACS project, identified the occurrence of predominantly synanthropic species. In the dunes, the presence of the coleopteran *Phaleria testacea* was observed, as it is considered the dominant invertebrate in the backshore strip (ROCHA-BARREIRA et al, 2001). Among the birds, the masked water tyrant (*Fluvicola nengeta*), the tropical mockingbird (*Mimus gilvus*), the white-winged swallow (*Tachycineta albiventer*), the scaled dove (*Columbina squammata*), the cattle tyrant (*Machetornis rixosa*), the red-cowled cardinals (*Paroaria dominicana*), the black-headed vulture (*Coragyps atratus*), the yellow-headed caracara (*Milvago chimachima*) and the southern crested caracara (*Caracara plancus*).

Among the wild mammals, it is worth to note the possible occurrence of some bat species and marsupials of the *Didelphis* sp. genus, which develop synanthropic habits and are important in public health (Sodré et al., 2010; Cutolo et al., 2014) (Figure 21).

Figure 21 - Land fauna identified in the study area. Source: Environmental Study - Angola Cables, 2017



*Phaleria testacea*



*Fluvicola nengeta*



*Tachycineta albiventer*



*Didelphis sp.*

The fauna survey must be carried out contemplating the primary data within the EIA / RIMA scope, to verify secondary data information.

### 10.2.3.3 Marine environment

Regarding the aquatic fauna, the area does not have significant courses and water sources in its territory, with the Cocó River mouth located outside the area directly affected by the intake and discharge; thus, it can be considered that the enterprise area's aquatic fauna is restricted to marine biota.

#### Plankton community

As mentioned in the PMI desalination studies, the research developed by Caruso Jr. Estudos Ambientais e Engenharia Ltda in mid-2011, in 6 sampling sites distributed along the Fortaleza coast, characterized the studied area's phytoplankton community encountering 62 species. They were divided into six classes, the most representative of which, *Coscinodiscophyceae*, *Dinophyceae* and *Bacillariophyceae*, accounted for 42.0%, 19.0% and 16.0% of the samples collected, respectively. The classes *Fragilariophyceae*, *Ebriidea* and *Cyanophyceae* appear with less representativeness. The most abundant species were *Asterionellopsis glacialis*, *Chaetoceros* sp. and *Rhizosolenia setigera*, which together represent 43.64% of the total sample.

The diagnosis and understanding of plankton communities, especially phytoplankton, is essential to the project, given the possible occurrence of algal blooms in Praia do Futuro, with direct effects the quality of the collected water to be treated.

According to the EIA of the Angola Cable submarine cables, there are records of phytoplankton proliferation during the rainy season (Phytoplankton Bloom) at Praia do Futuro's coastline, with high densities of the *Eunotogramma* sp. diatom (Tahim et al., 1990). The study mentions that the factors that trigger such proliferations are not well known, however, they must be associated with the width of the surf zone, variations in temperature and salinity, nutrients and local currents.

Regarding the zooplankton community, 31 taxa were identified, distributed in 11 classes. Of the identified taxa, four occur at all samples, namely: copepodites, *Euterpina acutifrons*, *Paracalanus* sp. and *Temoraturbinata*. The most representative classes were Copepoda, accounting for 81.2% of the total, followed by Appendicularia with 5.1% and Decapoda with 4.4%. The classes *Mollusca*, *Polychaeta*, *Radiolaria*, *Hidromedusa*, *Salpidae*, *Pteropoda*, *Cirripedia* and *Chaetognatha* were identified as well, with less representativeness, accounting for 9.3% of the total altogether.

#### Benthic Community

The fauna associated to sediments, in the intertidal, beach, and low coastal zones, is composed of a significant local variety of species and density. There are organisms that live over the sediments (epifauna), excavators and tubeworms (infauna), as well as benthic demersals, with significant water column mobility, despite their predominant association to sediments. Benthic biota can be further divided by size (benthic macrofauna and meiofauna), or even by eating habits.



Several taxonomic groups make up the benthic macrofauna, with the most common being the *Mollusca*, *Crustacea* and *Anellida*, and the less frequent *Sipunculidia*, *Nematoda*, and *Echinodermata*, among others. Polychaetes, Bivalves, Gastropods, Scaphopoda and Cnidaria altogether represent a large part of the diversity.

According to the study carried out by Rocha-Barreira et al., 2001, it was found that at Praia do Futuro the dominant organisms in the intertidal zone are the bivalve *Dona stratus* and the *Scolecopsis lefebvrei* polychaete, as well as crustaceans and the *Mellita quinquesperforata* echinoderm (sand dollar).

To characterize the benthic community in unconsolidated sediments in the Mucuripe Cove area, in mid-2011 Caruso Jr. Estudos Ambientais e Engenharia Ltda collected sediment samples in a grid composed of 35 sites, covering an area of approximately 7,5 km<sup>2</sup>.

A total of 721 organisms belonging to 86 taxa of 10 different phyla were identified. The phyla Annelida, Mollusca and Crustacea were the most abundant, presenting relative frequencies of 68.4%, 10.7% and 10.0%, respectively. Of the taxa identified, the most representative were the *Apoprionospio* sp., *Capitellidae* and *Magelonaposterolongata* polychaetes, all of small stature.

### **Nektonic Community**

In order to determine the specific composition and abundance of demersal nekton (fish and shrimp), the study developed by Caruso Jr. Estudos Ambientais e Engenharia Ltda, in mid-2011, in the Mucuripe Port area, performed sampling through the use of three different fishing devices: trammel nets (seines), slivers (gillnets) and trawlers (bottom trawls). The sampling made with trammel and scrap nets were carried out along the inner coastal strip of Praia Mansa, using rowing boats. Trawling sampling was made in the Mucuripe Cove area, west of the Mucuripe Port Mooring Channel, with a sailing vessel.

The main marine fish occurring in the region are the oveva (*Larimusbreviceps*), cangoá (*Stellifer spp.*), hake (*Isopisthusparvipinnis*) and the lookdown (*Selene spp.*). They are the most representative species in trawling, followed by the Atlantic thread herring (*Opisthonema oglinum*), which is predominant in trammel net fishing. The *Haemulidae* family, represented mainly by the roughneck grunt (*Pomadasyscorvinaeformis*), is frequent in both trawling and trammel or scrap net fishing.

Among the crustaceans, the *Penaeidae* family must be emphasized, having as its main representative the Atlantic seabob (*Xiphopenaeus kroyeri*), followed by the *Portunidae* family, represented by the Atlantic blue crab (*Callinectes ornatus*).

### **Cetaceans**

According to SIMMAM - Support System for the Monitoring of Marine Mammals (2016), although the coastal area of the State of Ceará is inhabited by several species of cetaceans, sightings of these specimens in the studied area have been observed in the Mucuripe cove region only. This cove, in addition to being naturally more sheltered than much of the state's coast, has become a haven for this marine species also due to the installation of several spikes and piers, which function as artificial reefs (Figure 22).



Figure 22 - Sighting of Guiana dolphins (*Sotalia guianensis*) at Mucuripe Cove, in Fortaleza



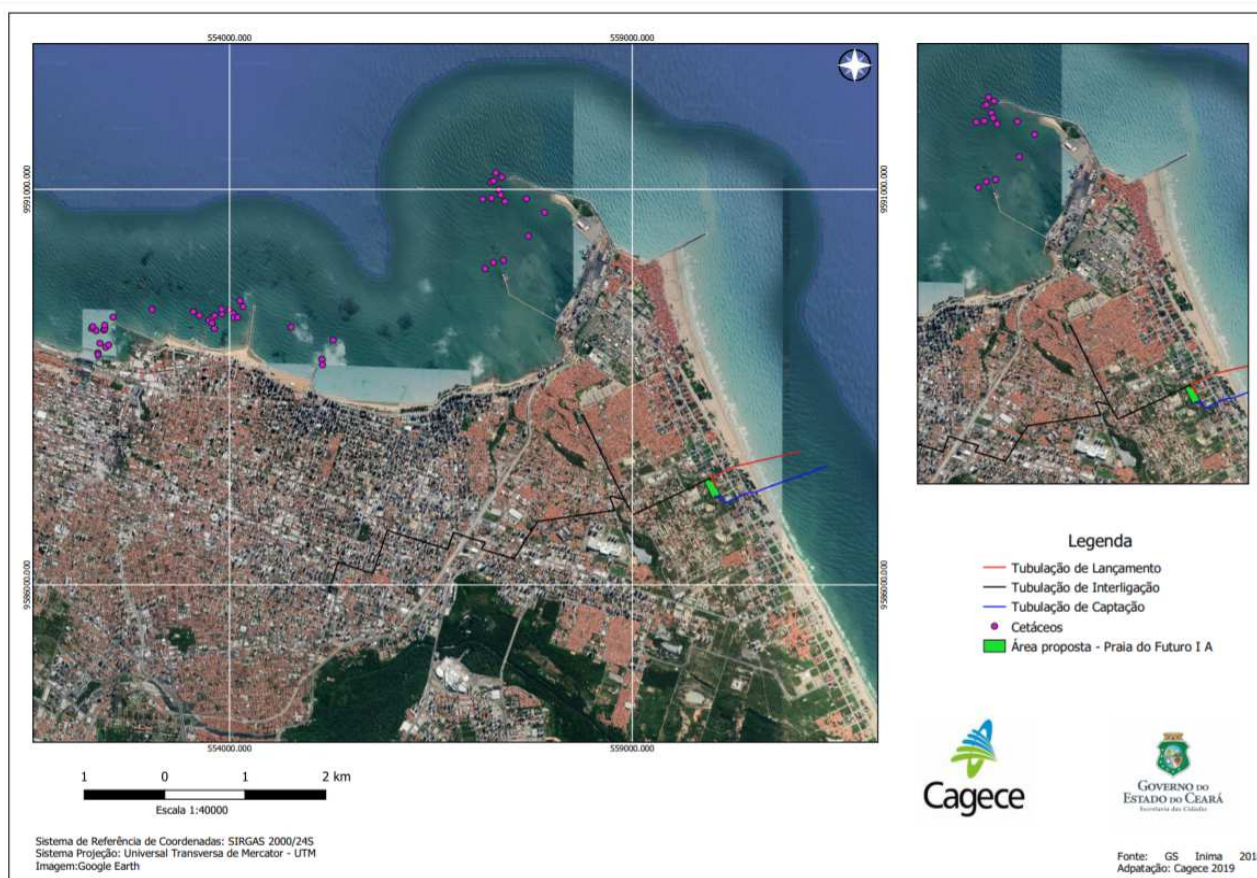
Source: Jornal O Povo, 03/20/2016

According to a study developed by MEIRELES (2013), the main places for the observation of Guiana dolphins at the Mucuripe Cove are Praia de Iracema, Marina Park, Mucuripe Port and Ideal Jetty, in that order. These sites are used by this species mainly for feeding; they use the spikes and piers in the structures as the foraging strategy, to optimize the capture of fish.

It emphasizes that the dolphin distribution area is not static, and can change according to environmental factors and distribution of food sources (DEFRAN et al., 1999; NEUMANN, 2001), as well as anthropogenic disturbances (HUNG; JEFFERSON, 2004). This claim was confirmed to some extent during the study's execution, due to the decreased frequency of sightings in the Mucuripe Port area during dredging operations carried out during the surveyed period.

It is important to emphasize that the Mucuripe Cove Guiana dolphins are protected by Municipal Law n° 9,949, of December 13<sup>th</sup>, 2012, which declares them as a natural patrimony of the municipality of Fortaleza, recommending their protection and restraint from activities that may cause damage to them or their habitat.

Figure 23 - Distribution of Guiana dolphin Sightings at the Mucuripe Cove (Period Oct, 2009 to Sep, 2011).



## Marine Turtles

As for the occurrence of turtle nesting areas in the coastal region of Fortaleza, according to the National Action Plan for Sea Turtle Conservation published by ICMBio - Chico Mendes Institute for Biodiversity Conservation, in mid-2011, the coast of Ceará is considered a feeding area for adult specimens, with only occasional nesting areas found. There is a protected feeding area located in Almofala, in city of Itarema, where there is a TAMAR Project base. The TAMAR - Fortaleza Nucleus was created in 1999, and its main function is to monitor the occurrences of sea turtle strandings on the beaches of this municipality.

Among the turtles that can be found along the coast of Ceará, are the *Caretta* (loggerhead turtle), *Chelonia midas* (green sea turtle), *Eretmochelys imbicata* (hawksbill sea turtle) and *Lepidochelys olivacea* (olive ridley sea turtle) species, all classified as threatened. Of these, only the first two can be found in most Ceará's coastline, including the coastal region of Fortaleza. Therefore, it can be said that there are no traditional sea turtle nest areas in the studied coastal area, therefore, they cannot suffer interferences from the venture.

LIMA (2001) evaluated sea turtle strandings on the coast of the Metropolitan Region of Fortaleza, from 1999 to 2000, having found 25 strandings, of which 92.0% were of the *Cheloniamydas* and only 8.0 % of the *Lepidochelys olivacea* species. Regarding location, 68.0% of strandings occurred on the beaches of Fortaleza, 28.0% in Aquiraz and the rest

in Caucaia. Fortaleza has the largest number of strandings, due to the fact that this municipality houses a greater concentration of fishermen working with gillnets.

LIMA et al. (2003) states that the fishing devices employed by fishing communities in Fortaleza capture dozens of turtles during their migration processes, between feeding and nesting, leading to the death of approximately 81.25% of the specimens found.

According to information from the local press and researchers, in 2019 there have been recorded sightings of hawksbills nesting on Praia do Futuro's shore. However, they are not regular or frequent nesting, as in other beaches.

#### **10.2.3.4 Conservation Units and Permanent Preservation Areas**

The development of conservation actions aimed at protecting biodiversity are represented in Fortaleza by the presence of 12 preservation units distributed throughout its territory (Chart 3 and Figure 24. Most were created by state and municipal public authorities and represent Coastal Vegetation Complex ecosystems, such as:

- ✓ Four fully protected preservation units - Pedra da Risca do Meio Marine State Park, the Cocó State Park, the Sabiaguaba Dunes Natural City Park and the Lagoa da Maraponga Ecological Park; and
- ✓ Eight sustainable use preservation units – Ceará River Estuary - Maranguapinho, Sabiaguaba and Pacoti River APAs, the ARIEs of Sítio Curió, Matinha do Pici, Prof. Abreu Matos and Cocó Dunes and Sapiranga Lagoon Private Ecological Reserve.

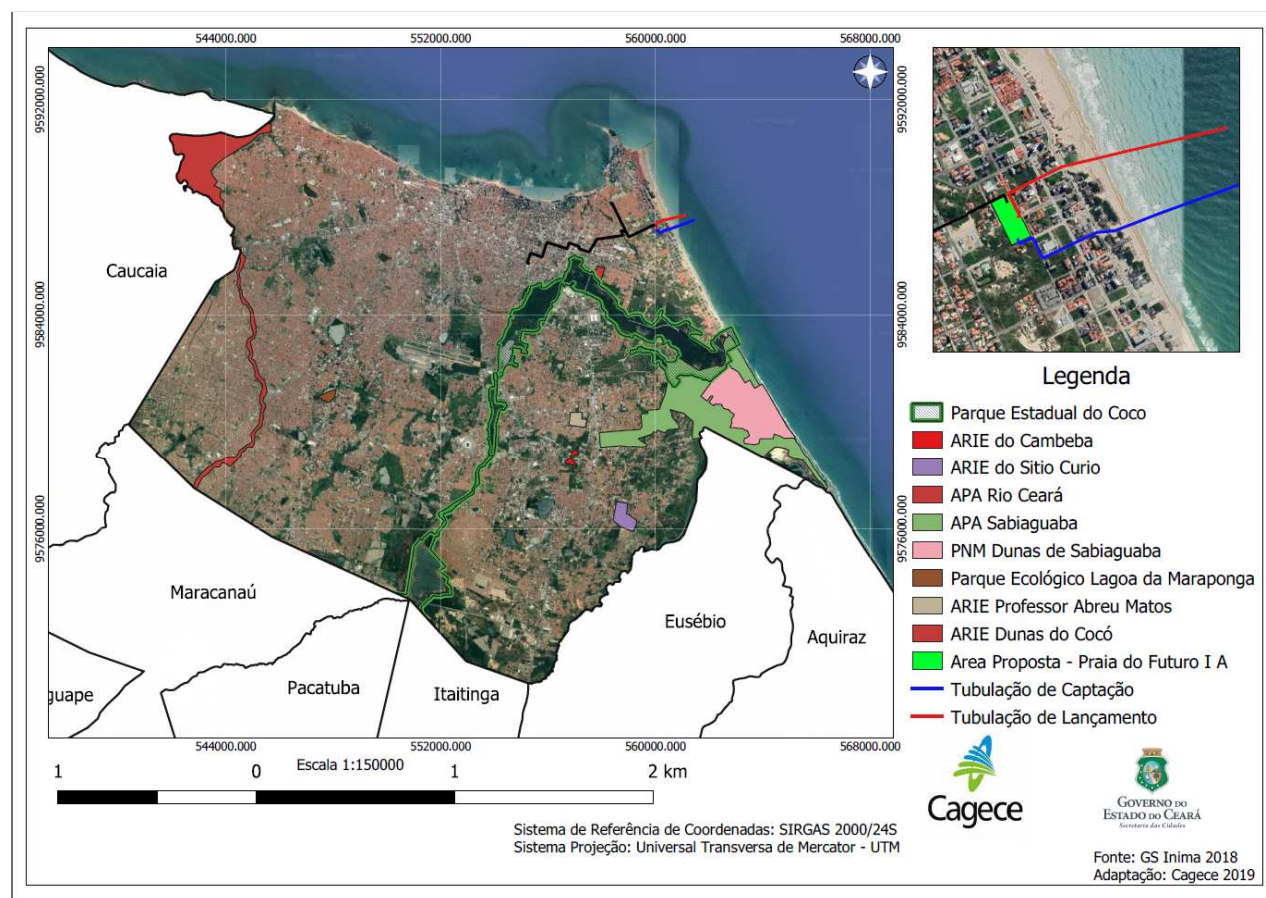


Chart 3 - Conservation Units in the City of Fortaleza

Conservation Unit	Legal Device	City	Area (ha)	Governing Body	Ecosystem Represented
<b>Fully Protected Preservation Units</b>					
Pedra da Risca do Meio Marine State Park	Law n° 12,717, of 09/05/1997	Fortaleza	3.320,00	SEMA	Marine
Cocó State Park	State Decree from 06/04/2017	Fortaleza	1.571,00	SEMA	Mangrove
Sabiaguaba Dunes Natural Municipal Park	Municipal Decree n° 11,986, of 02/20/2006	Fortaleza	467,60	SEUMA	Coastal Vegetation Complex (mobile dunes, paleodunes, beach strips and coastal and interdune lagoons)
Maraponga Lagoon Ecological Park	State Decree n° 20,253, of 09/05/89	Fortaleza	31,00	SEMA	Lacustrine System
<b>Conservation Units for Sustainable Use</b>					
APA (Ceará River Estuary - Rio Maranguapinho)	State Decree n° 25,413 of 03/29/1999. Expansion through Decree n° 25,413, of 03/29/2018	Fortaleza Caucaia Maracanaú and Maranguape	3.447,32	SEMA	Coastal Mangrove
APA (Sabiaguaba)	Municipal Decree n° 11,987, of 02/20/2006	Fortaleza	1.009,74	SEUMA	Coastal Vegetation Complex
APA (Pacoti River)	Decree n° 25.778, of 02/15/2000	Fortaleza, Eusébio e Aquiraz	2.914,93	SEMA	Coastal Vegetation Complex
Area of Relevant Ecological Interest - ARIE (Sítio Curió)	Decree 28.333, of 07/28/2006	Fortaleza	57,35	SEMA	Atlantic Forest Enclave
ARIE (Prof. Abreu Matos)	Municipal Law n° 10,537, of 09/09/2016	Fortaleza	18,80	SEUMA	<i>Cerrado</i>
ARIE (Cocó Dunes)	Municipal Law n° 9.502, of 10/7/2009	Fortaleza	15,25	SEUMA	Dune fields vegetation complex
ARIE (Matinha do PICI)	Municipal Law n° 10,463 of 03/31/2016	Fortaleza	47	SEUMA	Tableland Vegetation
Sapiranga Lagoon Private Ecological Reserve	Private UC	Fortaleza	58,76	Maria Nilva Alves Foundation	Coastal Vegetation Complex

 Sources: [www.sema.ce.gov.br](http://www.sema.ce.gov.br) and [www.mma.gov.br/areas-protetidas/cadastro-nacional-de-ucs](http://www.mma.gov.br/areas-protetidas/cadastro-nacional-de-ucs).


Figure 24 - Conservation Units in the City of Fortaleza



None of these conservation units will suffer interference from the works planned for the implantation of the Desalination Plant currently proposed, nor from impacts resulting from enterprise operation.

The Pedra da Risca do Meio Marine State Park, the only one of these UC's located in a marine environment, is positioned about 10 nautical miles (18.5 km) from area 04 (Iplanfor I), were implementation shall happen, towards 60° NE. This practically eliminates the risks of it being affected by the implementation and operation of the enterprise under analysis. This conservation unit, created by Law nº 12.717 / 1997, has an area of 33.2 km<sup>2</sup>, constituting a biological refuge of great value. It aims to protect an area of reproduction and feeding of marine species, rescue artisanal fishing, study and develop sustainable fishing programs and conduct research in the Biological Sciences, Tropical Marine Sciences and Fisheries Engineering fields, in addition to disseminating and promoting underwater tourism. This UC is managed by SEMA.

The permanent preservation areas identified in the territory of Fortaleza are represented by protection strips containing water courses and springs, with widths established by the New Forest Code (Federal Law nº 12.651, of May 25, 2012), mangroves originating from the Cocó, Ceará and Pacoti rivers, as well as tributaries in the stretches not protected by the existing conservation units and dune field vegetation. None of these are present in the Praia do Futuro IA area, as it does not have water courses, springs or mangroves positioned in its territory.

It is important to note that, according to the type of soil already informed in this study and in the Fortaleza's databases, the Praia do Futuro I area has a Dunes classification. However, the area currently projected for the desalination plant has been anthropized, with housing units, the implantation of technology companies and solid waste deposits on the surrounding highways. The area planned for desalination plant implementation has land already delimited by a wall, bearing the possibility of building homes or companies in the future (Figure 25).

Figure 25 - Desalination Plant Location Area



Source: Cagece, 2019

#### 10.2.4. Anthropic Environment

##### 10.2.4.1 Direct Influence Area Characterization

##### Evolution of Population and Geographic Distribution

In Ceará, the urbanization process took place quite quickly and intensely, given that in the mid-1960s, less than half of the state's population lived in cities and, currently, about 73.0% of the population lives in urban areas. In addition, the State does not have a network of cities with a hierarchical size gradation to allow the distribution of rural flight impact to a greater number of centers to receive migrant population. In fact, in Ceará, the main urban centers continue to be Fortaleza, Maracanaú and Caucaia, located in Fortaleza's Metropolitan Region, in addition to Sobral, in the northwest, and Juazeiro do Norte and Crato in Cariri. These areas concentrate the impacts resulting from urbanization, with all its implications. In 2016, the Metropolitan Region of Fortaleza was home to 44.79% of the state's urban population as a whole, with 64.99% of this total concentrated in the city of Fortaleza, the state's capital.

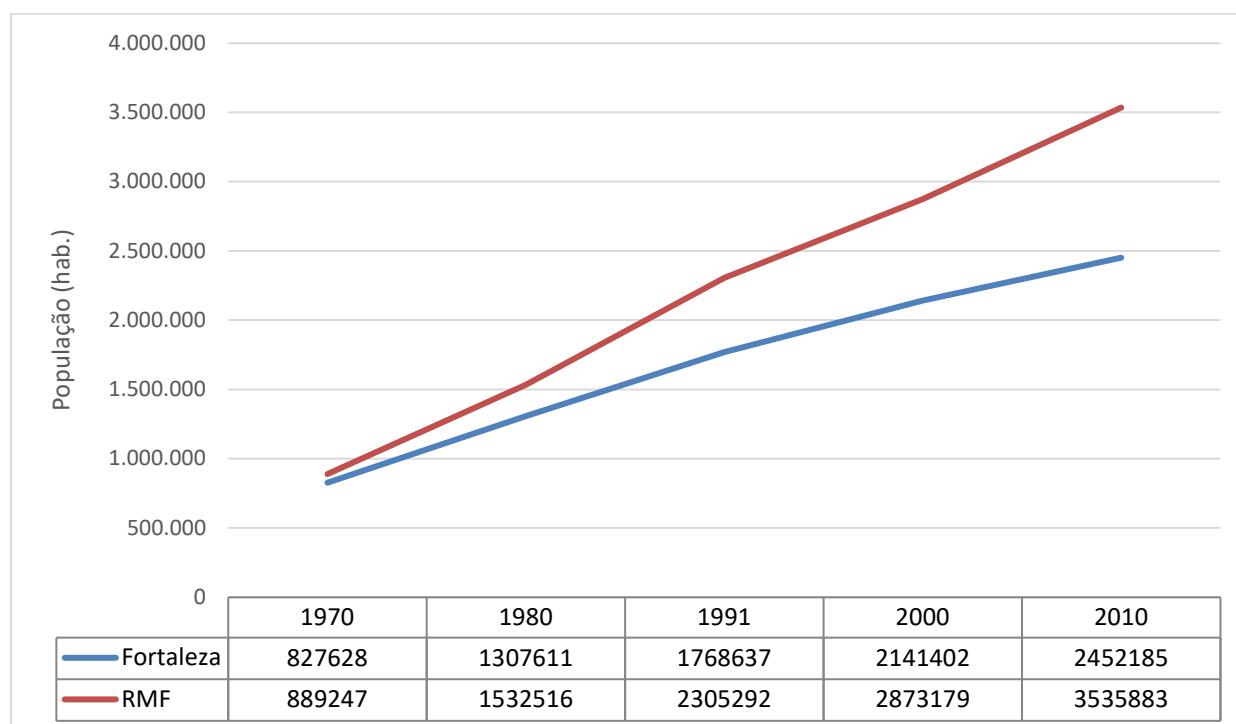
With a geographical area of 314 km<sup>2</sup>, the municipality of Fortaleza was home to a population of 2,452,185 inhabitants in 2010 according to IBGE data, corresponding to 29.0% of the total State population. The demographic density was 7,786.44 inhab/km<sup>2</sup>.



The municipality has 100.0% of its population with domicile in the urban environment. According to an IPECE estimate in 2017, Fortaleza already had a population of 2,627,482 inhabitants.

Fortaleza's population growth in the last three decades was, to a large extent, due to the strong migratory movement, coming mainly from rural areas from other cities to the state capital, and not, specifically, from its own growth. In 1980, Fortaleza had a population of 1,307,611 thousand inhabitants. In 2010, according to the last IBGE census, this population had already reached 2,452,185 inhabitants, a relative growth of 53.32% in 30 years, evidenced by the population growth curve, shown in Figure 26.

Figure 26 - Evolution of the Urban Population in Fortaleza and its Metropolitan Area (1970/2010)



Source: IBGE, Demographic Census, 1970/2010.

Fortaleza's demographic growth, as measured by geometric growth rates, reveals that from 1970 to 1980, Fortaleza experienced an accelerated growth rate above 4.0% per year. Nevertheless, as has occurred in almost all Brazilian metropolitan areas, Fortaleza underwent a growth rate decrease to 2.78% per year in the 1980s, to 2.15% per year from 1991 to 2000 and 1.34% per year from 2000 to 2010, as can be seen in Figure 27.

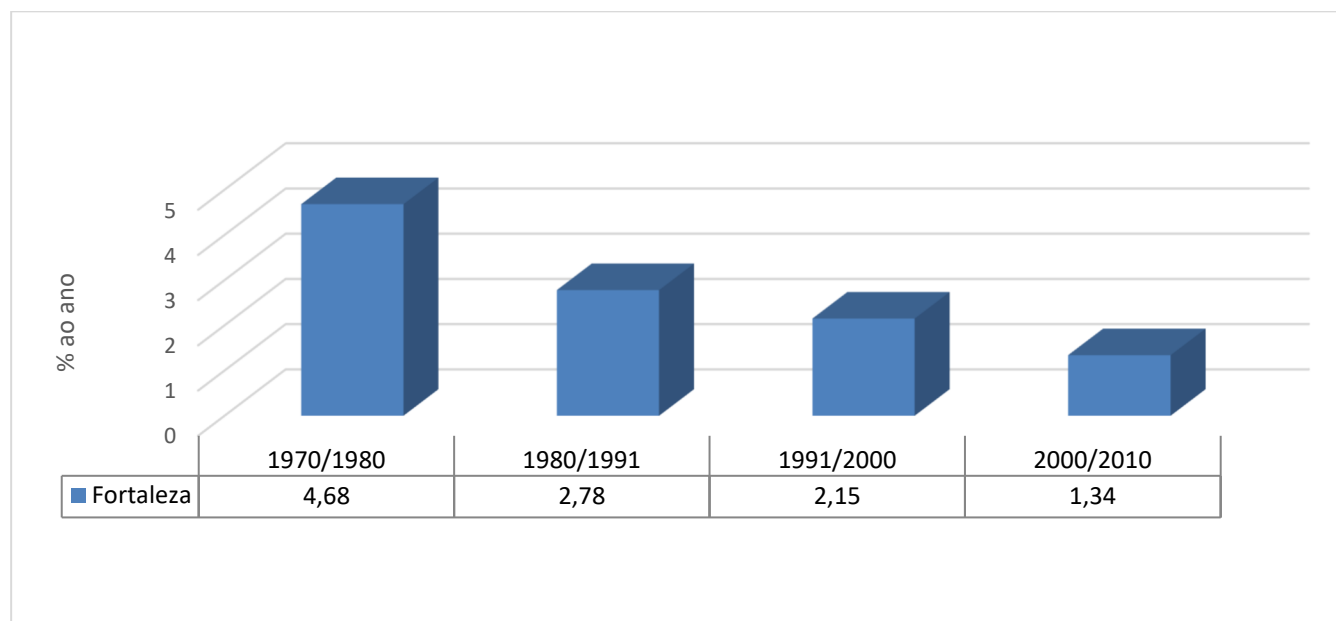
Meanwhile, in these last two periods, the Metropolitan Region of Fortaleza grew at much higher rates, of 2.48% and 2.10% per year, respectively. This fact shows that the municipalities bordering Fortaleza, mainly Caucaia and Maracanaú, started to absorb part of the immigrants, that in the past decades would head directly to the city of Fortaleza.

The most visible effects of the urbanization process in Fortaleza and its metropolitan region were the formation of a thriving urban middle class with a demand profile completely different from that of the population of rural origin, and the simultaneous process of social



segregation that pushed the low-income population to the outskirts of the city, where, paradoxically, they did not find what they came for: a better quality of life.

Figure 27- Fortaleza – Geometric Population Growth Rates (1970/2010)



Source: IBGE, Demographic Census, 1970/2010.

When analyzing the distribution of Fortaleza's population by zones, it is observed that this is done in various ways, with the West Zone, that encompasses Administrative Regions I, III, IV and V being densely populated, housing 64.27% of the population (Chart 4). Occupation by the middle and low-income population predominates in this region, and its most populous districts are Barra do Ceará (72,423 inhabitants), Vila Velha (61,617 inhabitants), Quintino Cunha (47,277 inhabitants), Pici (42,494 inhabitants) and Bom Sucesso (41,198 inhabitants) in the northwest, while in the southwest, Mondubim (76,044 inhabitants), Granja Lisboa (52,042 inhabitants), Genibaú (40,336 inhabitants), Granja Portugal (39,651 inhabitants) and Planalto Ayrton Senna (39,446 inhabitants) are the most populous.

The East Zone, formed by upper middle class neighborhoods and urban expansion areas, houses 35.73% of Fortaleza's population, presenting a high verticalization process of housing units occupied by the middle and upper-income population in the districts of Aldeota, Varjota, Papicu, Meireles and Mucuripe, as well as areas with low population density in the Praia do Futuro I, Praia do Futuro II and Dunas districts, all located in Administrative Region II. The most populous neighborhoods are Aldeota (42,361 inhabitants) and Vicente Pinzón (45,518 inhabitants).

Administrative Region VI, in turn, is characterized by extensive areas of demographic voids in the middle of the urban network, presenting a sparse occupation in the East and Southeast due to the physical barriers represented by the Cocó River, the dunes and the high price of urban soil. The most populous districts in the Southeast are Passaré (50,940 inhabitants), Jangurussu (50,479 inhabitants) and Messejana (41,689 inhabitants).

Chart 4 - Fortaleza – Population Distribution According to Administrative Regions – 2010

Administrative Region	West Zone		East Zone		Total	
	n° of Districts	Population	n° of Districts	Population	n° of Districts	Population
SERCEFOR	01	28.538	-	-	01	28.538
I	15	363.912	-	-	15	363.912
II	-	-	20	334.468	20	334.468
III	16	360.551	-	-	16	360.551
IV	19	281.645	-	-	19	281.645
V	18	541.511	-	-	18	541.511
VI	-	-	29	541.560	29	541.560
<b>Total</b>	<b>69</b>	<b>1.576.157</b>	<b>49</b>	<b>876.028</b>	<b>118</b>	<b>2.452.185</b>

Source: PMF/SDE, 2015. Source: PMF/SDE, 2015

The division of the city into two zones, West (in development) and East (developed) has been accentuated in recent decades, since its demographic dimension has increased annually by a significant number of migrants, which has caused a continuous expansion of the urban network. However, a parallel development of basic urban infrastructure has not occurred. If in the East side and in the other districts close to the traditional commercial center, the vertical growth indicates the struggle of some to remain in areas more equipped with goods and services, in the outskirts of the city, in communities or even districts not far away, the absence of urban goods and services is quite significant. The city as a whole presents a wide range of problems that mainly affect the large working mass.

It should be noted that the city of Fortaleza has a very fluctuating population, due to its position as the major polarizing center for state economy, functioning as a consumer and intermediary center between state producers, other states of the Union and the international market. In addition, it is an important leisure site, attracting a large flow of tourists, especially during long weekends, school holidays or high season periods, serving as well as a point of support for those who demand other tourist attractions in the state.

The area planned for the Desalination Plant's implementation is located in the East side of Fortaleza, more specifically in the territory of the Regional Secretary II, where the plant shall be located in the Praia do Futuro area (Bairro Praia do Futuro I), with its area of direct influence covering the districts of Praia do Futuro I, Vicente Pinzón and De Lourdes, due to their greater proximity to the desalination plant area. The layout of pipeline interconnections to the CAGECE water supply system, in turn, intercepts roads in the Praia do Futuro I, De Lourdes, Vicente Pinzón, Papicu, Aldeota, Cocó and Dionísio Torres districts, all positioned in the SER II area. Together, these districts housed, in 2010, a population of 152,374 inhabitants, with the most densely populated areas observed in the Vicente Pinzón, Aldeota, Cocó and Papicu districts.

### Quality of Life Indicators

Aiming to assess quality of life standards and levels of the population resident in the city studied, education, income and medical-sanitary conditions were analyzed, in addition to



the Municipal Human Development Index (HDI-M) developed by UNDP - United Nations Development Program. The results obtained are presented below:

### **Educational level**

Upon analysis of the educational level of Fortaleza's population in 2010, an illiteracy rate of 6.9% was observed among people over 15 years of age, that is, 131 thousand people have not received a formal education.

It was also observed that the distribution of illiterates across the territories the Regional Executive Secretaries is highly concentrated in Regionals V and VI, with more than 51.0% of the absolute illiterates residing in districts within these two regions, making a total of 67,291 people without any formal education. On the other hand, Regionals II and IV have the lowest number of illiterate people (Chart 5).

Chart 5 - Illiteracy Index Among Persons 15 and Above by Regional Executive Secretary - 2010

Executive Offices Regional	Number of districts	Total Population	Illiteracy rates		% of the total number of illiterates
			Nº	%	
SER I	15	275.153	21.394	7,78	16,23
SER II	21	294.914	13.400	4,54	10,16
SER III	16	281.335	18.901	6,72	14,34
SER IV	20	228.436	10.842	4,75	8,22
SER V	18	394.608	34.886	8,84	26,46
SER VI	29	424.057	32.405	7,64	24,58
<b>Total</b>	<b>119</b>	<b>1.898.503</b>	<b>131.828</b>	<b>-</b>	<b>100,00</b>

Source: IPECE, Report n° 47. Fortaleza's Municipal Profile. Theme XI: Profile of Illiteracy by District. Fortaleza, IPECE, 2012.

When classifying districts by proportion of illiterate residents, it appears that Pedras is the neighborhood with the highest proportion of illiterates, with 14.4% of its population having no formal education in 2010. Next, we have the Ancuri district (13,3%), Praia do Futuro I (13.2%), Sabiaguaba (13.0%), and Pirambú (12.9%). The districts with the lowest proportion of illiterates are Meireles (1.3%), Dionísio Torres (1.4%), Fátima (1.4%), Cocó (1.5%) and Gentilândia (1.8%).

Chart 6 shows the 10 districts with the highest concentration of illiterate people aged 15 and over, namely: Barra do Ceará, Granja Lisboa, Mondubim, Granja Portugal, Genibaú, Canidezinho, Vila Velha, Planalto Ayrton Senna and Vicente Pinzon. It also appears that 6 (six) of these districts are located in SER VI.



Chart 6 - Fortaleza Districts with the Highest Illiteracy Rates Among People

Districts	SER	Total Population in 2010	Illiteracy	
			Number of Persons	%
Barra do Ceará	I	54.152	4.952	9,14
Granja Lisboa	VI	37.527	4.144	11,04
Mondubim	VI	56.318	3.851	6,84
Granja Portugal	VI	28.513	3.524	12,36
Genibaú	VI	29.035	3.495	12,04
Canindezinho	VI	29.406	3.413	11,61
Vila Velha	I	46.223	3.373	7,30
Planlto Ayrton Sena	VI	28.363	3.210	11,32
Vicente Pinzón	II	34.417	3.095	8,99

Source: IBGE, Demographic Census, 2010.

### Income Distribution

Regarding income distribution, data from the 2010 IBGE Demographic Census for the municipality of Fortaleza confirms that 47.17% of existing households have a monthly income of less than two minimum wages, which proves the low living standard of the population resident in the enterprise's area of influence. Including the households that did not have an income, the situation becomes even more critical, with this percentage rising to 84.98%, denoting a high concentration of income (Chart 7).

Chart 7 - Nominal Monthly Household Income – 2010

City	Nominal Monthly Income (%)				
	Until 2 minimum wages	2 - 5 minimum wages	5 - 20 minimum wages	> 20 minimum wages	Without Income
Fortaleza	47,17	8,92	5,50	0,60	37,81
<b>Ceará</b>	<b>63,23</b>	<b>22,43</b>	<b>8,62</b>	<b>1,26</b>	<b>4,46</b>

Source: IBGE, Demographic Census, 2010.

Upon analysis of the average per capita income, it is observed that there was an increase of this value during the 2000/2010 period in the municipality of Fortaleza, from a level of R\$ 610.48, in 2000, to R\$ 846, 36, in 2010, higher than the minimum wage in force at the time, of R\$ 510.00 (Chart 8).

The proportion of people in poverty, that is, with per capita household income below R\$ 140.00 (in August 2010 values) in Fortaleza, declined from 27.54% in 2000 to 12.14% in 2010, with the proportion of people living in poverty below state average. Extreme poverty, measured by the proportion of people with *per capita* monthly income below R\$ 70.00 (in August 2010 values), decreased in the period considered. In fact, in the municipality of





Fortaleza, in 2000, the proportion of extremely poor was 9.02%, falling to 3.36% in 2010, a reduction of 9.4% per year.

Chart 8 - Income Distribution - 2000/2010

Cities	Per capita income (R\$)		Proportion of extremely poor (%)		Proportion of poor (%)		Income concentration (Gini Index)	
	2000	2010	2000	2010	2000	2010	2000	2010
Fortaleza	610,48	846,36	9,02	3,36	27,54	12,14	0,64	0,61
<b>Ceará</b>	<b>310,21</b>	<b>460,63</b>	<b>28,11</b>	<b>14,69</b>	<b>51,75</b>	<b>30,32</b>	<b>0,67</b>	<b>0,61</b>

Source: PNUD / IPEA / FJP, *Atlas do Desenvolvimento Humano do Brasil*, 2013.

The evolution of income inequality in this period can be described through the Gini Index, an instrument that measures the degree of income concentration, with zero representing a situation of total equality and 1 meaning complete inequality. The Gini Index, in Fortaleza, went from 0.64 in 2000 to 0.61 in 2010, but it still shows a strong concentration of income.

### **Medical-Sanitary Conditions**

The medical and sanitary conditions of Fortaleza's population were analyzed based on infant mortality rate and the relationship between hospital beds per inhabitants and doctors per inhabitants. The information on hospital beds and doctors was taken from the DATASUS website, at CNES - Physical Resources and CNES - Human Resources, and the IPECE projection for the population in 2015 was used for data on the population.

The infant mortality rate has been declining over the years. In 2000, the infant mortality rate in Fortaleza reached 34.6 deaths per one thousand live births. In 2010, this rate dropped to 15.8 deaths per one thousand births, and in 2015, it declined to 11.7%. The increase in women's education, in the percentage of households with adequate basic sanitation (sanitation, drinking water and garbage collection), the decrease in child and youth malnutrition, as well as greater access by the population to health services were the factors that most contributed to this reduction. It is noteworthy, however, that although this reduction is a positive aspect, the infant mortality rate in this urban core still remains slightly above the rate considered acceptable by the WHO - World Health Organization, which is 10 deaths for every one thousand births (Chart 9).

Chart 9 - Medical and Sanitary Indicators

City	Child Mortality rate (%)		Hospital Beds per Inhabitant List (2015)	Doctors per Inhabitant (2015)
	2010	2015		
Fortaleza	15,80	11,70	1:299	1:515
<b>Ceará</b>	<b>19,29</b>	<b>12,20</b>	<b>1:459</b>	<b>1:727</b>

Source: PNUD / IPEA / FJP, *Atlas do Desenvolvimento Humano do Brasil*, 2013; Datasus, TabNet, 2015; IPECE, Estimativa da População, 2015.



The number of hospital beds per inhabitant in Fortaleza is deficient, reaching, in 2015, the rate of one bed for every 299 inhabitants, a value slightly higher than the parameter recommended by WHO, which is 1:200. As for the doctors per inhabitant ratio, Fortaleza presents the value of one doctor for every 515 inhabitants Fortaleza, complying loosely with the parameter established by the World Health Organization, of one doctor for every 1,000 inhabitants.

It is important to note, however, that a good part of countryside towns in the State of Ceará present a deficit in this relationship, making people seek medical assistance in the great medical and hospital center of the state, the city of Fortaleza. Such deficiency contributes to the overload of the health sector infrastructure in this municipality, making the service not adequately satisfactory.

### **Human Development Index (IDH)**

Another important parameter for the analysis of the quality of life and human progress is the Human Development Index, which considers, for its calculation, in addition to the living standards (income), variables such as a long and healthy life (longevity) and access to knowledge (education). Chart 10 shows the HDI-M values for the municipality of Fortaleza.

Chart 10 - Municipal Human Development Index - 2000/2010

City	HDI-M		HDI-M Income		HDI-M Longevity		HDI-M Education		Ranking Ceará-2010
	2000	2010	2000	2010	2000	2010	2000	2010	
Fortaleza	0,652	0,754	0,697	0,749	0,744	0,824	0,534	0,695	1º
<b>Ceará</b>	<b>0,541</b>	<b>0,682</b>	<b>0,588</b>	<b>0,651</b>	<b>0,713</b>	<b>0,793</b>	<b>0,377</b>	<b>0,615</b>	-

Source: PNUD/Ipea/FJP, Atlas do Desenvolvimento Humano do Brasil, 2013

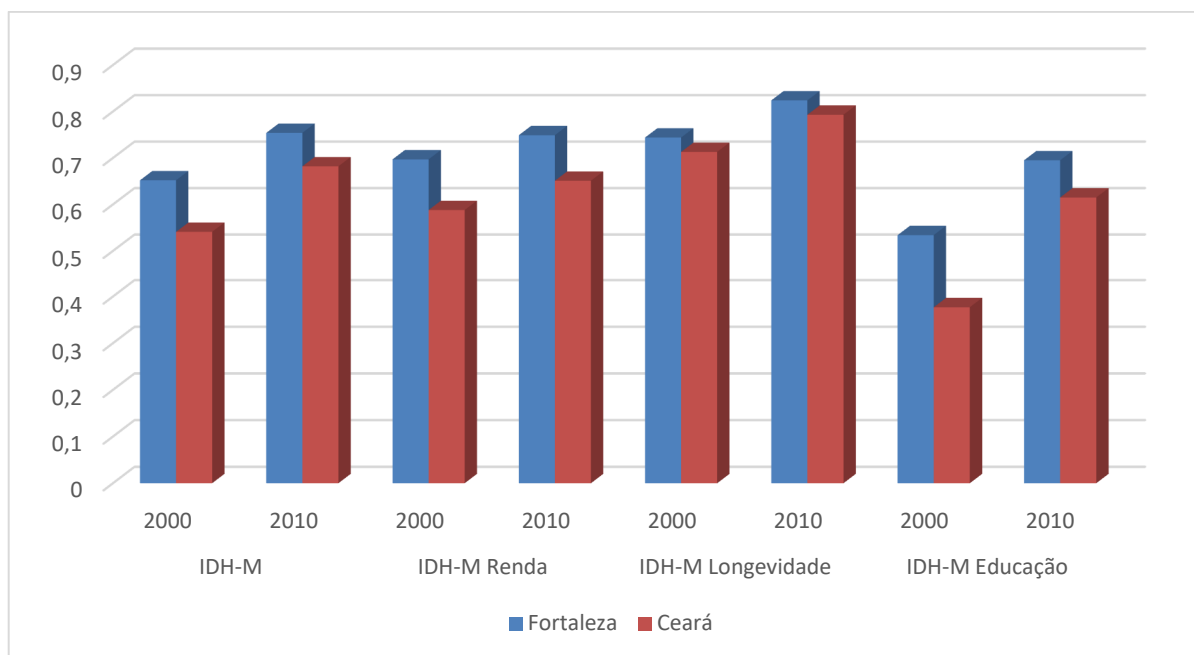
Over the period 2000 to 2010, an increase of 15.64% was observed in the HDI-M of the municipality of Fortaleza, which went from an index of 0.652 in 2000 to 0.754 in 2010, a value considered high (MHDI between 0.700 and 0.799). The human development gap, that is, the distance between the municipality's MHDI and the maximum index limit, which is 1, was reduced by 70.69% between 2000 and 2010.

In the state ranking, Fortaleza is the municipality with the best position, occupying the 1st position. This reflects the better conditions of income, longevity and education compared to other municipalities. Comparing the HDI-M values of 2000 and 2010, it appears that the indicators of income, longevity and education showed increasing values over the past decade. The greatest positive variations were seen in the education indicator (with growth of 0.161), while the longevity and income indicators showed smaller advances (Figure 28).

Among the variables that contributed to the HDI-M increase, there was an increase in income, a decrease in the rate of illiteracy and infant mortality, in addition to greater access to basic services.



Figure 28 - Evolution of the HDI-M Values in the Studied Area



Source: PNUD/IPEA/FJP, Atlas do Desenvolvimento Humano do Brasil, 2013

### Traditional Populations

According to data collected from FUNAI - Fundação Nacional dos Índios and Fundação Cultural Palmares, the municipality of Fortaleza does not have indigenous reservation areas, nor quilombo communities in its territory, with the traditional populations represented only by artisanal fishermen.

According to MEIRELES (2013), there are 87 recorded motorized vessels operating in the Mucuripe cove, composed of small boats with cabins and engines and small packet boats with tail outboard motors. The area occupied by these vessels is approximately 16.0 km<sup>2</sup>, throughout the entire cove, with a greater concentration observed in the area between the Mucuripe Port jetty and Porto dos Pescadores (Figure 29).

The community of artisanal fishermen who fish in the Mucuripe cove mainly uses surface and bottom netting, and travels in small paddle boats. The fishing activity developed is essentially for personal financial support, and due to the limited movement, most of these fishermen are less than 1.0 km from the coast.

According to MEIRELES (2013) the area used for fishing in the Mucuripe cove is approximately 38.0 km<sup>2</sup>, with its area of preference extending from the outside of the Titã jetty to the coastline, near the Maceió stream.

It can be affirmed that Praia do Futuro is not a competitive destination for fishing, since its bottom is composed of sand, not housing the species of great commercial interest most sought by fishermen. The fishing production of Fortaleza is strongly marked by lobster and reef fish, associated with rocky bottoms and biogenic formations (such as Pedra da Risca do Meio, for example), environments very different from Praia do Futuro, with a sandy bottom.

Figure 29- Mucuripe Fishing Port, with the oil pier in the background



Source: <http://www.feriasnoceara.com.br/pontos-turisticos/4259-2/>.

### Historical and Archaeological Heritage

According to information provided by IPHAN - Institute of National Historical and Artistic Heritage, the municipality of Fortaleza has only two registered archaeological sites - the Sabiaguaba I and Sabiaguaba II sites. These are coastal sites with the presence of ceramic, lithic and malacological remains in wind corridor areas, located near the Cocó River, in the Sabiaguaba Beach area.

It is important to note that neither of these two sites are located in areas of direct influence by the proposed Desalination Plant project. In addition, initially, no evidence has been identified of the existence of this type of heritage site in the region of Praia Mansa. However, experience indicates that the risk of degradation of archaeological heritage must be considered, as this type of heritage site is likely to be found in dune fields as well as in the seabed. Therefore, in compliance with Normative Instruction IPHAN nº 001/2015, the Environmental Characterization Form - FCA of this enterprise must be prepared and submitted to IPHAN's appreciation in the scope of licensing between this enterprise and this organ. It should be noted that depending on the framework proposed by IPHAN, it may be necessary to carry out more accurate archaeological studies before the start of the works, including the execution of archaeological surveys.

As for historical heritage, the municipality of Fortaleza harbors 36 buildings listed by SECULT - Secretary of Culture, dating from the colonization period. Among these, it is worth mentioning Farol do Mucuripe, which currently houses the Fortaleza Museum, since it is located relatively close to the enterprise area.

### Economic activities

The tertiary sector of the economy is the most expressive in the municipality of Fortaleza, having, in 2014, contributed with 83.3% of the Gross Domestic Product of this municipality.





Agricultural activity is still inexpressive, accounting for only 0.08% of municipal GDP, largely represented by the cultivation of vegetables. In the last decades, a relative increase in industrial activities has been observed, with its participation in GDP increasing to 16.62% (Chart 11).

Chart 11 - Gross Domestic Product by Activity Sector - 2014

City	GDP by Sector (R \$ 1,000)				Total GDP (R\$ 1.000)
	Agriculture	Industry	Trade and Services	Public Administration, Health, Educ. and Social Security	
Fortaleza	43.940	8.120.965	33.539.908	7.170.402	48.875.216

Source: Source: IBGE - Department of National Accounts, 2014.

For the creation of formal jobs, there is a greater contribution from the tertiary sector in service provision activities, followed by public administration and commerce, with a 45.94%, 19.74% and 18.53% portions, respectively. In the industrial sector, the transformation industry and Civil Construction stand out in job creation, accounting for 9.67% and 5.13% of the job opportunities created, while the Utilities and Mineral Extraction industries present little contribution, 0.66% and 0.02%, respectively. Agricultural activity is not expressive in terms of job and income generation, contributing only 3.01% to job creation (Chart 12 e Figure 30).

Chart 12 - Number of Formal Jobs 2016

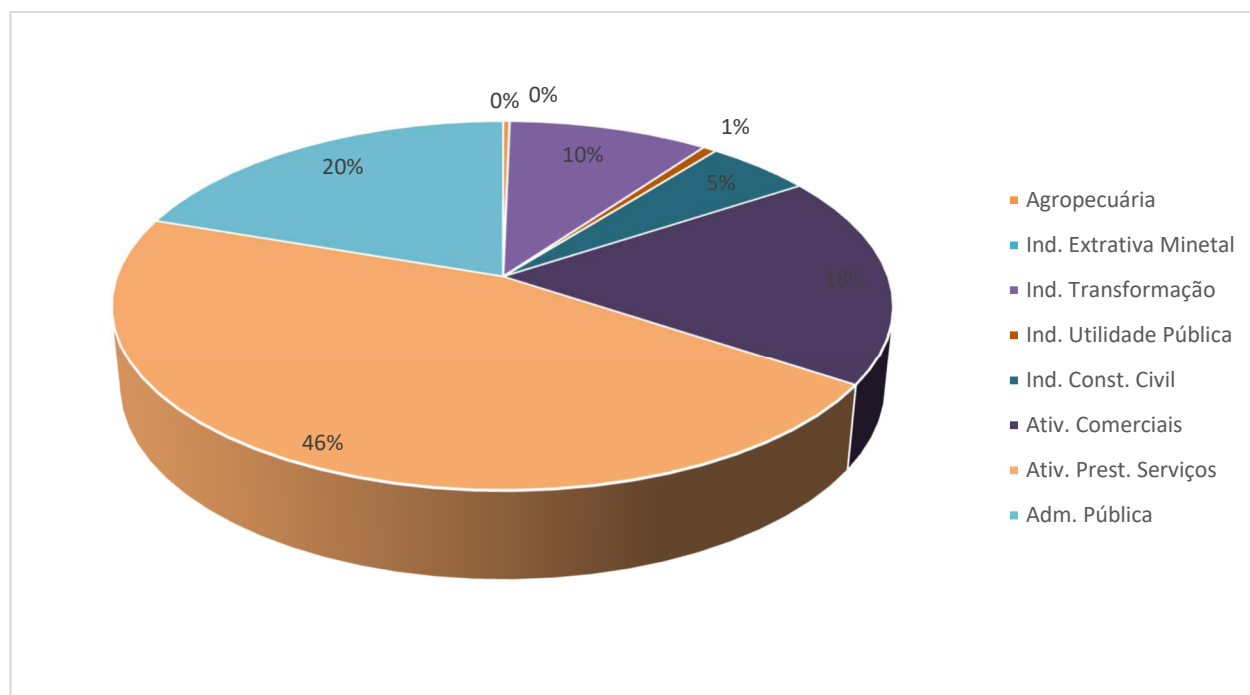
Type of Activity	Number of Jobs	%
Agriculture and livestock	2.330	0,31
Mineral Extraction Industry	155	0,02
Transformation Industry	74.724	9,67
Public Utility Industry	5.140	0,66
Construction Industry	39.678	5,13
Commercial Activities	143.268	18,53
Service Provision Activities	355.138	45,94
Public Administration	152.600	19,74
<b>Total</b>	<b>773.033</b>	<b>100,00</b>

Source: IPECE, Perfil Básico Municipal 2016 Fortaleza.

It should be noted that the commercial and services sectors of the State of Ceará present a representative portion concentrated in Fortaleza, the State capital and the main economic center. It presents the largest number of commercial companies and services, as well as the best quality standards of goods and services. Retail businesses are much more expressive than the wholesale, accounting for almost all commercial establishments in the municipality (95.84%). Clothing, Fabric, Shoes, Trimming and small item establishments predominate; general goods, food products come right after. Infrastructure for undertakings that strengthen the economic sector are very important, as well as the execution of educational campaigns to raise awareness among the population and entrepreneurs for the fact that tourism must be seen as a permanent activity.



Figure 30 - Number of Formal Jobs per Activity Sector 2016



Source: IPECE, Perfil Básico Municipal 2016 Fortaleza. Source: IPECE, Basic Profile Municipal 2016 Fortaleza.

Since it is the main commercial center of the State of Ceará, Fortaleza occupies the first place in state tourism, being known as *Terra do Sol* (Land of the Sun), with 25.0 km of beaches, where the Iracema, Praia do Futuro, Meireles and Mucuripe beaches stand out. In addition to the beaches, the city has as main tourist attractions the Nossa Senhora da Assunção Fortress, José de Alencar Theater, Dragão do Mar Cultural Center, and the historic preservation area, at Iracema Beach; Av. Beira Mar, where there are several bars and restaurants; the José de Alencar House; the Old Lighthouse at the Mucuripe Port; the craft trade at Av. Monsenhor Tabosa; the Ferreira and José de Alencar squares and the Cocó State Park, among others.

As for foreign trade, exports in the State of Ceará has reached, in 2017, according to IPECE data (Chart 13), the amount of US\$ 2,102.68 million, having metallurgical products (US\$ 1,074.61), footwear (US\$ 312.92 million), bovine leather and hides (US\$ 122.77 million), cashew nuts (US\$ 91.73 million), food products and beverages (US\$ 90.41 million) and fruit (US\$ 73,02 million) as pioneers.

As of 2017, with the start of operations at *Companhia Siderúrgica do Pecém*, the export agenda in Ceará started to have a new configuration, with metallurgical products accounting for 51.11% of the total value of products exported in 2017, reaching the amount of US\$ 2,102.68 million. The destination of exports is mainly the FTAA market - Free Trade Area of the Americas, OCDE - Cooperation Organization for Economic Development, the G7 and NAFTA – North American Free Trade Agreement. The main outlets for the flow of state production are located in the municipality of Fortaleza at the Mucuripe Port, or in its metropolitan region, at the Pecém Port.

Chart 13 - Main Products Exported by the State of Ceará - 2016/2017

Type of Activity	2016		2017		Var. (%)
	US\$	%	US\$	%	
Metallurgical Products	197.152.711	15,23	1.074.614.542	51,11	445,07
Footwear and related parts	290.800.034	22,47	312.921.804	14,88	7,61
Leathers and hides	145.690.821	11,26	122.772.062	5,84	-15,73
Cashew nuts (fresh or roasted)	103.206.128	7,97	91.730.430	4,36	-11,12
Food and Beverage Industry	87.985.593	6,80	90.410.652	4,30	2,76
Fruits (except cashew nuts)	99.378.636	7,68	73.023.319	3,47	-26,52
Mineral fuels, mineral oils and derivatives	51.131.202	3,95	59.455.980	2,83	16,28
Vegetable waxes	56.286.195	4,35	56.014.181	2,66	-0,48
Lobster	37.040.015	2,86	43.383.083	2,06	17,12
Textiles	48.742.523	3,77	37.870.346	1,80	-22,31
Other Products	176.721.845	13,66	140.486.631	6,68	-20,50
<b>Ceará</b>	<b>1.294.135.703</b>	<b>100,00</b>	<b>2.102.683.030</b>	<b>100,00</b>	<b>62,48</b>

Source: IPECE, Desempenho do Comércio Exterior do Ceará em 2017. Report n° 123. Fortaleza, IPECE, 2018.

The leadership in exports in the State of Ceará, in 2017, belonged to metallurgical products (US\$ 212.3 million), footwear (US\$ 312.92 million) and leather and hides (US\$ 122.77 million). Together, these products came to represent 71.83% of the total exported value, which was US\$ 2,102.68 million.

São Gonçalo do Amarante was the city that exported the most in 2017, accounting for 52.2% of total exports in Ceará. Sobral was the second largest exporter, and Fortaleza was in third place, losing a position, since in 2016 it was the second largest exporting municipality in the state. Among the ten main exporting municipalities in 2017, six showed a reduction in the amounts exported when compared to 2016, and they were: Fortaleza, Cascavel, Icapuí, Uruburetama, Caucaia and Eusébio.

According to data from the IPECE 2015 on industrial activities, the secondary sector of the municipality of Fortaleza was predominantly composed by the manufacturing industry, with 19,306 companies (Chart 14). It constitutes the main industrial center of Ceará, housing 48.51% of the industries in the state territory. Among the active manufacturing industries, the following stood out: clothing, footwear and fabric, leather and hide products (46.16% of the total); food products (11.93%); wood and furniture (8.47%); metallurgy (7.83%) and editorial and graphics (4.69%).



Chart 14 - Transformation Industrials - 2015

Type	Number of companies	%
Non-Metallic Mineral Products	370	1,92
Metallurgical	1.511	7,83
Mechanics	181	0,94
Electrical, electronic and communication material	315	1,63
Wood	502	2,60
Furniture	1.134	5,87
Leathers and hides	462	2,39
Chemistry	210	1,09
Plastic material	148	0,77
Textile	349	1,81
Clothing, Footwear and Crafts	8.911	46,16
Food products	2.304	11,93
Beverages	82	0,42
Editorial and Graphics	906	4,69
Other Companies	1.921	9,95
<b>Total</b>	<b>19.306</b>	<b>100,00</b>

Source: IPECE, 2015.

#### 10.2.4.2 Characterization of the Enterprise Area

The Desalination Plant area corresponds to a regular land plot formed by two partially unoccupied blocks separated by an unconsolidated street, located in the Praia do Futuro I area, in the vicinity of low and high standard residences. There is a building with service characteristics in one of the blocks, which must be compensated in the future.

According to information from the 2040 Fortaleza database, the related Iplanfor (2018) program establishes it as an area of damping and protection of sand dunes. However, the area already has a mixed-unit occupation density in the enterprise's surrounding areas.

Along this path, the interconnection pipeline layout will interfere with the following public use infrastructures: roads, railway lines, water distribution, sewage collection and storm drainage networks and gas pipelines. There will also be interference in some bus routes.

#### 10.2.4.3 Beach Shack Restaurant Conflicts

Conflicts were always present in the history of mankind, resulting from relationships between different social subjects who operate in space with divergent interests. They occur at different levels, nations, social groups and subjects. Little (2001, p.107) states that there are several types of conflicts, covering all spheres of human life, such as the psychological, political, economic and religious spheres. Nogueira and Suzuki (2013, p. 267) highlights the spatial dimension of conflicts:

“...multifaceted social relationships, resulting from various life and work trajectories that are expressed in the values, symbols, desires and projects that permeate the imaginary and attitudes of the social subjects involved”.

There are circumstances in which certain subjects are in favorable positions to resolve the issue, while in other instances, group interests prevail. There is a possibility that the





situation may change, favoring those who previously considered themselves to be harmed, through subordination to the will of others. The dispute for the permanence of the beach shack restaurants date back to 2005, with the start of a Public Civil Action. In certain periods, there were favorable judicial decisions, while in others, the interests of property owners prevail, for which there is no definitive solution.

The coastal population disputes the same geographical space for the most diverse activities and purposes, including housing, industry, commerce, transport, agriculture, fishing, aquaculture, leisure and tourism. It is natural that, in a restricted population density space, different groups compete for the same area for different activities, that can often be conflicting and even antagonistic (VASCONCELOS, 2005, p.16).

Regarding conflict implications, Nunes and Garcia (2012) affirm that new situations can originate, new strategies in which interests diverge. In the dispute for beach shack restaurants, questions are raised about their layout and service improvement.

The Desalination Plant area shall will not interfere with the beach shack restaurants at Praia do Futuro. The seawater intake and the brine discharge outfall systems will be implemented through a Non-Destructive Method - NDM. Thus, due to the technique used, there will be no intervention that may damage beach shack structure, access roads or cause an impact on the population.

#### **10.2.5. Environmental Zoning**

Environmental zoning is a political and technical planning instrument that aims to optimize the use of space and public policies, promoting the territory's integrated management regarding sustainable development. It is, therefore, extremely important that the spatialization of the activities developed in the enterprise area are carried out considering the existing rules and frailties presented by the environmental systems of the region where it will be based. For the execution of any and all spatial sectorization in environmental systems, it is necessary to carry out several basic studies, aiming for environmental characterization, to understand its various structures and dynamics.

As part of preliminary environmental study for the Desalination Plant Project, the surveys pertinent to basic studies covered biological, geophysical (geology, geomorphology, soils, water resources, climate and flora) and socioeconomic factors, with use of secondary data complemented by field assessments.

Based on the information gathered throughout this study, carried out by the multidisciplinary team and already informed by the Authorized Company, an environmental components diagnosis was carried out, with the aim to obtain more detailed knowledge. More than a description of the territory studied, the diagnosis was focused on the analysis and correlation between the various components of the abiotic, biotic and anthropic environments. In this way, it elucidated the different environmental conditions in the territory that are decisive in the characterization of environmental systems and in provision of subsidies for zoning.

After the classification of biogeophysical and socioeconomic factors was completed, the spatial sectorization of the territory began. In this study, a subjective method was adopted,

strongly interpretative of images and thematic maps and more suitable for zoning. This method uses geomorphology as a basic integration factor, since it reflects the most stable environmental qualities and synthesizes, at first instance, the result of environmental dialectics.

The adoption of geomorphological compartmentalization as a fundamental criterion for the geosystem identification and delimitation is justified by a greater facility in identifying, delimiting and interpreting topographic compartments and the features outlined in them.

The geomorphological compartments, however, do not have a physiognomic homogeneity, and are the result of the dynamic and unstable combination of climatic, hydrological, phytogeographic and anthropic elements. Therefore, the Natural Domains are subdivided into more homogeneous physiognomic units, called Environmental Systems.

To summarize, Environmental Systems are determined based on morphostructural and morphopedological conditions combined with other climatic, hydrological, phytogeographic and soil use and occupation components, as well as a combination of natural and socioeconomic elements.

After the identification and mapping of the Environmental Systems, dominant natural characteristics and the ability for the use of natural resources were defined for each. The latter is comprised of use potentials and limitations, in addition to the impacts and occupation risks

For geoenvironmental zoning, in addition to the adoption of geomorphological compartmentalization as criteria for delimiting geosystems, the land use and occupation zoning in the municipality of Fortaleza, preservation units and current environmental legislation were considered, in particular Law n° 12.651/2012 (New Forest Code), regarding permanent preservation areas.

The map presented in Attachment III shows the environmental zoning Fortaleza's area carried out based on its geomorphological compartmentalization, with emphasis on the alternative areas studied for the desalination plant's location.

After identification, each environmental system had its dominant characteristics described in Chart 15, specifying each system's support capacity, covering use potentials and limitations, in addition to the impacts and risks of occupation. This procedure allows the evaluation of the current situation in a synthetic way, besides providing a base for the planning of the rational territory occupation.

Chart 15 - Characterization of Environmental Systems

Geosystem	Geofaces	Dominant Natural Dominant Features	Environmental Potentials and Limitations	Ecodynamic Conditions and Vulnerability	Risks of Impacts by Occupation
Coastal Plain	Beach Strip	Flat area or with very gentle slope towards the sea, resulting from the accumulation of well selected marine sediments, from fine to coarse and fine to medium holocene sands, with irregular widths. In general, this environment is characterized by the absence of vegetation and constant sedimentary dynamics, strongly influenced by wind activity and the interaction between the continent and the ocean. Its morphology varies according to marine dynamics, which involves tides, ocean drift, wave intensity and direction and wind influence. It strongly limits occupation due to unstable conditions.	Landscape heritage with high potential for fishing, tourism and leisure activities. Land with high permoporosity and high vulnerability to groundwater resource pollution and contamination. Free aquifer present in shallow depth with sands of high hydraulic conductivity. Restrictions on mining activities.	Strongly unstable environment and highly vulnerable to occupation.	Risk of coastal sedimentological imbalance, which may trigger marine erosion processes and the coastline retreat. Loss of touristic attractions.
	Deflation Plain	Environment composed of residual deflationary deposits located between the beach strip and dune fields. It is an area defined by wind processes that produce flat surfaces, with wind corridors, groundwater resurgences and vegetation cover highly dependent on the presence of water resources. In some sectors of the coastal terrain, the quartzenic neosols are covered by pioneer herbaceous vegetation, forming a low layer composed essentially of salt-tolerant grass, adapted to wind intensity and solar radiation. These environments are subject to morphodynamic processes where pedogenesis is incipient or practically null, configuring environmental fragility and ecodynamics	Landscape heritage with high potential for fishing, tourism and leisure activities. Land with high permoporosity and high vulnerability to groundwater resource pollution and contamination. Restrictions on mining activities.	Transitional environment tending to instability, with high vulnerability to occupation.	Risk of coastal sedimentological imbalance, which may trigger marine erosion processes and the coastline retreat.  Compromise of water resources. Loss of touristic attractions due to disorderly occupation.



Geosystem	Geofaces		Dominant Natural Dominant Features	Environmental Potentials and Limitations	Ecodynamic Conditions and Vulnerability	Risks of Impacts by Occupation
			unfavorable to occupation, which must be carefully planned. As for the seawater intake and concentrate discharge pipelines, all the alternatives studied have most of all of their layout intercepting this environmental system.			
	Dune Fields	Mobile Dunes	Coastal zone with mobile dunes, fixed dunes and paleodunes, with very active wind dynamics. In fixed and paleodunes, pedogenesis favors the fixation of vegetation cover (coastal vegetation complex), preventing wind mobilization, with a predominance of the shrub stratum in fixed dunes.	Landscape heritage with high potential for fishing, tourism and leisure activities.  It has good groundwater potential, making the controlled use of water bodies necessary.	Strongly unstable environment and highly vulnerable to occupation on mobile dunes.  Transitional environment, with tendency to be moderately stable, with high vulnerability to the occupation of fixed dunes and paleodunes.	The interruption of mobile dune displacement due to disorderly occupation can compromise the entire coastal dynamics, resulting in sedimentological imbalance and contributing to the intensification of marine erosion and landscape mischaracterization, with loss of touristic attractiveness.  The destabilization of the dune environment due to the vegetation cover suppression of can lead to wind deflation and other degradating processes. Silting of lagoons and mangroves. Loss of scenic and tourist attractions.
		Fixed Dunes / Paleodunes		Environment strongly restrictive to urban expansion due to unstable conditions. Engineering works (roads, buildings, subdivisions, etc.) must be carefully designed considering the environment's vulnerability, and must be implemented through the execution of environmental impact studies. Restrictive environment for the practice of agroextractive and agricultural activities. Fixed dunes and paleodunes are present as compulsory and		
		Dissipated Paleodunes				





Geosystem	Geofaces		Dominant Natural Dominant Features	Environmental Potentials and Limitations	Ecodynamic Conditions and Vulnerability	Risks of Impacts by Occupation
				permanent preservation units.		
	<b>Fluvial Marine Plain</b>		<p>Strips perpendicular and parallel to the coastline in estuaries with fluvial and marine sediments. Sludgy, deep soils, partially submerged. Mangrove fixation happens as far as there is salinity, with halophytic vegetation serving as a shelter and breeding ground for numerous species of fish and crustaceans. They are classified as biological preservation areas, with use and access restricted by legal requirements. Ecosystems subject to permanent compulsory preservation of their biodiversity.</p> <p>There is no direct interference from the works proposed for the desalination plant with fluvial marine plains in any of the location alternatives studied.</p>	<p>Areas with complex biodiversity and significant floristic and faunistic productive capacity. Environmental vulnerability makes many activities unfeasible, except the rational management of mangroves. It presents legal restrictions, risk of periodic floods, high salinity and inconsistent substrates.</p>	<p>Transitional environment tending to instability, with high vulnerability to occupation.</p>	<p>Degradation of mangroves and decreased biological productivity. Elimination or reduction of fish species. Effluent or solid waste dumping. Reduction and compromise of biodiversity.</p>



Geosystem	Geofaces	Natural Dominant Features	Environmental Potentials and Limitations	Ecodynamic Conditions and Vulnerability	Risk of Impact by Occupation
Valleys	River Plain	Strips of alluvial accumulation on the plains formed by the Maranguapinho, Siqueira and Cocó rivers (in the medium course region), as well as by their tributaries and small coastal channels; low surfaces comprising floodplains partially flooded with alluvial sediments; dense drainage network and low river gradient that favors the widening of the valleys and the deposition of alluvium covered by riparian forests, presenting large stretches with degraded vegetation.	Edaphoclimatic and topographic potential favorable to agricultural activities. Good potential for surface and underground water resources. Some soils have salinity problems, in addition to imperfect drainage. Limited in terms of occupation due to the risks of periodic flooding and the vulnerability to pollution and contamination of water resources. Legal restrictions aimed at the presence of riparian forests.	Transitional environment with a tendency for instability or moderate stability due to the conservation status of riparian forests.	Degradation of riparian forests, triggering of erosive processes and river silting, resulting in worse floods. Risk of pollution of water resources. Difficulty in recovering riparian forests compromised by soil conservation status.
Pre-coastal Glacis	Pre-Coastal Tablelands	Flat surface with smooth topographic layout towards the coastline; it consists of unconsolidated sediments from the Barreiras Formation. The area is weakly carved by the superficial drainage that isolates tabliform features with small altimetric amplitudes between the valley bottoms and interfluvial ridge tops. There is a predominance of quartzenic neosols and clay soils covered by tableland vegetation, which is strongly uncharacterized by urbanization, being restricted to small isolated areas. Most of the Fortaleza urban area is located in this unit.  There will be no interference from the desalination plant areas with this environmental system in any of the alternatives studied.	Stabilized relief and low potential for mass movements to occur. Altered water table, very thick and easy to excavate. Water deficiencies during droughts. Environment little to moderately vulnerable to soil erosion, without significant limitations to urban occupation and expansion. It is potentially favorable to the implantation and expansion of the road network. Its frailties are not restrictive to urban/industrial use and occupation, agriculture, landfills, etc.	Stable environments with very low vulnerability.	Soil waterproofing by urban expansion can compromise the the Barreiras aquifer's refilling capacity. Sediment permoporosity favors leaching. Risks of pollution of water resources.



<b>Depression Hinterland</b>	<b>Preserved Pediments with Inselbergs</b>	<p>Flat surface, sloped towards the bottom of valleys and the coast, with altimetric levels of 60 to 120 m in crystalline basement rocks. Dense drainage with dendritic pattern and water courses with intermittent seasonal regime. Shallow to moderately deep soils covered by heavily degraded tree-shrub canals. Occasional occurrence of isolated hills (inselbergs). There is no interference from any of the three alternatives selected by the technical analysis with this type of geosystem.</p>	<p>It has few restrictions on urban occupation and the road network. Natural limitations imposed by the rainfall regime irregularity and the scarcity of water resources. Area suitable for use for extensive to semi-intensive livestock activities.</p>	<p>Transition environments with moderate vulnerability.</p>	<p>Degradation of areas covered by arboreal caatinga and tree-shrub vegetation, with erosion intensification and soil loss. Impoverishment of biological diversity.</p>
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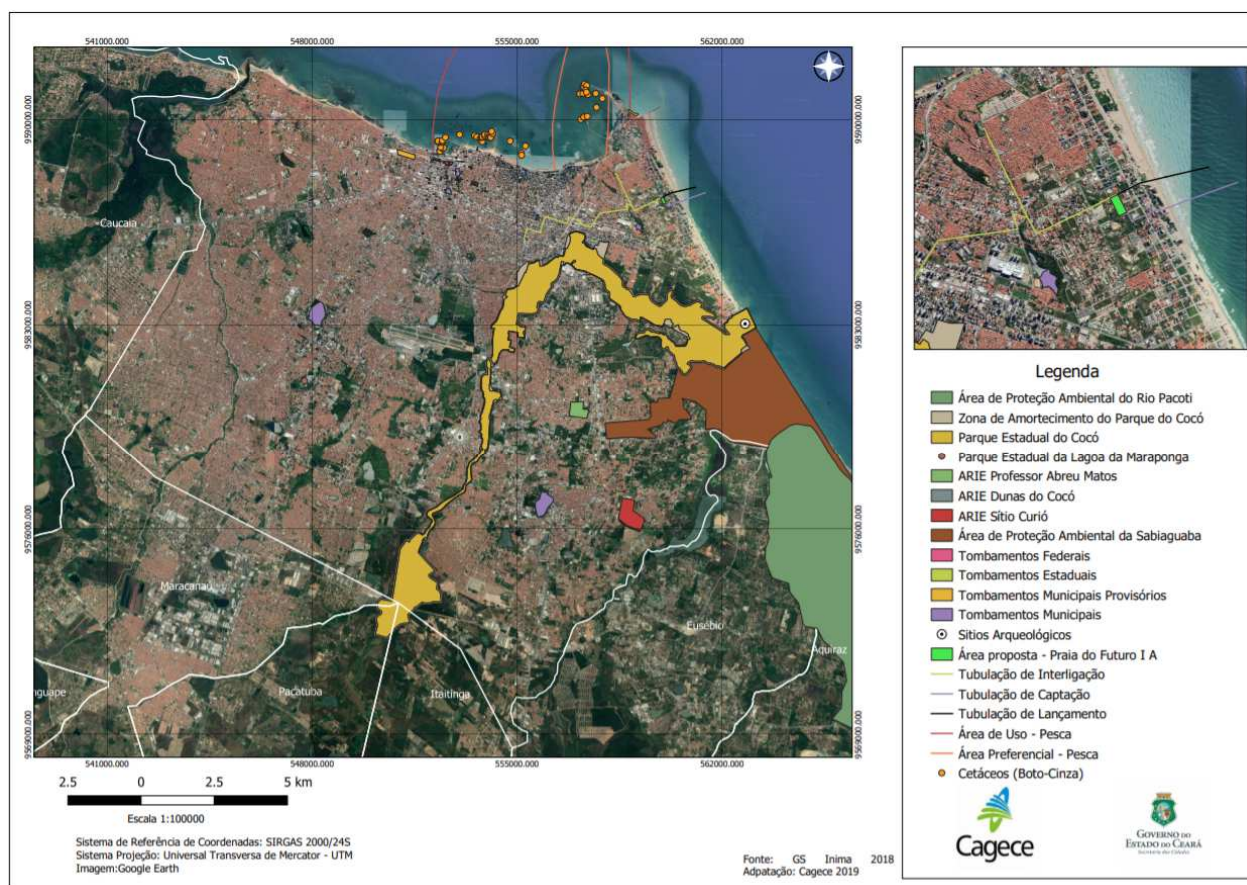


### 10.2.6. Identified Areas with Environmental Restrictions

Figure 31 displays environmentally restricted areas present in the city of Fortaleza. Below is a summary of the occurrence of interferences of the proposed enterprise with these areas, or lack thereof:

- ✓ There shall be no direct or indirect interference from the activities linked to the proposed undertaking with any of the conservation units present in the municipality of Fortaleza or its territorial sea;
- ✓ There shall be no interference between the activities planned for the proposed undertaking with areas of permanent preservation (mangroves, protected streams and water sources, etc.), except for the dune field in the surrounding area, which is already out of character due to real estate speculation.
- ✓ The extensive Praia do Futuro dune areas have been subjected to intense occupation and anthropization processes for decades. The land determined for the desalination unit's implementation corresponds to a fenced area previously destined to a residential condominium not yet installed, with anthropic interferences and altered vegetation. Aside from the land, there are fixed dune areas with different degrees of anthropization, surrounded by an area with significant property density;
- ✓ According to information from Fortaleza 2040 projections, the Praia do Futuro I area shall contemplate the Dune Damping and Protection Area; however, there is also a projection that states the increase of population density in this area.
- ✓ The municipality of Fortaleza does not have indigenous lands or quilombola communities in its territory, so it can be said that there will be no interference from the proposed undertaking over areas occupied by these traditional populations;
- ✓ The EIA / RIMA to be prepared should contextualize information about the fishermen present in the Praia do Futuro area, as well as predictions of direct and indirect impact, if any, on fishery production at the time of enterprise operation. It shall depend on the concentrate's marine outfall location and the technology used to promote rapid dilution of the concentrate plume (brine);
- ✓ No interference from the proposed enterprise works with historic buildings or listed archaeological heritage has been identified;
- ✓ The municipality of Fortaleza does not have traditional turtle nesting sites in its territory, so there is no interference from the proposed development with this type of area. However, local newspapers have published nesting occurrences on Praia do Futuro, Sabiaguaba and Serviluz. It is necessary that the respective environmental impact study to be carried out for licensing details the occurrence and trajectory of turtles in the currents and the desalination plant's intake and discharge areas.

Figure 31 - Identified Environmental Restrictions





## 11. Basic Studies to be Developed

Different environmental studies are cited below as important for the preparation of environmental impact studies for the enterprise's environmental licensing. Such studies can utilize secondary data, when available; however, many shall start from primary data collection, given site scale and specificity.

### 11.1. Marine environment

#### 11.1.1. Geophysical Survey

Various geophysical surveys shall be executed to obtain more detailed knowledge on the marine sedimentary bottom in the project area, whose geomorphology shall influence different items, such as effluent dispersion and the intake tower and marine outfall projects.

A bathymetric survey shall be carried out in the direct intake and outfall influence areas, covering an extension of about 20 km<sup>2</sup>. It is recommended to adopt wave compensators in the surf zone, or topographic methods capable of obtaining rates in the shallow areas with great wave influence, producing reports for *DHN* files (Brazilian Navy Hydrography and Navigation Directory). The lines should have little spacing, with cross-checking lines.

The survey can be carried out by single or multibeam equipment. If single beam equipment is used, it is recommended to complement the survey with a side scan sonar. Such studies are used to map sedimentary features and textures, for the identification of possible coral or algae banks, sandstone reefs, and other benthic features or microhabitats.

The sonographic survey, or even multibeam, should be carried out with a loose overlap of the area surveyed, to ensure good and integral area imaging.

Finally, considering the need for knowledge of the seabed subsurface characteristics of excavation zones for the implementation of the intake and marine outfall lines, it will be necessary to carry out a seismic survey. Survey lines should be drawn for shallow seismic data in the excavation area, to identify any obstacles to excavation.

The estimated PMI phase costs for the bathymetry is R\$ 82,500.00 (eighty-two thousand five hundred Brazilian reais), while the costs to carry out imaging with the scan sonar will be R\$ 112,500.00 (one hundred and twelve thousand and five hundred Brazilian reais). The estimated cost for the seismic survey will be R\$ 67,500.00 (sixty-seven thousand and five hundred Brazilian reais).

After construction of the intake tower and pipeline and the marine outfall, it will be necessary to update the nautical chart to signal the work and create an exclusion zone for fishing, anchoring, recreational and nautical activities. It must reflect the chart update produced by the Brazilian Navy Hydrography and Navigation Directory Board (DHN).

Therefore, a hydrographic survey (bathymetry) in category "A" must be carried out to support the formal exclusion zone registration process on the nautical chart. The procedure details for nautical chart updates are described in NORMAM 25 / DHN.

#### 11.1.2. Waves, Currents and Sea Level Measurements

To survey wave and current regimes operating in the enterprise's marine area, primary data collection campaigns will be carried out.

For this purpose, 2 (two) campaigns shall be carried out, one in the winter and another in the summer, with use of an ADCP (Acoustic Doppler Current Profiler), a hydro-acoustic chain profiler.

It is a device that measures particle velocity in the water column using the physical principle of sound wave propagation known as the Doppler Effect. It enables the measurement of direction and flow velocity profiles in the water column.

The studies of oceanic parameters, such as sea currents and wave and tidal regimes are decisive for the application of dispersion models for the brine plume discharged by the marine outfall, to enable its dimensioning, comprehension and impact evaluation analysis.

The measurements obtained by this campaign shall provide data on current direction and speed at each depth, with 2-meter spacing, from the bottom to the surface.

The estimated cost to carry out this study will be R\$ 52,500.00 (fifty-two thousand and five hundred Brazilian reais).

#### **11.1.3. Measurements of Physicochemical Parameters in Water and Sediments**

A study should be carried out to measure various water and sediment physicochemical parameters in the intake tower and marine outfall diffuser areas.

A sample grid representative of the receiving body should be drawn, in two depths, for the realization of two seasonal sampling campaigns (summer and winter). The scope shall contemplate the parameters specified for saline waters, according to CONAMA Resolution 357/05.

The sedimentology study, in turn, is important to determine the sediments that will influence desalination plant design and operation. It is through the detailed study of the sediment particles that can be transported by seawater, considering hydro climatologic processes, that the equipment and plant operation can be understood greater detail. Sedimentological granulometry and total organic carbon analyzes should be performed.

The estimated cost to carry out these studies is estimated at R\$ 240,000.00.

#### **11.1.4. Marine Biota Characterization**

The distribution of organisms in marine ecosystems is conditioned to a set of environmental parameters whose relative importance may individually vary in space and time. Therefore, the interpretation of biota distribution patterns in the intake and concentrate (brine) discharge areas of influence requires a detailed analysis of each factor operating in the occurrence of these organisms.

Benthic organisms are constantly subject to changes in the environment, whether natural, such as deposition or removal of sediments by currents or changes in sediment or water quality. For this reason, benthic organisms have been widely used as indicators of processes that promote environmental changes in marine ecosystems.

The characterization of benthic organisms will be carried out by collecting sediment samples, in three parts, to characterize, through screening, the community structure and identification and calculation of the main ecological indexes.

Likewise, planktonic communities should be characterized in the intake and effluent discharge areas. Phytoplankton samples can be obtained by water sampling in collecting bottles or with nets with suitable meshes, a bottom trawl and vertical opening, while zooplankton should be collected in the same sampling mesh, by horizontal dragging.

The ichthyofauna should be evaluated by sampling methodologies that represent demersal and nektonic organisms in the surrounding marine area. The study should include collection, identification, biometrics and calculation of community descriptors.

The estimated cost to carrying out these studies will be R\$ 40,000.00 (forty thousand Brazilian reais).

#### **11.1.5. Wind and Rain Measurements**

Wind and rainfall data should be studied to present their standards in the environmental impacts studies and to calibrate the mathematical dispersion models of the concentrate discharged by submarine outfall. Such descriptors may interfere with water quality and plume dispersion, and must be used in the model.

The estimated cost for this study will be R \$ 13,500.00 (thirteen thousand and five hundred Brazilian reais).

#### **11.1.6. Mathematical Simulation Study for Brine Plume Dispersion**

One of the brine dispersion processes is diffusion, which is governed by the combinations of the brine conditions with those of the receiving body (such as currents, density, jet speed and transport conditions). To model these phenomena, calculation programs that introduce discharge flow, brine salinity, temperature and current data, among others shall be used. Through this model it shall be possible to visualize how the brine plume will be dispersed and its expected concentration in each site.

For the study of environmental impacts, mathematical models of the plume discharged by marine outfall should also be implemented, to estimate dilution. A near and far field model should be implemented to consider all initial dilution phenomena and plume transport until natural receiving body conditions return, especially regarding the salinity index.

Consolidated models should be used, with adequate boundary conditions. For that, the data obtained from winds, bathymetry, waves, currents, temperature, salinity, flow and diffuser characteristics (number, height, distance among them, speed and angle of exit) must be used. The model must be calibrated and the plume generated in different environmental scenarios, such as the most frequent and the most critical.

The estimated cost for this study will be R\$ 50,000.00 (fifty thousand Brazilian reais).

## **11.2. Terrestrial Environment**

### **11.2.1. Floristic and Faunistic Survey**

The identification and characterization of the plant types present in the study area will be carried out through field surveys complemented by consultations with RADAMBRASIL Project. They must be updated based on satellite images and complemented with specialized bibliographic research.

A floristic inventory will be prepared, identifying the main and rare species found.

The study area's fauna characterization shall be carried out through field and bibliographic research, which shall be done on the BDT (Tropical Database) platform. It contains a Bibliographic Collection of 1,986 references, in addition to a compilation resulting from various project databases prepared by the Biodiverse Foundation. Research will also be carried out in BDDF, ICMBio, CEMAVE/IBAMA publications and the SCIELO networks, which contain a vast collection of works and scientific journals, as well as SIRIUS, for communication between university libraries.

The estimated cost for this study will be R\$ 10,000.00 (ten thousand Brazilian reais).

### **11.2.2. Archeological Study**

In compliance with Normative Instruction nº 001/2015, an initial consultation with IPHAN - National Historical and Artistic Heritage Institute will be carried out by filing of an Activity Characterization Form – FCA, to investigate if there is a need to develop an archaeological study in the enterprise area.

In case it is not necessary to develop new studies, only an enterprise area characterization shall be presented. It shall be based on the data gathered from IPHAN about protected historic, cultural and archaeological sites that are present, in the process of being registered or only identified by said organ in the region where the project will be implemented. The presence of historic buildings, monuments and cultural events and heritage will also be investigated.

If IPHAN requires studies for the attainment of Preliminary and Installation Licenses from the enterprise, the instructions contained in Technical Standard nº 080/11-DIVTEC/IPHAN/CE and other normative instructions issued by IPHAN shall be followed. They shall comprise procedures to carry out studies related to historical, cultural and archaeological heritage for enterprises subject to the EIA/RIMA process in the State of Ceará.

Considering that the project area has part of its seawater intake and brine discharge pipelines extending through the seabed, underwater archeology may be deemed necessary.

The estimated cost for this study will be R\$ 119,000.00 (one hundred and nineteen thousand Brazilian reais).

### **11.2.3. Socioeconomic Research**

Surveys will be carried out on the communities present in the enterprise's direct influence area, considering its economic, educational and cultural activities, as well as its basic infrastructure. For this purpose, a sample socioeconomic research will be applied. Among the socioeconomic factors to be contemplated, the following are worth noting:

- ✓ Occupation history of the area its surroundings;
- ✓ Industries, commerce, services and other activities in operation in the area, specifying the industrial segment, product type, consumer market, production flow, number of employees, water resources and air pollution potential, etc.;
- ✓ Demographic aspects and socioeconomic profile of the neighborhood, including education level, income level, associations, etc.;
- ✓ Occupation pattern of the neighborhoods in the studied area;
- ✓ Existing physical and social infrastructure (transport, education, health, electrical system, basic sanitation, communication systems, etc.), in addition to the infrastructure to support social and economic activities (training centers, auditoriums, event centers, etc.);
- ✓ Identification and characterization of the relevant economic activities in the study area, with emphasis on the fishing and tourism production chain; analysis of trends in the evolution of economic activities and urban expansion;
- ✓ Identification of formal and non-formal leaders active in the studied area;
- ✓ Identification of information flow in the enterprise's direct influence area;
- ✓ Cultural activities and religious events
- ✓ Characterization of the fishing communities that potentially use the enterprise's marine area, such as the fishery centers of Praia Mansa and Mucuripe, as well as the Cocó River's bar. This identification shall be carried out based on the evaluation of documents from the fishing colony and local fishermen associations, bibliography and sector database, as well as interviews to identify operating fishery and fish farming mechanism areas. It is recommended that workshops be held in fishing communities to prepare participatory maps of the fishing area.

The population expectations regarding the Seawater Desalination Plant Project must also be investigated, based on consultations with the population and active leaders active in the enterprise's direct area of influence.

The estimated cost for this study shall be R\$ 30,000.00 (thirty thousand Brazilian Reais)



## **12. Identification and Evaluation of Environmental Impacts**

### **12.1. Proposed Evaluation Method**

Based on the environmental diagnosis prepared and knowledge of the current environmental legislation and activities proposed by the project, confrontations will be made in order to identify the likely impacts that may be generated during the planning, implementation and operation phases of the project. Such impacts will be classified into a descriptive scale, considering that the quantitative assessment will be evaluated during the development of the environmental impact study, given the need to carry out primary and secondary studies to effectively subsidize the impacts generated by the plant.

In the Environmental Assessment area, there are several methods for measuring environmental impacts, which will be addressed later in the study to be required by the environmental agency in the Preliminary License phase. The company responsible for the study will use the most appropriate method to detail all the impacts generated, including international experiences in the desalination area.

### **12.2. Prediction of Identified Environmental Impacts**

#### **12.2.1. Impacts Incident over the Abiotic Environment**

During the implementation of the RMF Desalination Plant Project works, the adverse impacts on the abiotic environment shall be due mainly to the cleaning of terrains and embankments required to implement the buildings on the plant's construction site, as well as the excavation of ditches for the layout of pipes for the interconnection with the CAGECE macrosystem, combined with the movement of machinery and heavy vehicles.

The deforestation or cleaning of the respective terrain and embankments required during construction site implementation, although in small amounts, resulted in the emission of dust and noise, temporarily impairing air quality, only in a restricted area and away from urbanized areas. The required land movements may result in sediment input into the marine environment, causing turbidity and silting only on a minor scale.

However, attention should be given to the need to install an adequate sanitary sewage infrastructure in the construction site area, to avoid pollution of underground water resources and the marine environment. The project states the use of septic tanks, which must be located far from the sea and at an adequate distance from the water table level. In the work site support facilities, mainly during the implementation of the interconnection pipeline to the Cagece macrosystem, chemical toilets will be used, and the collected effluents shall be sent to Cagece's WWTP, which must be properly regularized with the competent environmental agency.

Considering the large number of workers active on project implementation, a significant amount of solid waste shall be produced in the construction site and its support facilities (rubble, paper / cardboard, plastics, cement bags, wood, organic, PPE's, etc.). In case a mechanical workshop is implemented, solid waste will be generated through oils, grease and tow; in its turn, the outpatient clinic there shall generate waste contaminated by

pathogens. These residues must be properly collected, stored and taken to an environmentally correct destination (incineration, recycling or sent to the ASMOC – West Caucaia Metropolitan Landfill), so that the problems normally resulting from improper handling of solid waste are avoided: foul odors, proliferation of disease vectors (cockroaches, flies, rats, etc.), the pollution of soils and water resources and landscape degradation.

During the work implementation phase there will be emission of particulate material and noise on a large scale, which may be reduced in the areas planned for plant construction and the land stretches destined to seawater intake and brine discharge, by wetting of machinery and vehicle paths. In addition, even if these works have relatively significant earth movements, the impacts on air quality will be restricted to the Directly Affected Area around the plant, which has houses. The pipeline interconnection to the CAGECE microsystem shall intercepting densely populated areas, which is why the impact on air quality resulting from trench digging is considered more relevant, although it presents a lower level of intensity.

Another measure to be adopted to reduce the impact on air quality during work implementation is the periodic maintenance of the vehicles and machinery allocated there, avoiding the emission of black smoke. In addition, the monitoring of black smoke emitted by diesel powered vehicles and machinery should be performed with use of the Ringelmann scale, aiming at the adoption of appropriate measures whenever levels above standard 2 are detected.

During work implementation the triggering of erosive processes shall also happen, with high risk of slope undermining by trench excavation due to the sandy texture of the soils (Quartzenic Neosols), requiring the use of continuous trenching or ditch excavation with embankments, in the specific case of seawater intake and brine discharge pipelines.

Special attention should be given to the areas where the chamber and seawater intake pipelines, brine discharge pipelines and permeate and brine reservoirs shall be located, given the large earth movements and the required excavation depths at these sites during the works. For the intake and discharge piping onshore areas, the Reference Project indicated the use of Non-Destructive Methods (MND), thus mitigating such impacts.

It is also expected to trigger erosive processes during the rainy season, making it necessary to close the excavated trenches immediately after the layout of piping for the intake and discharge systems, water and sanitary sewage from the power plant, electrical and firefighting, as well as the pipeline interconnection to the Cagece macrosystem, thus preventing the establishment of such erosion processes. It is also necessary to quickly implement the rain drainage system and protect the landfill embankments in the desalination plant and the road system areas.

As the Praia do Futuro area does not have water courses and springs in its territory, there will be sediment contribution only to its marine environment. It must be noted that the work implementation period shall be relatively short, and that excavations will be carried out preferably during the dry season, no significant silting or water turbidity are expected on referred environment. There shall also be no sediment contributions to water courses



resulting from work implementation for the pipeline interconnection to the Cagece microsystem, since these works shall happen entirely along already paved roads, and the presence of water courses has not been found throughout its path.

During the execution of earthmoving operations in the plant's work areas, it is necessary to use borrow quarries. It is emphasized, however, that the project provides for earthy, granular and stone materials in deposits and commercial quarries, duly licensed and registered with the competent environmental agencies, which, in this case, are the National Mining Agency - ANM and SEMACE.

During the layout of the seawater intake and brine discharge pipelines, which involve seabed dredging, large scale turbidity will be generated, given the turmoil and destabilization in the seabed. The project must adopt silt curtains to prevent the passage of suspended solids from the dredging site, as well as sediment pollution from reaching greater proportions, which may affect fishing areas. Another effective mitigation measure could be the adoption of techniques that consider a shorter excavation section, with piping anchored on the seabed, or even the use of non-destructive techniques, such as directional drilling. Such analysis must be carried out in conjunction with engineering design guidelines.

In addition, due to its rapid reversibility, since sand settles quickly, the intensity of this impact can be considered small. The current actions planned for the layout and burial operations of the intake and brine discharge pipelines are sufficient to avoid, as much as possible, the extension of work execution periods in the marine environment.

Although the deforestation required in the area projected for the implementation of the plant's works is not significant, as it is restricted to some tree specimens and grass / herbaceous vegetation covers, there will be decreases in the rainwater infiltration rates and in the recharge of the Dunes aquifer in the Praia do Futuro area, given the greater speed of runoff of rainwater in bare soils; however, this will not be significant. As for the climatic conditions of the project area and the surrounding region, these will remain practically unchanged, with no significant increases in air temperature due to vegetation suppression.

The construction of buildings planned in the desalination plant area, as well pavement of the access, internal and parking area roads will result in soil waterproofing. Therefore, it can be said that there will be a reduction in infiltration rates, which may reduce water table recharge. The guidelines and criteria established by the legislation of the city of Fortaleza must be met, especially the city code.

With the start of the desalination plant's operation, there will be an increase in the water supply in the municipality of Fortaleza and its metropolitan region, since it shall provide a flow of 1.0 m<sup>3</sup>/s of drinking water from a secure source. It is important to note that impacts on the seawater availability due to the desalination plant's intake flow (2.3 m<sup>3</sup>/s) are not expected, since this is considered an inexhaustible source.

In the Desalination Plant's operational phase, one of the main adverse impacts detected is the disposal of brine generated by the reverse osmosis units. However, with the proper sizing of diffusing lines, this impact can be minimized and restricted to a smaller area

In order to endorse this claim, it is necessary to carry out, within the scope of the Environmental Impact Study - EIA / RIMA, a brine plume diffusion study after discharge, which shall find how far total saline dilution can be observed into the receiving body, thus identifying the marine environment areas subject to impacts.

For the Fortaleza Desalination Plant, whose project adopts the use of reverse osmosis, the chemical pre-treatment of salt water shall be carried out through sulfuric acid dosing to adjust pH, sodium hypochlorite for disinfection, sodium metabisulfite to reduce the concentration of residual chlorine, ferric chloride for coagulation and dispersant to prevent precipitation of salts. Finally, it is planned to apply powdered activated carbon to adsorb the pollutants.

Therefore, the wastewater from membrane washing in the reverse osmosis process may contain such chemicals, which is why it is necessary to neutralize it, before it is mixed with the concentrate (brine) for later discharge into the sea. The project proposes its treatment by a chemical cleaning effluent neutralization system composed of the following equipment: a neutralization tank, neutralizing chemical dosing pump, agitation system and neutralized water conductors to discharge the brine.

The waste water used to wash the filters can be mixed with the concentrate (brine) for later discharge into the sea, as long as it is in compliance with the standards required by current environmental legislation. Otherwise, the project proposes its transportation to the water filter backwashing treatment system. This system is equipped with the following equipment: decanter, sludge extraction pumps, sludge dryer, sludge container and subsequent transport of decanted water for brine discharge.

In addition, in order to reduce the brine salinity levels, the proposed project plans the adoption of the measures described below, contributing to the reduction of the polluting potential of this effluent:

- ✓ Mixing pressure filter washing water with brine, before its release in the receiving body, aiming to reduce the concentration of suspended solids and comply with current legislation;
- ✓ Provision of diffusers in the final section of the brine outfall, which shall diffuse the brine into the sea, speeding up the dispersion process in the receiving body.

The receiving body's water quality monitoring is also necessary to assess whether there will be a risk of impact on marine biota resulting from brine discharge. Another measure to be adopted is the elaboration and execution of systematic environmental audits to monitor the operational performance of the desalination system, identifying environmental conformities and non-conformities, and when applicable, defining action plans and ratifying actions already implemented.

### **12.2.2. Impacts Incident on the Biotic Environment**

The deforestation required for the installation of the construction site shall be of little impact, given the small area where it shall be performed, and the fact that the plant's proposed area has a predominant sandbank vegetation cover.

As for impacts on the biotic environment during work implementation, the damage resulting from deforestation / land clearing operations shall not be significant either, as the enterprise area is predominantly covered by this same type of vegetation. Currently, no endemic, rare or endangered floristic species of economic, medicinal or scientific interest were identified.

In addition, the seawater intake and the concentrate (brine) discharge areas will be developed exclusively underground, using a non-destructive method - MND, without intervening in the vegetation present in the area. The pressure lines composing the interconnection to the Cagece's macrosystem, in turn, shall be positioned along existing roads, not requiring the execution of deforestation / land clearing operations.

As for the fauna in the enterprise area, it is not very diversified, being basically composed of some species of birds and reptiles, which occasionally visit these areas in search of food, with insects being the most representative fauna group. The presence of some types of crustaceans (the mangrove tree, fiddler and ocpode crabs) was also observed. In addition, the enterprise area does not have any water courses or bodies in its territory, thus the aquatic fauna is restricted to marine biota.

Therefore, it can be said that deforestation / clearing operations in the work areas shall not result in significant impacts on the flora and fauna of this region. There was no evidence of endemism in the composition of flora or fauna, and the areas planned for the works do not intercept the critical natural habitats or conservation units.

It is recommended that the vegetation removal / land clearing operations necessary during the construction phase are carried out gradually by the contractor, as they are required for the execution of the works, to avoid triggering erosive processes, with consequent sediment input to the marine environment, disturbing the habits of aquatic fauna. They shall also be restricted to the works areas, avoiding unnecessary deforestation. In addition, before carrying out vegetation suppression operations, a team of biologists must be engaged in the execution of this activity, scanning the work area to manage fauna species that may be visiting the enterprise area in search of food.

The fauna expelled from the project areas targeted by the deforestation/land clearing operations will migrate to the peripheral region; however, given its low biodiversity and low numerical density, it is not expected to establish competition with the fauna already established there, in territorial and food terms. There will be an exodus of venomous animals and the removal of some bird species that may increase insect populations.

During work implementation, the impacts on the biome shall also result from earth movements (cuts, embankments and excavations). The main damages resulting from these activities are the triggering of erosive processes with sediment transportation to the marine environment, causing turbidity and disturbing aquatic fauna habitats, in a more significant scale than previously reported. It is also noteworthy that the large movement of machinery and heavy vehicles will result in the emission of noise and vibrations, which can disturb fauna habits, and even cause them to flee to more distant areas.

It is noteworthy, however, that the intervention on the seabed to implement the intake and brine discharge systems constitutes the most impacting activity on aquatic fauna during



the work implementation phase. Indeed, it shall result in the emission of noise, disturbance of the marine soil and an increase in the suspended sediment concentration, contributing to the disturbance of aquatic fauna and its migration. In addition, suspended material, when in excess, can cause damage to aquatic organisms by interfering with their respiration and filtration mechanisms, also accumulating on the body of small animals. As a mitigating measure, it is suggested that dredging areas are isolated by curtains (barriers), which limit the passage of suspended particulate material. Another effective mitigation measure will be the adoption of construction techniques that consider a shorter excavation area, with piping anchored on the seabed, or even the use of non-destructive techniques, such as directional holes. Such analysis must be carried out in conjunction with the engineering design guidelines.

During project operation project, since the seawater chemical pre-treatment adopted advocates the controlled use of chemicals, the impact on the marine biota will only be of a thermohaline character, since the effluents discharged present a much higher salinity than that of the seawater, which may drive away or kill some marine species. Such impact, however, has a punctual character due to the great dilution/dispersion capacity of the marine environment, affecting only a certain distance from the brine discharge site.

Among the impacts on the marine biota resulting from the change in seawater salinity, we can mention the possible damage to the marine biota habitat, depending on the concentrate discharge site and the behavior (direction) of the marine currents active in Praia do Futuro and surrounding areas, which can influence the concentrate dilution/dispersion into the receiving body. The biota impacts will be evaluated at EIA/RIMA elaboration, which will contain primary and secondary data, as well as simulations in the intake and discharge areas of the plant and environmental quality analysis.

It is noteworthy, however, that the proposed project sought to locate the marine outfall at an appropriate and safe distance. In addition to adopting measures aimed at favoring faster brine dilution, such as the adoption of diffusers in the final section of the brine outfall, as well as the mixture with the pressure filters' backwash water, as well as with the rainwater from the drainage system.

As described in this study, the local press highlighted the occurrence of nesting of critically endangered turtle species in Sabiaguaba, Praia do Futuro and Serviluz. The EIA / RIMA should detail all aspects regarding the plant's in nesting areas, contemplating their location, periods, species and the intake and outfall's relationship with turtle migratory flows.

In addition, the seawater quality monitoring, as well as of marine biota under the supervision of the competent environmental agency. Adopting the appropriate measures whenever necessary significantly reduces the risks of damage to the marine ecosystem and its biota, highlighting the dolphin community existent there.

### **12.2.3. Anthropic Environment Impacts**

The disclosure of the news that a seawater desalination plant will be built will have a positive impact on most residents of the city of Fortaleza, who will benefit from the supply of good quality water from a safe source, even during periods of prolonged droughts.

The scientific area and the state's tourism sector will also be positively impacted, since the primary objective of implementing this plant is to guarantee water availability, as well as the creation of a database and a trained and specialized technical staff for the application and improvement of an alternative technology for drinking water supply to coastal regions of the state's territory, with potential for growth and restrictions on fresh water supply. Thus, it shall be a way to compensate water deficits in many coastal areas of the State.

With the beginning of work implementation, a small increase in the offer of jobs for unskilled labor is expected, impacting the income level since wages offered by the Contractor are generally higher than those common in the area. The tertiary sector, too, shall have a slight increase in demand for products, given the greater purchasing power of workers and the acquisition of construction material, food products and vehicle rental by the Contractor. It is necessary, however, that workers and the local population be alerted about the temporary nature of the jobs offered. During the operation stage of the project, in turn, there will be a small increase in the offer of stable, linked to the operation and infrastructure maintenance of the desalination plant, with positive effects on the level of income.

When hiring, priority should be given to workers in near to work site, as well as for services (food, transportation, etc.) and the purchase of products in the local market. A qualification and training program for the hired labor must also be implemented, which shall acquire new knowledge, raising their level of qualification.

The health problems linked to enterprise implementation, in essence, are not particularly different from those already affecting a given community. However, in large projects, factors such as the crowding of workers in a specific area with a rigid schedule, which requires a synchronization of activities, controlling the pace of the entire process, in general, are responsible for the highest incidence of negative impacts on health, since:

- ✓ There is the risk of importing and spreading diseases by the construction workers, exposing the local population to new pathologies, requiring the execution of medical control when hiring workers;
- ✓ The heavy traffic of machinery and heavy vehicles will increase the risk of accidents involving construction workers and users of access roads around the work site and those intercepted by the pipeline interconnection to the Cagece macrosystem;
- ✓ Risks of accidents with construction workers involving the undermining of embankment slopes and ditches, given the poorly cohesive (sandy) structure of the soils in the construction areas;
- ✓ Accident risks from civil construction activities (falls, electrical discharges, etc.).

Regarding deforestation / land clearing, although it shall happen in a small area, there will a risk of accidents involving venomous animals for workers engaged in this activity. Thus, during work implementation, pressure on the regional health sector is likely to occur, since it is dimensioned only to serve the native population.

These risks, however, can be mitigated through the adoption of occupational safety standards, and the Contractor must prepare and implement the safety programs required by labor legislation - PCMAT, PCMSO, PPRA, PAE and PGR, as well as create and establish a CIPA - Internal Commission for Accident Prevention, providing the construction

site with an ambulatory. In addition, it is recommended that the Contractor carry out a prior survey of the regional health sector conditions, aiming to expedite medical assistance to construction workers in case accidents happen. There shall also be disturbances caused by the increased flow of vehicle traffic on the main access roads to the beach in Praia do Futuro I, mainly during work implementation due to the need for the transportation of goods.

The intersection of the interconnections to the Cagece macrosystem with express and arterial roads in Fortaleza, which are characterized by an intense flow of vehicles, will cause traffic disruptions, requiring large signage in these stretches during the implementation of these works. In addition, the risks for accidents involving pedestrians becomes relatively significant, requiring the adoption of well-planned temporary traffic deviations and the intensive use of warning signs work site. It will also be necessary to change some bus line routes.

In addition, obstacles will be created to pedestrian movement, making it difficult for pedestrians to access their homes, as well as the commercial and service establishments that exist there, with negative effects on the local economy. It is necessary to establish walkways, as well as strict adherence to the works' implementation schedule, to reduce the impacts on these economic activities. There will also be emission of dust and noise on a large scale, with negative effects on public opinion.

In relation to the intersection with other public use infrastructures, trench digging for pipeline installation, to provide the interconnection with the Cagece macrosystem shall result in interference with infrastructure present along the roads (networks water supply, sewage networks, drainage networks, railway line, gas pipeline, etc.), with risks of damage to these infrastructures and temporary interruption in the provision of these services, if the appropriate measures are not adopted. The concessionaires of these services must be contacted by the Contractor, to provide data on the exact location of this equipment, as well as on the rules to be followed during the work execution in these stretches.

Special attention should be given to the intersection of the said pipeline with the CEGÁS gas pipeline layout at two points, given the significant risks of accidents, despite the project providing the intersection by a non-destructive method. Therefore, it is necessary to establish communication with CEGÁS about the crossings to be made and request the safety standards and conducts to be adopted during the implementation of these works.

As for the archaeological heritage, it can initially be affirmed that the impacts may be of medium relevance, considering that the large earth movements required during work execution in Praia do Futuro I, which will lead to the execution of studies to be evaluated by IPHAN. In compliance with IPHAN Normative Instruction nº 01/2015, the Activity Characterization Form - FCA of the enterprise must be prepared, which shall be submitted to IPHAN's appreciation, and this body should, based on the characteristics of the enterprise and its area of influence, perform classification the proposed project and define the studies to be developed by the entrepreneur.

Among impacts related to the conclusion of the works, there will be unemployment of the workforce allocated in project construction, in addition to the slowdown of the local economy, with negative effects on the level of income, which will contribute to the

generation of social tension. The workers and local population should be alerted, from the beginning of project implementation, about the temporary nature of the jobs offered and the activities developed.

When operating and maintaining the Desalination Plant, workers engaged in these activities are subject to chemical contamination risks. However, these risks can be considered of little relevance, since the use of metering pumps will be adopted for chemical dosing, and the water/chemical mixture shall be carried out within a closed circuit. As a result, the risks of contact with toxic gases formed by the reaction of sodium metabisulfite with water are zero. There are also risks of accidents during the handling of pumps at lifting stations (electric shocks); however, since the project provides training for the workers and the adoption of safety rules, these risks will be substantially reduced.

Potential impacts on the economic activities developed in the region associated with concentrate (brine) discharge into the sea shall be related only to its thermohaline character (effluent salinity is much higher than that of seawater), occurring in a specific area due to the great capacity of dilution/dispersion of the marine environment, affecting only up to a certain distance from the discharge point. This question shall be evaluated by the execution of a brine plume dispersion study, to ensure the effectiveness of brine dilution, as well as the distance reached by the discharge plume.

No negative impacts are expected on the tourist and fishing activities carried out in the coastal region of Fortaleza, nor damage to the health of fishermen or the population that practices recreational and leisure activities there, since the impact caused by brine discharge in the sea is of thermohaline character only. In addition, the plume quickly disperses to a small extent from the point of concentrate release in the receiving body. Among the recommended environmental protection measures, there is monitoring of the water quality of the marine biota receiving body.

On the other hand, with the implantation of the Desalination Plant in Fortaleza, the water supply to this urban center will be guaranteed, with good quality water from a safe and inexhaustible source. This will have a positive impact on the economic activities developed there, with emphasis on the tourism. There will be a great boost in local and regional development, due to the increased flow to the tertiary sector in the region reflecting the greater availability of drinking water, which will have a positive impact on tax collection.

As for scientific knowledge impacts, the desalination plant implementation shall contribute to the acquisition of knowledge and technical staff training in this alternative technology to obtain drinking water in areas of fresh water supply restrictions and potential for development, since it is the first desalination plant of this size in Brazil.

## **13. Recommended Environmental Control and Monitoring Measures**

### **13.1. Classification of Mitigating Measures**

The adoption of measures aimed at mitigating the adverse impacts arising from the implementation and operation of the RMF Desalination Plant Project is of paramount importance, given that the failure to incorporate environmental protection measures may result in damage to the natural anthropic environments, in the project's direct and indirect influence areas.

The general guidelines for the main necessary measures will be presented below, which should later be converted into specific projects, appropriate to the local reality, but with unequivocal efficiency. Based on this premise, the Concessionaire / SPE and / or the Contractor will be in charge of preparing and implementing the plans and programs presented, and the competent environmental body, in this case, SEMACE, will supervise all implementation of plans and programs, as well as provide guidance for the services to be performed. Chart 16 provides a summary of the main environmental protection measures and monitoring programs recommended for the present environmental study by the technical team engaged in its execution; however, the EIA/RIMA may suggest the application of other control measures due to the data collected and the impacts measured in the study required by the environmental agency.



Chart 16 - Recommended environmental protection measures

Type of Plan	Nature		Project Phase to be Adopted		Intended Environmental Factor			Permanence Period		Responsibility for Elaboration and / or Implementation
	Preventive	Corrective	Implementation	Operation	Abiotic	Biotic	Anthropic	Short	Long	
Responsibility for Elaboration and / or Implementation	X		X		X	X	X	X		Concessionaire / SPE
Environmental Control Program for Civil Works	X		X		X	X		X		Concessionaire / SPE (Deforestation Plan / Fauna Management) and Contractor (other plans)
Worker's Protection and Safety Plan	X		X				X	X		Contractor (Construction Implementation Phase) and Concessionaire / SPE (Operation Phase)
Identification and Rescue Program for Archaeological Heritage	X		X		X		X	X		Concessionaire / SPE
Emergency Plan for Chemical Leaks	X			X	X	X	X		X	Concessionaire / SPE
Public Heritage Protection and Recovery Plan		X	X				X	X		Concessionaire / SPE and Fortaleza City Hall
Support Program for the Development of Artisanal Fisheries		X	X				X		X	Concessionaire / SPE
Social Communication Program	X		X	X			X		X	Supervisory Company (construction phase) and Concessionaire / SPE (operation phase)
Environmental Education Program	X		X				X		X	Supervisory Company (construction phase) and Concessionaire / SPE (operation phase)
Enterprise Solid Waste Management Plan	X			X	X	X	X		X	Concessionaire / SPE
Training of Workers for Desalination Plant Operation and Maintenance	X			X			X		X	Concessionaire / SPE
Permeate Quality Monitoring Plan (fresh water)	X			X	X	X	X		X	Concessionaire / SPE
Sea Water Quality Monitoring Plan	X			X	X	X	X		X	Concessionaire / SPE
Marine Biota Monitoring Plan	X			X		X			X	Concessionaire / SPE
Implemented Infrastructure Maintenance Plan	X			X	X	X	X		X	Concessionaire / SPE
Environmental Audit Program	X			X	X	X	X		X	Concessionaire / SPE
Eventual Project Deactivation Plan		X		X	X	X	X		X	Concessionaire / SPE



## 13.2. Environmental Control Measures

### 13.2.1. Environmental management plan

The Environmental Management Program of the RMF Desalination Plant aims to ensure that the project implementation has an adequate environmental conduct and that it has the necessary mechanisms for the execution and control of the actions contained in the mitigating and environmental control measures proposed for this undertaking within the scope of environmental studies.

During implementation of the Desalination Plant works, an Environmental Management structure must be created, to ensure that the environmental rehabilitation and protection measures recommended in environmental studies are applied effectively. It shall also aim to monitor the environmental programs not directly linked to the works, integrating the various internal and external agents, contracted companies, consultants and public and private institutions, directly or indirectly involved with the project, aiming at meeting environmental standards and legislation.

The elaboration of the Environmental Management Program shall be performed by the Concessionaire / SPE, but the operation of the related plans and mitigation and environmental control programs, recommended within the EIA/RIMA scope, shall be executed in the work implementation phase, under the Contractor's and the Supervisory Company's responsibility, according to their relationship with the work itself.

Therefore, programs directly related to engineering works must be implemented directly by the Contractor, and their costs must be included in the construction budget.

Programs that are not directly related to engineering works (Social Communication Plan and Environmental Education Program) shall be implemented through the contract signed with the Supervisory Company. It should be noted that the present plan provides for the implementation of a new supervision concept, which includes monitoring not only for the quality control of engineering works, but also for the implementation of mitigating measures proposed by the environmental studies.

Within this context, the Supervisory Company must rely on its technical staff with environmental specialists, in addition to the professionals and technicians expected to supervise the engineering works. In addition, the Supervisory Company's organization chart should have a sector dedicated to environmental management.

### 13.2.2. Environmental Control Program for Civil Works

The Environmental Control Program aims to mitigate the impacts arising from the project's work implementation on biological, geophysical and socioeconomic components in its area of influence through the establishment of environmentally sustainable guidelines and procedures to be adopted by the Contractor, under the supervision of Supervisory Company and entrepreneurs. It consists of the following plans:

- ✓ **Air Quality and Noise Levels Control Plan:** provisions on the monitoring and control of air quality (fugitive dust and black smoke indexes) and noise and vibration levels during the project implementation's works, allowing the comparison of the



results obtained with the current legislation, in order to adopt the appropriate measures (wetting, periodic maintenance of machinery and vehicles, use of PPE's, etc.), if necessary. It is important to note, however, that the enterprise currently under analysis is located in a mixed area (homes and businesses), within a 50-meter radius of approximately. In this way, it can be said that the impacts on air quality and noise levels affect mainly the workforce, interventions happening in the plant area and on the roads where the desalinated water distribution system will be implemented. In addition, local atmospheric conditions allow a rapid dispersion of fugitive gases and dust generated;

- ✓ **Deforestation / Clearing for Work Areas and Fauna Management:** considering that the required deforestation reaches a small amount, the action plan to be implemented should have as objectives: an area assessment by a team specialized in fauna management before deforestation starts; deforestation and clearing operations restricted to the areas where the works will be implemented; preservation of the genetic heritage represented by the native vegetation in the surrounding areas; to reduce the area to be deforested to a minimum, promoting the protection of workers against the attack of venomous animals;
- ✓ **Plan for Temporary Detours / Signage of Works Areas:** this measure aims to discipline vehicle traffic in areas peripheral to the works that intercept the region's road network, or operate simultaneously to it (pipeline interconnections with the CAGECE Macrosystem), to facilitate the flow of affluent traffic, as well as to reduce the risk of accidents. It plans the implantation of temporary traffic detours, if necessary, and the fixation of large traffic signs in these sections;
- ✓ **Recovery Plan for Degraded Areas:** aims at reducing the degradation imposed on the environment by the use of borrow quarries. The proposed project adopts the acquisition of earthy, granular and stone materials from commercial quarries duly legalized by the competent environmental agencies, in this case SEMACE - State Environmental Superintendence and ANM - National Mining Agency. As for the disposal of material generated by earthmoving operations, the project states the adoption of control procedures, taking into account the following factors: disposal in technically appropriate places, pile shaping, surface drainage of the shoulders and platform, as well as the opening of peripheral canals to prevent surface water from draining into the deposit and, finally, the stabilization of vegetation waste. Regarding the recovery of the construction site area, the project suggests the use of its facilities for the Desalination Plant's infrastructure, which makes it unnecessary to recompose the landscape of the area it will occupy;
- ✓ **Effluent Management Plan:** for the works' implementation phase, the project proposes the interconnection of the construction site's sanitary sewage to the CAGECE collection network, which is interconnected to Fortaleza's marine outfall. Concerning the possibility of concrete mixer washing water, the project establishes the acquisition of most of the machined concrete to be used in the works from concrete plants operating in the RMF, duly regularized by the competent environmental agency. In addition, for the case of concrete produced in the construction site area, the project promotes the adoption a Concrete Hydration

Stabilizer Additive (AEH) in the concrete mixer washing water. This product allows its later reuse as mixing water for the production of new concrete.

- ✓ **Civil Construction Solid Waste Management Plan:** aims to establish procedures regarding the handling, classification, segregation, storage, transport, disposal and destination of waste generated in the construction site (offices, cafeteria, infirmary, mechanic workshop, washing and lubrication station, etc.), in addition to construction waste. Hiring a solid waste collection and transportation company, duly licensed and accredited by the competent environmental agency must be included in the project, as well as the destination of waste to duly authorized locations (sanitary landfill and/or RCC recycling companies).

The details of the Deforestation and Clearing Plan for the Work Site and Fauna Management Areas are a responsibility to be undertaken by CAGECE - Concessionaire / SPE, while its implementation will be carried out by the Contractor. The preparation and implementation of the other plans included in the Works Environmental Control Plan will be the Contractor / Concessionaire's responsibility.

### 13.2.3. Worker Protection and Safety Plan

This measure aims to preserve the health and physical integrity of the workers engaged in the work implementation and, subsequently, of Desalination Plant operators, by anticipating, recognizing, evaluating and consequently controlling the accident risks that exist or may exist in the work environment, that may cause damage to construction workers, Desalination Plant employees, the peripheral population and / or the environment.

In compliance with the current environmental and labor standards and in addition to the rules to be presented herein, the following plans must be drafted and implemented by the Contractor and by the Desalination Plant's Administrator during the work implementation and operation phases: Work Environment Conditions Program in the Construction Industry - PCMAT (specific for the Contractor), Occupational Health Medical Control Program - PCMSO, Environmental Risk Prevention Program - PPRA, Risk Management Program - PGR and the Emergency Action Plan - PAE.

The implementation of this measure will be a responsibility of the Contractor hired during the work implementation phase, being passed to the Concessionaire / SPE's responsibility during the enterprise's operation phase.

### 13.2.4. Archeological Heritage Identification and Rescue Program

Any undertaking that can potentially damage Brazilian archaeological heritage must, necessarily, be preceded by an archaeological survey and rescue project, duly authorized by IPHAN - National Institute of Historical and Artistic Heritage. The identification and restoration of the archaeological heritage sites aims to locate, identify and, eventually, rescue the testimonies of social groups that occupied the region and that may be affected by enterprise's implementation.

In compliance with IPHAN Normative Instruction n° 01/2015, the enterprise's Activity Characterization Form - FCA must be prepared and filed with IPHAN. Based on the information contained in this form, IPHAN establishes the framework the definition of

procedures to be adopted by the entrepreneur. If the enterprise is classified in levels I or II of said normative instruction, the entrepreneur will be required to carry out the following procedures:

#### **13.2.5. Enterprises Classified as Level I**

The entrepreneur must sign a Term of Commitment to undertake responsibility, in the event of discovery of archaeological assets in the enterprise area, for the provisional conservation of the discovered asset(s), committing itself to adopt the following measures:

- I. Immediately suspend construction works or activities;
- II. Report the findings to the IPHAN State Superintendence;
- III. Wait for IPHAN's deliberation and pronouncement on the actions to be performed;
- IV. Take responsibility for management costs that may arise from the need to recover archaeological material.

#### **13.2.6. Enterprises Classified as Level II**

Archaeological monitoring must be carried out by an Archaeologist in the field, who will be responsible for the management of the archaeological heritage eventually identified during work implementation, especially those that require earth movement. Partial progress reports must be submitted by the archaeologist to IPHAN, as well as the Final Report of Archaeological Monitoring, which must contain a detailed description of the activities carried out, accompanied by consistent geo-referenced photographic documentation proving the work performed in the field. Archaeological monitoring must be carried out by an archaeologist duly authorized by IPHAN.

In case of archaeological findings, the following measures should be adopted:

- I - Suspension of works in the stretches or areas where the archaeological heritage site was identified;
- II – Inform IPHAN of the existence of archaeological heritage in the Directly Affected Area - ADA of the enterprise, requesting the measures to be adopted;
- III - Wait for IPHAN's decision and announcement to the environmental licensing agency and the entrepreneur within a maximum period of fifteen days, concerning the actions to be performed.

If the current undertaking falls within levels III or IV of the aforementioned normative instruction, which deals with medium to high interference on the prevailing soil conditions, which is unlikely, IPHAN will require studies in the work implementation area, initially aiming at the identification of archaeological sites. Prospecting shall be carried out in the in heritage site areas shall those be identified, with the rescue and forwarding of the rescued material to scientific institutions.

In both cases, authorization must be requested from IPHAN for the development of the archaeological studies required for the project's licensing process with this body. Subsequently, systematic prospecting and archaeological rescue projects shall be developed by SEINFRA and submitted to IPHAN before the work's implementation. Among IPHAN requirements to authorize the execution of archaeological studies, are:



- ✓ The elaboration of a research project, in accordance with the scientific standards established for archeology projects, developed by researchers and institutions approved by IPHAN;
- ✓ The official support of an academic or scientific institution, which must ensure the necessary laboratory structure for material analysis, guarding and curing;
- ✓ Proof that the entrepreneur will bear the financial costs of the project.

In short, two distinct and subsequent projects shall be implemented by researchers hired by the entrepreneur:

- ✓ Systematic Prospecting Project, with subsoil intervention and prior to the works, contemplating potential archaeological site areas, aiming to identify them and define measures to be adopted for these sites, whether it is civil work detours, rescue or research;
- ✓ Archaeological Rescue Project, compensating the physical loss of these sites by the production of scientific knowledge and its incorporation into national files, carried out before or simultaneously with the works.

In addition to these projects, the work must be monitored by an archaeologist, authorized by IPHAN, who will proceed with the registration and eventual rescue of sites discovered. The implementation of this measure will be the Concessionaire's responsibility, which should have its implementation started at the licensing stage with IPHAN and continue throughout the period of project implementation.

#### **13.2.7. Public Heritage Protection and Recovery Plan**

The Public Heritage Protection and Recovery Plan to be implemented during the Plant's interconnection works to the Cagece microsystem aims not only to prevent damage to public assets, but also to recover them, when these damages are unavoidable. The main infrastructure for public use liable to damage during the implementation of the works are road pavements and sidewalks. In addition, attention should be given to the possible interference with water distribution networks, sanitary sewage, rainwater drainage, electricity and telephone lines, as well as gas pipelines and the railway line (freight trains), by tracing the interconnection pipeline to the Cagece microsystem.

Before implementation of the works, the Contractor must proceed with the investigation of existing interferences to prevent any existing pipes, boxes, cables, poles or other structures in the area to be affected by excavation during trench digging. If the excavation interferes with galleries and pipes, the Contractor must provide their fixation and support. If there is no possibility of support, at the inspecting body's discretion, the Contractor will proceed with interference relocation, which may be temporary or definitive.

In principle, all excavation must be carried out by a mechanical process, except in the following cases, where the excavation must be manual: too close to registered or detected interferences; regularization of ditch bottoms and other places at the inspecting body's discretion.

The Contractor must keep the grids, plugs and manholes belonging to the public service network unhindered and positioned close to the trenches, and these components must not be damaged or clogged.

If there are other public services located within the trench delimitation areas, the Contractor will be responsible for not interrupting these services, until the respective relocation is authorized.

The Contractor shall arrange for the relocation of facilities that interfere with the services to be performed. The relocations must be scheduled in advance and in accordance with the inspection, owners and / or concessionaires of the services whose facilities need to be relocated. The damages that may be caused to the existing facilities during the relocation must be duly compensated by the Contractor, who must obtain all information regarding the installations to be relocated.

In cases of paving removal, the following must be observed:

- ✓ In the case of reusable materials, these must be removed and stored in suitable places, for later use;
- ✓ When there is a need to remove guides, the operation must be carried out agreement with adjacent locations. Before replacement, the areas must be cleaned from the adhering grouting mass;
- ✓ The rubble and materials not subject to reuse from any demolition or removal must be taken to landfills approved by inspection or sent to RCC recycling plants.

The restoration of road and sidewalk pavements should be carried out as soon as possible after the backfill completion, to allow the restoration of normal vehicle and / or pedestrian traffic at the work site. The materials for rebuilding pavements should preferably be of the same nature as those that existed on the demolished pavement.

For pavement placing upon dirt roads, after the ditch is closed, it must have its bed leveled with a motor grader. For coated roads, the following provisions must be observed:

- ✓ Replacement of asphalt pavement - the reconstruction of the base and lining layers must be carried out with the equal or better quality than the situation found prior to the ditch excavation;
- ✓ Sidewalk replacement - must be performed with the same or better quality than the one previously existing, considering two types of coating:
  - Common finish - should be concrete, taking up 210 kg of cement per cubic meter, with a minimum thickness of 5.0 cm with a finished of 2.0 cm of cement mortar and sand in the 1: 3 proportion;
  - Superior finish - must be a mosaic grouted with cement and sand, following the previous pattern, or another finish obeying the characteristics of the existing materials, in order to reconstitute the initial conditions.

- ✓ Paving replaced in parallelepiped or concrete blocks - should be laid on a sand base and grouted with sand or asphalt, where necessary. Base dimensioning must comply with the instructions contained in the technical specifications of the project;
- ✓ Replacement of guides and gutters – guide layout and construction of gutters shall be carried out according to the situation found before trench excavation.

Complementary concrete services must comply with the general requirements contained in the project's technical specifications. The mortar used for the execution of complementary services in masonry, as well as concrete, must be made in mixing bowls, and the execution of concrete mortar on asphalt is prohibited.

In the demolitions and withdrawing necessary to clear work areas, the Contractor must take all necessary protective measures, using siding, scaffolding and signage, as well as observe the necessary precautions regarding materials that can be reused in the work itself, or others

Construction site cleaning must happen constantly during the work execution period, thus avoiding further inconveniences to the neighborhood and accident risks. It also contributes to a good image of the company in charge of executing or contracting the work. Therefore, after the ditches are filled, the entire area affected by the works' execution must be cleaned and swept, removing from all the debris originated, which must be removed for convenient disposal (specific landfills). After the execution of all services, immediate cleaning of the execution site must be carried out.

The implementation of this measure will be the Concessionaire's responsibility, through the Contractor in charge of the works' implementation or the transfer of funds to other respective concessionaires for the affected public services. It should be noted that the costs to be incurred with the activities recommended by this measure are already included in the engineering project budget.

#### **13.2.8. Artisanal Fishing Development Support Program**

The execution of a support program for traditional fishermen will depend on the identification of the project's possible impact on the activities developed by this class.

If it is understood to be necessary, participatory diagnosis shall be carried out to elaborate the activities contemplated by the program, giving the opportunity for those affected to indicate activities of their interest. The program's options are not pre-defined by the entrepreneur or licensing agency.

With specific objectives the referred plan can be designed to:

- Make a participatory diagnosis of the fishermen impacted by the enterprise and eligible for the program, to enable the program's execution;
- Assess the demands, considering legal restrictions, financial compatibility and collective interest;
- Define the program activities and schedule;

## Program implementation

The duration, scope, purpose and costs must be in line with the impact identified, and must be subject to analysis and approval by the parties involved.

### **13.2.9. Social Communication Program**

The Desalination Plant's implementation and its interconnection to the CAGECE macrosystem will intervene directly or indirectly in the daily life of the population in the enterprise's area, generating expectations regarding its implementation and operation. The lack of information related to the project may create misinterpretations and insecurity. In addition, this deficiency tends to complicate the execution of actions that aim to mitigate the impacts generated by the planning, construction and operation of the enterprise.

The lack of information about work progression, especially regarding execution times and the labor involved, also means that local services and businesses cannot adjust to new demands in a timely manner or prepare for future demands when construction is completed.

The main objective of this program is to inform the population about the events to take place after enterprise installation, clarifying doubts that may arise. The creation of an information medium, established in a transparent and systematic way, reduces the degree of stress in the population, allowing people to see the entrepreneur as a representative of their aspirations.

The Social Communication Program shall be created as a way to facilitate the development of actions to be taken during the Desalination Plant's implementation and interconnection to CAGECE's macrosystem, and to avoid the any social tension that may arise from the population's expectations, the creation of obstacles to vehicle and pedestrian traffic during pipeline layout for the integration with CAGECE's macrosystem, its consequent repercussions on the economic activities situated along the roads and an increased risk of pollution of the marine ecosystem from brine discharge during the plant's operation.

In addition to the disclosure of protection and safety measures that shall be adopted during the Desalination Plant's operation, the referred program will seek to inform the population about the impacts associated with the implementation phase of the project's works and the measures that will be adopted to mitigate them.

The program's target audience shall be defined initially, as well how and which information should be disclosed. Regarding the implementation stage, the information comprises technical data about the works, inherent traffic disturbances, accident prevention and behavioral rules and safety standards to be adopted by the workforce.

Therefore, the proposed Social Communication Program should be based on two basic aspects: contact with the population and workforce training. The first branch shall promote contact with the population located in districts and neighborhoods surrounding the project area and users of the roads intercepted by the Desalination Plant and CAGECE's interconnection's piping, will shall have as an objective to present information about the

works to be implemented and its potential impacts, aiming to clarify existing doubts regarding impacts on air quality in the enterprise's surrounding areas and the creation of obstacles to vehicle traffic by road intersections, consequently impacting economic activities in the region.

Procedures that shall be adopted to minimize the adverse impacts associated with the Desalination Plant's implementation and its interconnection to the CAGECE macrosystem, with emphasis on interferences with the local road system, strict schedule adherence to reduce impacts on the economic activities developed in the region and alerts about the risks of accidents with the peripheral population and with road users in the intervention areas (pedestrian falls in ditches, etc., must also be informed.

The second branch deals with the establishment of behavioral rules when addressing the population and work safety and environmental protection norms to be followed by the workers during implementation of the works.

With these parameters in mind, it is necessary to formulate a program for information spread focused on mass media, in material preparation and distribution and in the execution of lectures and training courses. Therefore, it is suggested that the entrepreneur adopt the following measures:

- ✓ Lectures for the community in locations or neighborhoods located around the enterprise area, with the primary purpose of informing the population about the project to be implemented and the procedures to be adopted to mitigate its adverse impacts;
- ✓ Spread of information to the population, fishermen, tourist industry, business owners and service providers in the region of the main accident prevention measures through the distribution of educational booklets;
- ✓ Disclosure to the population, fishermen, tourist industry, business owners and service providers in the region of interferences with the road system, informing the manners adopted to ease traffic flow through the distribution of pamphlets;
- ✓ Disclosure of the execution of the training courses for the workers, whose content shall deal with hygiene and safety rules, explaining to the trainees the dangers to which they will be exposed, individual and collective protective equipment, basic principles of accident prevention and first aid concepts, in addition to rules of conduct and environmental preservation rules, among others;
- ✓ To incline the population towards the creation of Popular Community Council, aimed to obtain information and discuss local environmental problems and policies;
- ✓ Invite the population to attend lectures, seminars, workshops and others to be carried out under the Environmental Education Program and spread of small informational messages via radio.

The preparation of booklets, as well as the content of the messages to be disseminated and even their executions should be in charge of the team responsible for this program's implementation.



The target audience of the Social Communication Program shall include representatives from Fortaleza's City Hall and other public bodies in the enterprise area, other local political leaders, unions and class associations operating in the region, environmental movement, religious and community leaders, citizens, etc., in addition to the contractor's personnel.

The Social Communication Program has a strong relationship with the Environmental Education and Worker Protection and Safety programs, and their activities shall be developed concurrently and in a complementary manner.

The elaboration and execution of the Social Communication Program shall be a responsibility of the company hired by Cagece, the Concessionaire/SPE, which must supervise work implementation, as previously informed in the Environmental Management Plan. The only exception is the worker training course, which shall be the Contractor's responsibility.

This measure shall be implemented one month before the start of engineering works for the Desalination Plant, and last for the project's entire operational phase.

#### **13.2.10. Environmental Education Program**

The Environmental Education Program to be implemented aims to promote the internalization, discipline and strengthening of the environmental dimension in the educational process, aiming to prevent and contain adverse environmental impacts, contributing to improve the quality of life of the construction workers and service providers, as well as employees engaged in the operation of the Desalination Plant and the community directly and indirectly affected by this venture.

A relevant aspect is to contribute to the formation of environmental public policies to promote awareness to the society in general, as well as to workers engaged in the implementation and operation of the enterprise. It must address problems related to the management, preservation and protection of natural resources, with an emphasis on water resources. In short, it seeks to clarify and raise awareness for the program's target audience, to promote an integrated understanding of the environment in its multiple and complex relationships, and to bring about changes in behavior, through the incorporation of sustainable attitudes and habits. Among the specific objectives to be achieved by the Environmental Education Program, are:

- ✓ To disseminate principles and techniques on environmental preservation among construction workers and service providers, as well as employees engaged in the desalination plant's operation and society in general;
- ✓ To propose alternative measures to eliminate or minimize environmental problems identified in the area;
- ✓ To promote monitored visits to the desalination plant facilities and lectures on water resource preservation programs and seawater desalination technologies for students from public and private schools.

An evaluation of the program's implementation should be carried out at the beginning of each phase and after its conclusion, presenting correction and improvement suggestions for the proposed activities or referrals.

The elaboration and execution of the Environmental Education Program will be a responsibility of the company hired by Cagece (the Concessionaire / SPE) to supervise work implementation. After the conclusion of the works, the Program should be implemented by the concessionaire responsible for the operation of the project.

#### **13.2.11. Solid Waste Management Plan Developed by Enterprise**

The Solid Waste Management Plan - PGRS presented here aims to establish guidelines for the management of the waste generated during Desalination Plant operation, aiming to minimize environmental impacts. It provides guidance on the handling, classification, segregation, storage, transport and final disposal of the waste generated in the project's facilities.

The introduction of an adequate solid waste management process is part of a larger plan that involves the productive and public sectors. It is up to the public sector to establish the model to be implemented, and the productive sector to fulfill its responsibility according to the rules established by the model. In turn, a waste recycling process depends on different factors, including the waste quality, which has as its main condition an adequate segregation at its source.

Therefore, it involves a prepared area in the Desalination Plant, conscious employees and procedures to guide the waste segregation process, including its quantification, storage and correct destination. When preparing its waste management project, the Desalination Plant's Administration must also include actions aimed at reducing waste at the source, as well as reusing and recycling the waste generated.

Therefore, the Desalination Plant area should be planned with an aim to establish a waste management system, including:

- ✓ The distribution, throughout the Desalination Plant, of deposits for temporary storage of different types of waste;
- ✓ Rental of sites for waste storage until collection and transportation for its final destination or recycling.

The sensitization of Desalination Plant employees is the second step towards the PGRS implementation, and must take place at two different times. Initially, presentation of the PGRS to be implemented in the work site must be made. It must involve all hierarchical levels, from senior management or their representatives to the enterprise's entire functional body, including supervisors, janitors, etc. Subsequently, the administration shall define an awareness campaign and consolidate the content introduced in it.

During awareness and training, a clean working environment culture should be emphasized, where aspects of organization and cleanliness influence environmental quality and the importance of individual responsibility in minimizing losses and waste generation.

The Enterprise's Solid Waste Management Plan must be drafted and implemented by the concessionaire responsible for desalination plant operation of the desalination plant.

Additionally, the environmental agencies shall request solid waste management plans, either during the installation phase (PGRCC) and during the operation (PGRS), with guidelines to be followed in the Term of Reference or another regulatory instrument.

### **13.2.12. Emergency Plan for Chemical Leaks**

The Emergency Action Plan will focus on preventing and addressing emergency situations that may occur during desalination plant operations, resulting from the leak of chemicals used in the pre-treatment and post-treatment systems of the water to be supplied to the Cagece macrosystem.

In the Desalination Plant's operation, the risks are related to accidents involving the transport, storage and handling of chemicals used in water treatment, represented, in the specific RMF Seawater Desalination Plant's case, by products used in the pre-treatment systems (sodium hypochlorite, sulfuric acid, sodium metabisulfite, ferric chloride, dispersant and powdered activated carbon) and chemical post-treatment (CO<sub>2</sub>, calcium hydroxide, sodium fluorosilicate and sodium hypochlorite).

Accidental spillage of toxic or potentially polluting chemicals can be of a high magnitude, especially when the accident occurs near urbanized areas, water sources or the marine ecosystem. In this case, special attention should be given to minimize such impacts.

The main information about the toxic products to be used in the desalination plant can be seen in their respective safety information sheets. In the referred sheets, the product's toxicological information is explained, along with identification of hazards, first aid, fire-fighting, and leaks and spills control measures, personal protective equipment, information on treatment and disposal and transport and storage of each product.

Considering that the basic purpose of any safety program is to preserve the physical integrity of employees and the peripheral population, it is essential to carry out basic safety training for employees, informing them about the risks to which they will be exposed and the ways to avoid them.

Theoretically, one can think that serious accidents should not occur, as long as certain specific safety rules are followed. But these accidents do occur; and in these cases, the staff must be prepared to take, without hesitation, the correct and immediate actions. All of this is possible through prior and specific training, whose main objective is to guide and train personnel to avoid accidents, but take immediate action if they occur.

"Risk Maps" must be prepared, which must be posted on every door, indicating the risks existing in each workplace. Some basic safety rules will be listed below. It is evident, however, that these are just a few of them; but as long as they are followed, many accidents can be avoided:

- ✓ All employees must know the Risk Map at their workplace;
- ✓ Persons not working in the Desalination Plant must not be allowed to enter;
- ✓ Do not smoke, eat or drink liquids in the workplace, where toxic products are handled;

- ✓ Do not store incompatible substances in the same place;
- ✓ Learn to correctly use the PPE's - Personal Protective Equipment available in the workplace;
- ✓ Know the toxic properties of chemical substances before handling them for the first time;
- ✓ Maintain an updated list of emergency telephones, placing a copy posted in areas close to chemical storage tanks;
- ✓ Find out about the types and uses of fire extinguishers, as well as their location and carry out their periodic maintenance;
- ✓ Report any accident, no matter how small, to the person responsible for the Sector.

Among the emergency actions to be adopted, an Emergency Action Plan should be prepared with the aim to provide a set of guidelines and information that promote the necessary conditions for the adoption of logical, technical and administrative procedures, structured to be quickly triggered in emergency situations, to minimize impacts on public health, the safety of employees and the peripheral population, natural resources and economic activities.

Therefore, it constitutes a detailed planning of all procedures and routines, which contemplates accidental hypotheses, their consequences and effective measures for the use of control actions, for each accident situation that may occur during the operation phase of the enterprise.

In addition, the effective treatment of these emergency situations requires the availability of personnel qualified for the assessment, decision making and for taking actions compatible with the accidents presented. Therefore, plan structure must also clearly define the roles and responsibilities of those involved, also providing human and material resources, compatible with the accidents that may happen, in addition to the use of procedures and routines to combat emergencies, according to the typology of the accident scenarios studied.

The intervention procedures in emergency situations must be defined, contemplating a set of actions previously established, according to the competences of the participating bodies. Cagece / Concessionaire Company should basically include the following steps in the plan:

- ✓ Assistance flowchart - the emergency plan must provide for the activation of an assistance system for assistance, based on the detection of an event that may result in an emergency situation. This system, as a basic condition, must have a 24-hour work regime, with people trained to serve the public. To perform the activation, it is necessary to have at least a minimum of information for evaluation and decision making. Therefore, the Cagece and Concessionaire must present, in a flowchart form, the decision process. With the information considered essential to trigger the attendance of an occurrence, obeying a flow of information previously stipulated, the activation of a professional and / or team will be triggered to perform the referred attendance;

- ✓ Occurrence Assessment Procedure: this step aims to identify the problem to be resolved, according to the type and size of occurrence, so that procedures for controlling the situation can be defined. It consists of the initial contact with the occurrence in the field, when the potential risk conditions are preliminarily determined and promotes the initiation of small actions to minimize and or reduce the impacts caused by the occurrence. Before the team travels to the field to perform the service, it is important to gather as much information as possible about the occurrence to be attended. The use of this good work practice, in addition to promoting guidance at a distance for the adoption of actions that can minimize the risks and consequences of the episode, shall provide the team, during its displacement, with preparation, development and articulate strategies for emergency care;
- ✓ Emergency Control Measures: the methods and tactics to control an emergency can vary widely, according to the type of accident and scenario of occurrence. The emergency plan must list all emergency procedures to be adopted for each type of accident that may occur during the operation of the Seawater Desalination Plant, resulting from the handling of chemical products.

For the organizational structure of the emergency action plan, Cagece and the Concessionaire must have an emergency response brigade formed by trained professionals. In addition to the emergency response brigade hired by Cagece and the Concessionaire, the organizational structure of the emergency action plan requires the establishment of partnerships with public bodies that are responsible for responding to these types of occurrences, such as: Fire Department, Coordination State Civil Defense, DETRAN, ICMBio, SEMACE, SEMA, SEUMA, etc.

To facilitate the integration of the plan elaborated by Cagece and the Concessionaire with other institutions, a meeting should be held with the main public bodies involved the response to emergency situations, so that each entity points out its attributions according to its competencies. Therefore, the attributions and responsibilities of each participating group or body must be presented within the scope of the plan. The respective duties and responsibilities shall be attributed to the activities under the competence of Cagece or the Concessionaire Company, or even service providers hired by these contractors.

An organization chart shall also be elaborated to display the hierarchical view of the plan's teams and coordinators. The plan's organizational structure must be represented, with each of its members, groups or teams projected clearly defined, along with their functions, duties, responsibilities, as well as communication means (telephone) between the participating members.

As recommended by current legislation, Cagece or the Concessionaire Company must provide all support necessary to control the event when an accident occurs, in addition to providing clarifications requested by public authorities, it must also provide all necessary support to control the occurrence, whether at the request of the public agency and / or on its own initiative.



Corrective actions to be implemented involve procedure and isolation definitions of the affected areas, as well as emergency techniques and equipment to be adopted to contain, remove and / or neutralize the products. It also includes emergency medical care and transfers to hospitals and the containment, collection, shipment and final disposal of the toxic products leaked.

Considering that Cagece and the Concessionaire Company will deal more frequently with possible chemical spills dosed into water treatment, it is recommended to adopt the following procedures:

- ✓ Provide conditions for first response assistance in emergency situations involving dangerous products;
- ✓ Isolate drainage devices that may be affected by the flow of dangerous products, using soil barriers or absorption blankets;
- ✓ Conduct periodic training of intervention teams, regarding duties and responsibilities, signage, isolation, traffic management and product identification;
- ✓ Creation of a database of products used in the Desalination Plant that are potentially dangerous, their characteristics when spilled and containment measures, removal, neutralization, disposal of products and personal handling protection;
- ✓ To perform the first service and incident assessment;
- ✓ Operate signage in the area, as well as isolation;
- ✓ Identify and classify the product, if possible;
- ✓ Call the Fire Department, AMC, DETRAN, IBAMA, SEMACE and other relevant bodies, passing on product information, in case of large quantities of toxic product from the Desalination Plant threatening to reach the marine ecosystem.

In order to intervene in these episodes, the respective team members must have a set of previously defined procedures, send it to a qualified professional site to obtain technical information and have the skills to interact with different teams, as well as have autonomy to make decisions and hire services, meeting the expectations and demands of public agencies. It shall also provide, for field work, all the human and material resources necessary to attend to the occurrence, meeting the entire demand generated by public agencies, with the velocity that the situation requires.

Given the unpredictable nature of the need to mobilize the plant's structure to deal with accidents involving dangerous products, priority should be given to the definition of the institutions involved, and the implementation and permanent data base updating on dangerous substances, and, based on the accumulated information, promote training and changes in service procedures.

The products to be generated involve the emission of periodic database update reports and a procedure manual to deal with accidents involving dangerous products, in addition to training to update the personnel to be active in accident scenes.

The costs the implementation of the emergency service system, involving the preparation of a database and risk maps, training and disclosure, must be undertaken by the Concessionaire responsible for the project's operation. Service structure accidents with toxic products should be covered by the budget proposed by the agencies involved, since

it constitutes an institutional demand. The implementation of this measure by Cagece or the Concessionaire shall last throughout the entire project's life.

### **13.2.13. Implemented Infrastructure Maintenance Plan**

A desalination plant as large as the one proposed for the municipality of Fortaleza requires a large amount of equipment and processes, operating with a high degree of automation.

The operation, supervision and control of the desalination plant will be done remotely from the control room. The control system provided includes all software, licenses, DCS equipment, HMI (Human Machine Interface) equipment, system inputs and outputs, as well as the necessary devices, accessories and auxiliary equipment. It also includes programming for the plant's correct operation and maintenance.

The equipment's scheduled maintenance contributes to avoiding the interrupting the desalination process, in addition to contributing to a longer equipment durability. Therefore, aiming at the efficient operation of the infrastructures and equipment installed in the desalination plant, routine maintenance and repairs of unpredicted damages must be carried out, at the entrepreneur's choice.

The maintenance of the intake and discharge lines basically consists of removing accumulated sediments, cleaning, performing periodic surveys to identify leaks and prevent corrosion. At the seawater intake structures, a sulfuric acid and sodium hypochlorite dosages are projected to clean the collection tower and the seawater outfall.

The lifting station pumps shall be submersible, with cathodic protection to prevent corrosion. They must be operated by trained personnel, with electric motor maintenance to be carried out every year, and reconditioning every 5 years.

For closed filter maintenance, the membranes shall be washed with brine and air obtained by blowers. Backwashing shall be done by washing pumps, which shall draw the brine from a tank. The brine produces effective filter washing, also contributing to reduce the absorption of sea water, thus increasing plant productivity (water produced / water collected). The execution of RO membrane chemical cleaning is also part of project, to avoid an increase in head loss or the loss of permeate quality.

Finally, the maintenance activities of salt water and permeate reservoirs consist in maintaining the water inlet devices in the reservoir clean, and to periodically clean the reservoirs themselves.

Finally, it should be noted that all equipment used must be maintained in accordance with the manufacturer's guidelines, and that good maintenance requires a competent work team, properly equipped. The Implanted Infrastructure Maintenance Program must be prepared and implemented by the concessionaire responsible for the project's operation.

### **13.2.14. Plant Maintenance and Operation Capacitation Program**

To provide the technical staff to be hired with a set of information to enable them to operate and maintain the Desalination Plant to be implemented in a more correct and safe manner, desalination plant operation and maintenance training courses shall be offered. These courses shall also aim to promote ecological conscience with the operators, to provide a

satisfactory coexistence between the enterprise's operation and maintenance of with the environment.

The courses content taught must address basic knowledge on sanitary engineering with the use of concepts, water resources in qualitative and quantitative terms, types of salt water desalination systems (distillation, electrodialysis, reverse osmosis, etc.), the elements that compose these systems (intake and supply system, salt water reserve system, pre-treatment, desalination, energy recovery, concentrate discharge in the sea, post-treatment, etc.) and their functions. The desalination plant design must be introduced during training, to allow the trainees to have a perfect knowledge of the type of system they will work with. The following items should be detailed:

- ✓ Definition of responsibilities at the Desalination Plant, specifying the activities and tasks relevant to each technician;
- ✓ Definition of corrective measures to be taken to solve the most frequent operational problems;
- ✓ Discuss, in order to solve as quickly as possible, the most common problems that can disturb the desalination plant's operation;
- ✓ Definition of the necessary care for the correct preservation of the system's infrastructures and equipment;
- ✓ Computer skills, since the desalination plant has a high degree of automation, with the operation of all plant variables monitored and controlled by computers.

One should also take advantage of the opportunity to provide information on hygiene and safety rules, instructing trainees about the dangers they will be exposed to, individual and collective protective equipment, basic principles of accident prevention and first-aid notions. Information on the operation and maintenance of the desalination plant must also be provided.

Regarding the incorporation of the environmental approach, the courses must provide information related mainly to the control of water resource and soil pollution, with emphasis on the current environmental legislation and the self-cleaning capacity of pollution loads by water resources, in addition to the management and proper disposal of solid waste generated in the plant area. Particular emphasis must be given to the importance of periodic intake and discharge pipeline maintenance, as a way of controlling soil and groundwater pollution by concentrate supply in the event of leaks and pipe ruptures.

As a way of implementing the teachings taught, serving as a complementary activity to the courses, a field visit to a desalination plant should be carried out, if possible, to carry out a practice class.

The methodology to be adopted in the development of the courses provides the execution of expository and practical classes, group work, discussions and debates, group dynamics and bibliographic research. Educational material about the course content should be provided to the trainees.

The courses to be executed shall be done by the concessionaire responsible for the project's operation. The target audience will be made up of technicians to be engaged in

the Desalination Plant operation and also by the team to be designated for operation and maintenance services of the seawater pipelines and the brine discharge in the high seas.

#### **13.2.15. Environmental Audit Program**

An environmental audit is an instrument that allows an assessment of the degree of implementation and the efficiency of plans and programs in the control of environmental pollution and safety risks. It is used as an important tool to avoid impacts and assess costs involved in accidents or activities that pose risks to the environment and safety of employees and the surrounding communities.

Therefore, this program aims, through a systematic analysis of the enterprise's Environmental Management System, a strategic assessment of its environmental performance and the adoption of corrective measures, if necessary.

The implementation of the mandatory environmental audit will be a responsibility of the concessionaire company responsible for the project's operation, and it must be executed by a duly qualified professional with higher education. The plan details must be submitted to the competent environmental agency before the start of project operation.

#### **13.2.16. Eventual Project Deactivation Plan**

This plan establishes programs and procedures to be adopted in the event of an eventual project deactivation. It aims at the elimination of environmental liabilities and the restoration of degraded areas, in addition to considering issues related to the safety of employees and surrounding communities/facilities, environmental protection, as well as the possible future use of the land and compliance with legal requirements.

This plan must include the following steps: justification for deactivation / decommissioning; characterization of the enterprise; characterization of the environmental situation of the project area; characterization of the equipment to be deactivated / decommissioned; preparation of the disassembly and cleaning plan; identification of reusable materials and debris; prognosis of environmental quality after plant deactivation and the recovery plan for degraded areas.

The elaboration an Eventual Project Deactivation Plan is the concessionaire's responsibility while running the enterprise's operation.

### **13.3. Environmental Monitoring Plans**

#### **13.3.1. Permeate Water Quality Monitoring (Fresh Water)**

In order to guarantee the quality of the fresh water to be distributed to the population, it must be monitored at the Desalination Plant level, through the collection and periodic sampling analysis of raw permeate. It shall verify reverse osmosis treatment efficiency and the need to perform post-treatment. The post-treated permeate should also be monitored to verify if it meets relevant legislation requirements (Consolidation Ordinance n° 05, of September 28<sup>th</sup>, 2017 - Attachment XX and WHO recommendations)

It is recommended that the following physicochemical parameters be analyzed: color, turbidity, odor, dry residue, pH, oxygen consumed, sodium, chlorides, sulfates and TDS.

Bacteriological parameters, total coliforms, fecal coliforms and iron-oxidizing bacteria should be investigated as well. The collection and periodic analysis of the samples will be in charge of the Desalination Plant Administration.

The reports to be issued by the Desalination Plant laboratory or by another it hires will be identified with the laboratory's name, report number and signed by a chemistry professional, duly registered with the relevant Council. The permeate quality standards must be met at all times, whether by simple or compound sampling.

A permeate monitoring report shall be prepared monthly by the Desalination Plant, containing the following topics: summary of the operating conditions for the period (number of days in operation and maintenance occurrences); permeate (average monthly volume); sampling (date and time, type of sample - simple or compound and signature of the sampling technician); results (analytical reports); comments (statistical treatment of results and comparison with reference standards) and conclusions.

Monitoring product water quality is already a routine activity in the operation of desalination plants, which is why its costs shall not be a burden to this project. The concessionaire responsible for the project's operation shall be liable for the implementation of this measure. However, the importance of SEMACE's monitoring of this process is emphasized, as a way to guarantee water quality for the population.

### **13.3.2. Receiving Body Water Quality Monitoring**

A systematic control of the water quality of the body destined to receive the concentrate (brine) produced by the Desalination Plant is of paramount importance for the detection and correction of possible flaws in the plant's salt water pre-treatment system, ensuring preservation of the marine environment.

It is noteworthy, however, that sampling in marine waters must consider other factors, in addition to those established for fresh water, such as tides, currents, seasonal variations, discharge dilution and sampling at different depths.

The sampling programs shall vary according to the objectives to be achieved, making it necessary to select the sampling sites and water characterization parameters to consider the following aspects: geographic characteristics of the region and tidal regime; intensity and direction of currents; existence or lack of vertical stratification of the water body, which is a result of salinity and temperature; location of the polluting source; characteristics of pollution sources and intended uses for coastal waters (recreation, aquaculture, fishing, port area, etc.).

Due to the complexity of all these factors, general rules cannot be formulated to establish sampling programs. The recommended is to carry out preliminary studies to discover systematic variations after the injection of effluents from the project's implementation, defining the monitoring program as this data is obtained.

The monitoring to be put in place aims to draw a trophic level evolution line regarding the ecosystem of interest, determining the environmental changes resulting from this activity, and providing subsidies for efficient concentrate control. It must be based on proven



scientific evidence, with the aim to maintaining the environmental quality required by the current legislation. The implementation of this measure should be a responsibility of the concessionaire responsible for the enterprise's operation.

The parameters to be analyzed under the EIA/RIMA were provided in the Reference Term issued by SEMACE (Attachment VI). Monitoring frequencies, general and specific parameters shall be defined during the installation and operation phases of the project's environmental licensing process,

### **13.3.3. Marine Biota Monitoring Plan**

Possible impacts on the marine environment due to concentrate (brine) discharge from the seawater desalination process may not be potentially critical or very significant, when considering an appropriate outfall location and the adoption of technologies that favor the rapid concentrate dilution. However, only monitoring can confirm these trends.

Within this context, the proposed marine biota monitoring aims to assess the possible spatial and temporal changes in the ecological descriptors of the biotic communities evaluated, motivated, occasionally, by possible changes in seawater quality due to the injection of concentrate (brine) from the desalination plant. It also aims for to permit the adoption of appropriate measures whenever necessary, significantly reducing the risk of damage to the marine biome. In addition, measures and planning have already been applied to optimize brine plume dispersion and minimize potential impacts in the project phase.

The monitoring to be carried out should cover the planktonic, benthic and nektonic communities present in the enterprise's influence area.

It is worth remembering that porpoises appear mainly in the Iracema and Mucuripe coastal areas. If the diagnosis made at the licensing stage has identified which cetacean (gray porpoises) population uses the enterprise area, monitoring efforts of this group should be included in this plan, at least until the interaction patterns and enterprise impacts on the area's populations are well established.

Marine benthic macrofauna species and the nekton have been used as indicators of aquatic environment conditions in medium and long-term studies, in view of their important role in the food chain of coastal zone ecosystems. Due to their close relationship with the seabed substrate, where contaminating substances accumulate, benthic organisms are constantly subject to environmental changes, whether natural, such as deposition / removal of sediments by currents or changes in salinity, or anthropogenic, such as overfishing and pollution (LANA, 1994; FRANKLIN JÚNIOR, 2000).

The study of phytoplankton, benthic and demersal nekton communities in the brine discharge's area of influence has as objectives:

- ✓ Monitor community structures, based on the elaborated biotic environment diagnosis;
- ✓ Characterize the spatial and temporal distribution patterns of these species in the study area, based on traditional ecological indicators and indexes;

- ✓ To perform an analysis of possible changes in its composition and distribution as a result increased marine environment salinity, or even of another descriptor identified as statistically significant, through the application of exploratory analyzes of main components and MDS, among others;
- ✓ Prepare reports that allow the assessment of cause and effect relationships, in case signs of biological variations are identified.

To determine changes or alterations in the marine communities over a period of time, a detailed monitoring in the project's interference area and its surroundings should be carried out. During this survey, the unconsolidated substrate biota and the water column should be monitored.

The study to be developed should have the following configuration:

- ✓ Elaboration of a work plan, with proposals for the sampling scope, frequency and methodology for collected samples, data analysis and treatment, to be subjected for approval by the environmental licensing agency;
- ✓ Survey of the environmental conditions in force in the project's area of influence, characterizing the substrate, biota and ocean water;
- ✓ Identification of the different organisms present in the area of influence, up to the lowest possible taxonomic level;
- ✓ Definition of sampling frequency according to the knowledge of environmental dynamics of the areas to be monitored;
- ✓ Definition of facilities, equipment, consumables and personnel necessary for monitoring;
- ✓ Monitoring of marine communities over a period of time;
- ✓ Preparation of a report with the data's statistical treatment and consolidated analysis, aiming at periodic evaluations of the sampling scope and frequency.

The selection of sampling spots must consider that the distribution of organisms in marine ecosystems is conditioned to a set of environmental parameters whose relative importance may, individually, present spatial and temporal variations. Therefore, the interpretation of the biota distribution patterns in the concentrate outfall's area of influence requires a detailed analysis of the role played by each of the factors acting on the distribution of these organisms, namely topography, tides, type of substrate, salinity, temperature, dissolved oxygen, humidity and luminosity, as well as biological factors such as predation and competition. Thus, these characteristics must be considered when defining the study's target area and selecting sampling spots.

Sampling frequency shall be biannual, so the execution of two campaigns in a year should be anticipated. The biota monitoring plan must have a duration conditioned to the agreements with the environmental agency in the project's licensing processes.

An Authorization for Capture, Collection and Transport of Biological Material should be requested as well the characterization and environmental monitoring, in consolidated and unconsolidated substrates of the benthic macrofauna and planktonic and ichthyofauna communities, present in the concentrate outfall's area of influence. For this end, the "Marine Biota Sampling Plan" must be prepared and submitted to this body.

The activities and information produced regarding data collection and treatment for marine biota monitoring and characterization in the brine discharge's area of influence should be analyzed according to the methodology established in literature. The results of the aquatic fauna must be statistically treated to obtain ecological indexes of amount, diversity, abundance, dominance and equitability. Special attention should be given to the determination, within each group, of species that may prove to be of significant value as bioindicators of environmental quality, either because of their fragility in the face of environmental changes, or their intrinsic ecological characteristics (i.e., position / role in the food chain, potential to cause environmental imbalances, etc.).

Whenever technically and logistically possible, physicochemical parameters should be measured *in situ* with a multiparameter probe, allowing a correlation analysis between water quality and sediment data among aquatic biota ecological indexes.

Information such as the date and time for the start and end of sampling, site validation georeferencing, path velocity, trap number and arrangement, indication of the season in which the samplings were performed, meteorological and oceanographic observations at the time of the sampling operation, etc.

The implementation of this measure shall be undertaken by the concessionaire responsible for project operation.

#### **13.3.4. Fishing Activity Monitoring Plan**

The Plan's elaboration will be conditioned to the assessment of the diagnosis and impacts to be elaborated and identified within the Environmental Impact Study / Environmental Impact Report - EIA / RIMA.

## **14. Operational Costs According to the Environmental Licensing Phase**

### **14.1. General Information**

The operational costs to be incurred in the different environmental licensing phases involve not only Preliminary, Installation and Operation licenses expenses with the competent environmental agency, but also the payment of the environmental compensation.

It shall also cover expenses with the elaboration of the enterprise's Environmental Impact Study - EIA / RIMA and the Basic Environmental Plan - PBA, as well as the execution of the archaeological studies required for the enterprise's licensing process with the IPHAN - National Historical and Artistic Heritage Institute. Below is a brief description of each of these costs, as well as their estimates.

### **14.2. Environmental Licenses Expenses**

The estimated costs for the environmental licenses were based on the License and Authorizations Costs Simulator, contained in the SEMACE website at: (<http://www.SEMACE.ce.gov.br/licenciamento-ambiental/o-licenciamento/>).

In view of the fact that the enterprise to be licensed is not part of the list of activities eligible for licensing, it was classified according to the activity that best suited the characteristics of the enterprise to be implemented. Therefore, the framework of the proposed project was classified in Activity Group 27.00 – ENVIRONMENTAL SANITATION, more specifically in Activity 27.04 - Water Supply System with Conventional Treatment. It is worth noting that COEMA Resolution nº 02, of April 11, 2019, was published this year, referring to the procedures, criteria, parameters and costs applied to environmental licensing within SEMACE's scope.

As already highlighted in this document, some procedures were altered in the licensing process; for example, the Preliminary License request – LP, substituted for the installation and operation licensing procedure, this called LIO for this activity.

As for the information required about the project, it was informed that it is not located in a protected area; it is located about 10.0 km from SEMACE headquarters and shall have an intake flow estimated at 2,230 L/s. Simulations of license costs were carried out, considering the current prices, but a projection of an annual cost increase of 5% of these processes was estimated over the years. The results obtained in the simulator are presented below, considering the following.

For the Preliminary License, request costs were already solicited from SEMACE in the base year of 2018. For the Installation and Operation License, the estimated value considered the elapsed processing period, with an estimate for the year 2021, in the value described below. Operating License Renewal has its application expected in the year 2023, considering the 5-year validity of the LIO license.

- ✓ Preliminary License: R\$ 10,834.47
- ✓ Installation and Operation License: R\$ 19,386.28

✓ Operation License: R\$ 16,838.37

### 14.3. EIA/RIMA Elaboration Costs

The costs to be incurred in the preparation of the Desalination Plant's Environmental Impact Study - EIA / RIMA involves the preparation of an environmental diagnosis for the areas of influence, covering the physical, biotic and socioeconomic means, terrestrial and marine environments. It should cover the execution of several basic studies, most of which are detailed in Chapter 11 of this report, including characterization studies of benthic organisms and sedimentology, measurements of sea water temperature and salinity, floristic and fauna inventories, socioeconomic research, mathematical simulation study for brine plume dispersion, a hydrogeological study, etc.

It also recommends the identification and assessment of environmental impacts resulting from the implementation and operation of the project, as well as the project for the mitigating and environmental control measures recommended. It will be developed by a multidisciplinary technical team, whose costs were originally budgeted as R\$ 722,690.00, but reduced to R\$ 535,157.29 with the segmentation of marine data sampling costs presented below. A period of 05 (five) months was projected for its execution.

For the EIA / RIMA evaluation stage, an onus of approximately R\$ 10,000.00 was projected for the performance of public hearings required within the project's environmental licensing and monitoring processes by SEMACE, in addition to the LP emission fee already mentioned (R\$ 10,834.47).

### 14.4. Basic Environmental Plan (PBA) Expenses

To obtain Installation Licenses, it is necessary to detail the mitigating and environmental control measures recommended in the Environmental Impact Study - EIA / RIMA for the project, that is, it is necessary to execute the PBA - Basic Environmental Plan.

Therefore, when requesting the Installation License, the environmental protection measures directly linked to the implementation phase of the engineering works must be submitted to the competent environmental agency, namely:

- ✓ Environmental Management Plan, a manual that must be prepared by the CONCESSIONAIRE containing a summary of the mitigating and environmental control measures to be implemented during the project's implementation and operation phases, detailing liability for its execution (Entrepreneur, Contractor or Supervisor). A cost of R\$ 10,000 is estimated;
- ✓ An Environmental Control Program for Civil Works, which involves plans to control air quality and noise levels, temporary traffic/signage deviations due to the work site, recovery of degraded areas, management of construction site effluents and solid waste, which are under the CONCESSIONAIRE's responsibility. These plans must be implemented without onus to the Government, and it must be the CONCESSIONAIRE's obligation to present these plan details before the engineering works start. Among the measures included in the Environmental Control Program for Civil Works, the Deforestation / Cleaning Plan for works sites





shall also be under the CONCESSIONAIRE's responsibility, given that the licensing of vegetation removal is an essential measure to obtain the Installation License for the project. The cost for its preparation was budgeted at R\$ 40,000.00;

- ✓ A Workplace Protection and Safety Plan, that covers the plans required by labor legislation (Program for Working Environment Conditions in the Construction Industry - PCMAT (specifically for the Contractor); an Occupational Health Medical Control Program - PCMSO, Occupational Health Program Environmental Risk Prevention - PPRA, Risk Management Program - PGR and Emergency Action Plan - PAE). It is emphasized that the elaboration of the referred plans will not result in onus for the Government, since it is a labor legislation requirement. In the implementation phase of the works, this measure will be the CONCESSIONAIRE's responsibility, as well as in the enterprise's operation phase;
- ✓ An Archaeological Heritage Identification and Rescue Program. Its costs were calculated in connection with the project's environmental licensing process with IPHAN, as can be seen in item 14.5;
- ✓ A Protection and Recovery Plan of Public Property. The implementation of this measure will be the CONCESSIONAIRE's responsibility, through the Contractor in charge of work implementation or by the transfer of funds to the respective concessionaires responsible for the affected public services. It should be noted that the costs to be undertaken with the activities recommended by this measure must already be included in the bidder's Commercial Proposal.
- ✓ A Social Communication Program. It involves a project of actions to be developed within the Communication Program, as well as the preparation of visual arts and promotional material. It will be a responsibility of the Company supervising the enterprise's work implementation, having been estimated in R\$ 20,000.00;
- ✓ An Environmental Education Program, to involve the implementation of lectures, courses and workshops in the work implementation phase, which will be a responsibility of the Company supervising the enterprise's work implementation. Its target audience shall be the civil society, fishermen and the workers, with an estimated of R\$ 50,000.00;
- ✓ A Civil Construction Solid Waste Management Plan, which shall be implemented at no cost to the Government, and it is mandatory for the CONCESSIONAIRE to present the details of this plan before the start of implementation of the engineering works.

When requesting the Operation License, the following mitigation and environmental control projects must be presented to the competent environmental agency:

- ✓ A Solid Waste Management Plan, which must be prepared by the Concessionaire, with the costs estimated at R\$ 18,000.00;
- ✓ An Environmental Education Program, in the project operation phase; this program must be developed by the Concessionaire, including its operating costs, without any onus to the project;
- ✓ The Operator Training Program for Desalination Plant Operation and Maintenance, and the Permeate Quality Monitoring Plan (fresh water) to be implemented by the



Concessionaire, already integrate the Desalination Plant's operational costs, without onus for the enterprise;

- ✓ An Emergency Plan for Chemical Leaks, whose elaboration should be made by the Concessionaire, with an expected cost of R\$ 20,000.00;
- ✓ The Seawater Quality Monitoring Plan, whose elaboration should be done by the Concessionaire, with a cost of R\$ 35,800.00. This plan involves a diagnosis of the current situation, selection of sampling spots and definition of methodologies and equipment to be used. It should be noted that the implementation of this measure requires service provision on a continuous basis by a team of specialists to be hired by the Concessionaire throughout the operation, with the execution of quarterly water sampling;
- ✓ A Marine Biota Monitoring Plan, whose elaboration shall be done by the Concessionaire, with a cost of R\$ 30,000.00 for its elaboration, involving a diagnosis of the current situation, selection of sampling spots and definition of methodologies and equipment to be used. It should be noted that the implementation of this measure requires service provision on a continuous basis by a team of specialists to be hired by the Concessionaire throughout the operation, with the execution of quarterly sampling of marine biota;
- ✓ A Fishing Activity Monitoring Program, which may or not be needed, according to the diagnosis and the impacts of the relationship between the enterprise and the fishing activities in its area of influence;
- ✓ A Plan for the Protection and Recovery of Public Property, already included in the engineering project expenses, without any onus to the Government;
- ✓ A Maintenance Plan for the Implemented Infrastructure, already included among the engineering project expenses, without onus to the Government;
- ✓ An Environmental Audit Program, which must be drafted by the Concessionaire, with a cost of R\$ 25,000.00 for its preparation;
- ✓ Eventual Project Deactivation Plan, must be prepared by the Concessionaire, and with costs estimated at R\$ 36,500.00.

A period of 5 (five) months has been estimated for the elaboration of the outline of the plans and programs that shall integrate the enterprise's PBA. Chart 17 below shows the costs to be incurred for the mitigation and environmental control measures included in the project's PBA, which together totaled R\$ 295,300.00.

Chart 17 - Costs of Mitigation and Environmental Control Measures Included in the PBA - Basic Environmental Plan

Classification	Project Phase to be Adopted	Responsibility for Elaboration and / or Implementation	Costs (R\$)
Environmental Management Plan	Implementation of Works	CONCESSIONAIRE	10.000,00
Construction Works Environmental Control Program	Implementation of Works	CONCESSIONAIRE	40.000,00
Air Quality and Noise Levels Control Plan	Implementation of Works	CONCESSIONAIRE	Without onus to the Government. It is the Concessionaire's obligation to present this plan before the start of the works.
Deforestation / Cleaning Plan for Construction Areas and Fauna Management	Implementation of Works	CONCESSIONAIRE	10.000,00
: Plan for Temporary Deviations / Signage of Construction Areas:	Implementation of Works	CONCESSIONAIRE	Without onus to the Government. It is the Concessionaire's obligation to present this plan before the start of the works.
Recovery Plan for Degraded Areas	Implementation of Works	CONCESSIONAIRE	Without onus to the Government. It is the Concessionaire's obligation to present this plan before the start of the works.
Construction Site Effluent Management Plan	Implementation of Works	CONCESSIONAIRE	Without onus to the Government.
Civil Construction Solid Waste Management Plan:	Implementation of Works	CONCESSIONAIRE	Without onus to the Government.
Worker's Protection and Safety Plan (PCMAT, PCMSO, PPRA, PGR and PAE)	Implementation of Works / Project Operation	Contractor (construction phase) - CONCESSIONAIRE (operation phase)	Plans required by labor legislation, without onus to the Government.
Identification and Rescue Program for Archaeological Heritage	Implementation of Works	CONCESSIONAIRE	The costs related to this program were calculated in connection with the project's environmental licensing process with IPHAN.
Public Heritage Protection and Recovery Plan	Implementation of Works	CONCESSIONAIRE	It must already integrate the Engineering Project costs.
Social Communication Program	Implementation of Works / Project Operation	CONCESSIONAIRE	R\$ 20,000.00, with calculation of the communication program's agenda to be implemented and the elaboration of graphic arts and promotional material.



Classification	Project Phase to be Adopted	Responsibility for Elaboration and / or Implementation	Costs (R\$)
Environmental Education Program	Implementation of Works / Project Operation	CONCESSIONAIRE	Works Implementation Phase (50,000.00) Operation Phase - integrates operational costs of the desalination plant.
Enterprise Solid Waste Management Plan	Project Operation	CONCESSIONAIRE	R\$ 18.000,00
Emergency Plan for Chemical Leaks	Project Operation	CONCESSIONAIRE	20.000,00
Operator Training Program for Desalination Plant Operation and Maintenance.	Project Operation	CONCESSIONAIRE	It already integrates the desalination plant's operational costs.
Permeate Quality Monitoring Plan (Fresh Water)	Project Operation	CONCESSIONAIRE	It already integrates the desalination plant's operational costs.
Sea Water Quality Monitoring Plan	Project Operation	CONCESSIONAIRE	R\$ 35,800.00 to outline the monitoring plan. The implementation of this measure requires the execution of quarterly sampling of marine biota by a specialized team during the entire operation.
Marine Biota Monitoring Plan	Project Operation	CONCESSIONAIRE	R\$ 30,000.00 to outline the monitoring plan. The implementation of this measure requires the execution of quarterly sampling of marine biota by a specialized team during the entire operation.
Maintenance Plan for the Implemented Infrastructure	Project Operation	CONCESSIONAIRE	It must already integrate the Engineering Project costs.
Environmental Audit Program	Project Operation	CONCESSIONAIRE	25.000,00
Eventual Project Deactivation Plan	Project Operation	CONCESSIONAIRE	36.500,00

## 14.5. IPHAN Environmental Licensing Costs

The environmental licensing of the project with IPHAN - National Historical and Artistic Heritage Institute shall also cover three phases - Preliminary, Installation and Operation Licenses. In this case, no fees are charged for the license emissions. Therefore, the costs to be incurred in this case are associated with execution of the studies requested by IPHAN during the licensing process.



Considering that the enterprise will most likely be classified by IPHAN at Level III (medium to high interference on the prevailing soil conditions, large areas of intervention, with limited or no flexibility for changes in location and layout) recommended by Normative Instruction nº 001/2015, the following studies shall be required:

- ✓ Preliminary License: elaboration of an archaeological research project (Archeological Heritage Impact Assessment Project) and its respective Archaeological Heritage Impact Evaluation Report, whose elaboration costs were estimated at R\$ 119,058.60, and this amount may change due to underwater archeology requirements;
- ✓ Installation / Operation Licenses: provisions on the preparation of the Archaeological Heritage Management Program, the execution and costs that depend on the results obtained by the studies developed in the 1st licensing phase. The following projects, the Archaeological Rescue Project and the Integrated Heritage Education Project must be carried out within the referred program, in addition to the subsequent preparation of the Archaeological Cultural Heritage Management Report, which must contain the following items: Salvage Report, Technical Report -scientific with the results of archaeological monitoring, inventory of rescued archaeological goods, etc. and the Integrated Heritage Education Report, among others. A cost of approximately R\$ 171,616.00 was calculated for the execution of the activities listed above, not including expenses with the execution of the Archaeological Monitoring Project during work implementation, if necessary. However, it shall depend on the results obtained by the archaeological studies developed to obtain the Preliminary License, the present licensing phase (Installation / Operation License) can either be carried out or not, as well as suffer changes in its expenses, depending on the occurrence of archaeological sites in the studied area. This program must integrate the PBA - Basic Environmental Plan and may be developed before or simultaneously to with the civil works;

It should be noted that, according to Ordinance nº 007/1988, an archaeological research project should be prepared and forwarded to IPHAN requesting a license / authorization for each phases of the archaeological research, with the area being released for research shortly after publication at the DOU (Official Gazette) - Section 1.

Along with request sent to IPHAN's National Archeology Center (CNA), there must be a proof of financial endorsement issued by the contracting company, as well as a declaration of institutional endorsement, signed by the scientific institution that will be responsible for the safekeeping of any archaeological discoveries.

The costs now presented refer to the execution of studies pertinent to the first and second IPHAN licensing phases, which amount to R\$ 119,058.60 (1<sup>st</sup> Phase - Preliminary License) and R\$ 171,616.00; (2<sup>nd</sup> Phase - Installation / Operation License). The expenses incurred with the execution of archaeological monitoring, in case it is required by IPHAN, was not being included in the last phase's calculation. Deadlines of 6 (six) months were projected for the execution of each phases of the licensing process, already including the deadlines required by IPHAN for analysis of the reports produced.



## 14.6. Costs with Other Licenses and Authorizations

It is also necessary, during the initial phase of enterprise installation, to perform licensing with the competent environmental agency in the construction site: of the quarry areas to be explored, if the use of commercial deposits and concreting and crushing plants, among others, are not adopted. If necessary, the right to use the water during work implementation must be obtained from the competent body.

It should be noted that these licenses must be carried out with the competent environmental agency by the Contractor, with the costs to be incurred by the Contractor, not resulting in a burden for the Government.

Other types of authorizations and licenses may be required by the Fortaleza City Hall, considering that the project shall also include the transport of treated water to the water tower located at Praça da Imprensa, in the Dionísio Torres district. Urban and road interventions must be requested from the competent bodies (State and City), as well as eventual communication with private companies due to the use of underground areas.

## 14.7. Costs with Environmental Compensation Payment

In the State of Ceará, the method to determine the amount of environmental compensation in undertakings subject to the Environmental Impact Study - EIA / RIMA was modified in mid-2014, by the State Environmental Council - COEMA, an organ part of the State Environmental System. Such modification was regulated by COEMA Resolution nº 11/2014 and standardized by COEMA Resolution nº 26/2015.

Previously, in compliance with federal legislation (Art. 31 of Decree nº 4,340 / 02 and Decree nº 6,848 / 09) the calculation of environmental compensation was the product of VR (Reference Value = investments required for the project implementation, except for costs of MPA's) by the Degree of Impact (GI), the latter being calculated by mathematical formulas that considered the magnitude and intensity of environmental impacts, reaching values between 0 and 0.5%.

However, according to COEMA Resolution nº 26/2015, the Degree of Impact (GI) was set at 0.5% for all projects under licensing in the State of Ceará, requiring information from the VR entrepreneur, that is, of the total investment value, excluding investments related to the implementation of plans, programs and mitigating measures for adverse environmental impact. Thus, the new resolution eliminated GI calculation and fixed its value at a maximum of 0.5%. Thus, the environmental compensation value presented in this chapter is the product of VR with the set percentage of 0.5%.

The investments required to implement the project were estimated in the Engineering Preliminary Project at R\$ 484,486,896.89, not including investments related to plans, projects and programs to be required in the environmental licensing procedure to mitigate impacts caused by the project, nor the charges and costs incurred on enterprise financing;

Therefore, the Environmental Compensation Value (CA) to be invested by the project's entrepreneur in conservation units and monitoring and inspection activities shall amount to R\$ 2.422.434,48, as shown in Chart 18.

Chart 18 - Value of Environmental Compensation per Project Phase

<b>Discrimination</b>	<b>Total Invested (R \$ 1.00)</b>	<b>Compensation Amount (R \$ 1.00)</b>
Desalination Plant	R\$ 484,486,896.89	2.422.434,48

It is important to note that this amount will be reviewed at the time of Executive Project detailing, and these changes must be submitted when requesting the Installation License for the project. According to COEMA Resolution 11/2014, 70.0% of this amount will be used for preservation unit protection, while the remaining 30.0% will be allocated to control and inspection actions.

Payment of environmental compensation may be made in full or in installments, or in another way established by the competent environmental authority, in this case SEMA, for the corresponding licensing procedure. If the installment system is adopted, it must happen on a schedule defined by the competent environmental authority. Payment in 24 monthly installments was considered herein, distributed over the period between the emission of the Installation and Operation licenses, as provided in the relevant environmental legislation (COEMA Resolution 06/2017).

As determined by Decree nº 32.310/2017, the entrepreneur must comply with the payment schedule to avoid the suspension of the environmental license, as described in art 6.

*Art. 6-A The entrepreneur must maintain the regular payments of the amounts related to environmental compensation, under penalty of suspension of the current environmental license or nonrenewal of the subsequent license.*

*§1º SEMA must communicate regular payments SEMACE, as well as defaults of the amounts related to environmental compensation.*

*§2º TCCA acquittal, to be certified by SEMA, is an essential condition for issuing the operating license.*

## **14.8. RAMA Payment Costs**

During the environmental licensing procedure, the interested party must submit for analysis by the competent environmental agency, each year and counting from the date of emission of the respective Environmental License (LIO and RENLO), an Environmental Surveillance and Monitoring Report - RAMA regarding the activities' environmental management plans and programs, works or projects potentially making use of licensed environmental resources included in the approved schedule, upon payment of the respective analysis price (Art. 22, §1 of COEMA Resolution nº 02/2019).

The annual cost to be incurred with RAMA analysis payment will depend on the amount established by the competent environmental agency at the time of environmental license application, corresponding to 50.0% of the updated value of the respective license. It



should be noted that RAMA presentation is annual; the first must be executed a year after the license is issued (LIO), and subsequently in the operation phase of the project.

In the specific case of the current project, the Installation License cost was estimated at R\$ 19,386.28, with an average annual cost of R\$ 9,693.14 to be incurred during the work implementation phase based on the annual license fee update. For the renewal phase of the project's operation, this annual cost was budgeted at R\$ 8,419.19, based on the estimated updated value for the first Operation License renewal, which was R\$ 16,838.37.

It is important to note that RAMA costs will vary annually, considering the criterion of 50% of the updated value in relation to the corrected license. Thus, RAMA's price will not be fixed, with a tendency for a progressive increase throughout enterprise operation.

## 15. Physical-Financial Schedule of the Enterprise's Environmental Costs

The following table summarizes unit costs used as a reference to guide the costs for different licensing phases, whose details were presented in the previous items.

Table 2 - Licensing Processes Price Reference.

Items	Projection(R\$)	Frequency
EIA / RIMA elaboration	535,157.29	Single
Archaeological Research Project and Archeological Heritage Impact Assessment Report	119,058.60	Single
EIA / RIMA Protocol	13,360.00	Single
EIA / RIMA Evaluation and Execution of Public Hearings / LP Emission	20,834.47	Single
Compliance with LP Conditions (including preparation and analysis of the Basic Environmental Plan)	295,300.00	Single
Installation License (LIO) Request and Emission	19,386.28	Single
Installation / Operation Licensing with IPHAN: Archaeological Heritage Management Program (archaeological rescuing, heritage site monitoring and education) / Archaeological Heritage Management Report	171,616.00	Single
Marine Monitoring	240,000.00	Yearly
Monitoring and Environmental Observation Report / RAMA (construction works phases)	9,693.14	Yearly
Monitoring and Environmental Observation Report / RAMA (plant operation phases)	8,419.19	Yearly
Payment of Environmental Compensation	2,422,434.48	Single
Renewal Request for Operation Licenses (LO) / Proof of Execution of all environmental conditions required by SEMACE / LO Emission	16,838.37	Every 8 years

Considering the estimated deadlines for each stage of the licensing process, Table 3 shows cost distribution over the 30 years of the project's concession. It contains the initial costs in the EIA / RIMA elaboration phases, including submission, analysis and emission costs for the Preliminary License, as well as those necessary for the Installation and Operation License's submission, analysis and emission costs, including those related to environmental compensation. The estimated costs for maintaining and renewing the Operation licenses are presented for the remaining years of plant operation.

Table 3 - Physical-Financial Chronogram of the Various Licensing Process Stages.

DESCRIÇÃO / ANO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mudança de Titularidade LP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Elaboração do EIA/RIMA	535.157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Projeto de Pesquisa Arqueológica e Relatório de Avaliação de Impacto no	119.059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Protocolo do EIA/RIMA	13.360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avaliação do EIA/RIMA e Execução das Audiências Públicas / Emissão da LP	20.834	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cumprimento de Condicionantes da LP	0	295.300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Solicitação e emissão da Licença de Instalação (LIO)	0	19.386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Autorização de Supressão Vegetal / Limpeza do Terreno junto a SEMACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Licenciamento Instalação / Operação IPHAN: Programa de Gestão do Patrimônio	0	171.616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Autorização para coleta e captura de fauna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Monitoramento Marinho	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000
	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Relatório de Acompanhamento e Monitoramento Ambiental/RAMA (Fase de	-	-	9.693	9.693	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pagamento da Compensação Ambiental	-	605.609	1.211.217	605.609	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0%	25%	50%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Solicitação das Renovações das Licenças de Operação (LO) / Comprovação da	-	-	-	-	-	-	16.838	-	-	-	-	-	-	-	-	16.838	-	-	-	-
	0%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%
Apresentação dos RAMA durante a operação	-	-	-	-	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419
	0%	0%	0%	0%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
TOTAL MENSAL	928.410	1.331.911	1.460.910	855.302	248.419	248.419	265.258	248.419	248.419	248.419	248.419	248.419	248.419	248.419	265.258	248.419	248.419	248.419	248.419	248.419
TOTAL ACUMULADO	928.410	2.260.321	3.721.232	4.576.533	4.824.953	5.073.372	5.338.629	5.587.049	5.835.468	6.083.887	6.332.306	6.580.725	6.829.144	7.077.564	7.342.821	7.591.240	7.839.660	8.088.079	8.336.498	8.584.917
PERCENTUAL MENSAL	8,4%	12,0%	13,2%	7,7%	2,2%	2,2%	2,4%	2,2%	2,2%	2,2%	2,2%	2,2%	2,2%	2,2%	2,4%	2,2%	2,2%	2,2%	2,2%	2,2%
PERCENTUAL ACUMULADO	8,4%	20,4%	33,6%	41,3%	43,5%	45,8%	48,2%	50,4%	52,6%	54,9%	57,1%	59,4%	61,6%	63,8%	66,2%	68,5%	70,7%	73,0%	75,2%	77,4%

DESCRIÇÃO / ANO	21	22	23	24	25	26	27	28	29	30	TOTAL
Mudança de Titularidade LP	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Elaboração do EIA/RIMA	0	0	0	0	0	0	0	0	0	0	535.157
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Projeto de Pesquisa Arqueológica e Relatório de Avaliação de Impacto no	0	0	0	0	0	0	0	0	0	0	119.059
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Protocolo do EIA/RIMA	0	0	0	0	0	0	0	0	0	0	13.360
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Avaliação do EIA/RIMA e Execução das Audiências Públicas / Emissão da LP	0	0	0	0	0	0	0	0	0	0	20.834
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Cumprimento de Condicionantes da LP	0	0	0	0	0	0	0	0	0	0	295.300
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Solicitação e emissão da Licença de Instalação (LIO)	0	0	0	0	0	0	0	0	0	0	19.386
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Autorização de Supressão Vegetal / Limpeza do Terreno junto a SEMACE	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Licenciamento Instalação / Operação IPHAN: Programa de Gestão do Patrimônio	0	0	0	0	0	0	0	0	0	0	171.616
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Autorização para coleta e captura de fauna	-	-	-	-	-	-	-	-	-	-	-
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Monitoramento Marinho	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	240.000	7.200.000
	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	100%
Relatório de Acompanhamento e Monitoramento Ambiental/RAMA (Fase de	-	-	-	-	-	-	-	-	-	-	19.386
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Pagamento da Compensação Ambiental	-	-	-	-	-	-	-	-	-	-	2.422.434
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Solicitação das Renovações das Licenças de Operação (LO) / Comprovação da	-	-	16.838	-	-	-	-	-	-	-	50.515
	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	100%
Apresentação dos RAMA durante a operação	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	8.419	218.899
	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	100%
TOTAL MENSAL	248.419	248.419	265.258	248.419	248.419	248.419	248.419	248.419	248.419	248.419	11.085.947
TOTAL ACUMULADO	8.833.336	9.081.755	9.347.013	9.595.432	9.843.851	10.092.271	10.340.690	10.589.109	10.837.528	11.085.947	11.085.947
PERCENTUAL MENSAL	2,2%	2,2%	2,4%	2,2%	2,2%	2,2%	2,2%	2,2%	2,2%	2,2%	100,0%
PERCENTUAL ACUMULADO	79,7%	81,9%	84,3%	86,6%	88,8%	91,0%	93,3%	95,5%	97,8%	100,0%	100,0%



## 16. Technical Team Original Study

The company responsible for preparing the original Environmental Impact Study is Engesoft Engenharia e Consultoria Ltda, a service provider in the water resources and environmental areas, registered with the CGC/MF under number 73879934 / 0001-19, headquartered at Av Washington Soares, 855, 11<sup>th</sup> Floor - Edson Queiroz, in the city of Fortaleza, State of Ceará. Its telephone number is PABX (085) 3133.4900. Civil Engineer Adonai de Sousa Porto is the endorsing professional.

The technical team responsible for the coordination and preparation of this Environmental Impact Study is shown in Chart 19, with names, qualification, professional board registration and the Federal Technical Registry - CTF / AIDA, thoroughly explained. Proof of registration of team members with CTF / AIDA can be viewed in Attachment VII. Chart 20, in turn, displays the information of the technical support team also engaged in the present study.

Chart 19 - Technical Team Responsible for the Coordination and Preparation of the Environmental Impact Study

Technician Name	Professional qualification	Professional Registration Document	CTF / AIDA Registration
Adonai de Sousa Porto	Civil engineer	RN 0600388956	463438
João Bosco Andrade de Moraes	Geologist / MSc Hydrogeology	RN 0601044371	118122
Luís Gonzaga Sales Júnior	Biologist	CRBio 5554/05D-CE	242264
Naimar Gonçalves Barroso Severiano	MSc in Rural Economy / Environment Specialization	CORECON 1996/8 <sup>a</sup> R-CE	301619

Chart 20 - Technical Team Responsible for the Coordination and Preparation of the Environmental Impact Study

Technician Name	Professional Qualification	Professional Registration Document
Agnelo Fernandes de Queiroz	Archaeologist	-
Francisco Edson de Alencar Souza Junior	Civil engineer	RN 060494009-2
Flávio Lage Rocha	Civil engineer	RN 060039083-7
Marcelo Brauner dos Santos	Civil engineer	RN 060853359-9
Raphael Ramalho Gomez	Environmental and Sanitary Engineer	-



## 17. Cagece Technical Team for Environmental Study Alterations or Updates

Considering area alterations for the desalination plant, the Cagece team carried out the change/update of the environmental impact study prepared by the Engesoft. Chart 21 and Chart 22 displays the professionals responsible for changing / updating the environmental study

Chart 21 - Technical Team Responsible for the Coordination and Preparation of the Environmental Impact Study

Technician Name	Professional Qualification	Professional Registration Document	CTF / AIDA Registration
Alisson Carlos Melo Oliveira	Specialist in Environmental Engineering. Technician in Environmental Sanitation / Water Resources. Technician in Environmental Studies at Cagece	RN 060595984-6	5767366
Silvano Porto Pereira	PhD in Environmental Sanitation and Biologist at Cagece	CRBio 27.563/05-D	
Bauer Rodarte de Figueredo Rachid	PhD in Biological Oceanography and Oceanographer - FGV Consultant	AOCEANO 2163	509635

Chart 22 - Technical Support Team for the Elaboration of the Environmental Impact Study

Technician Name	Professional Qualification	Professional Registration Document
Kelson Airton Rodrigues Antonino	Environmental Manager	-
Davi de Alencar Araripe P. Alves	Specialist in Geoprocessing and Agronomic Engineer	RN 0614337330

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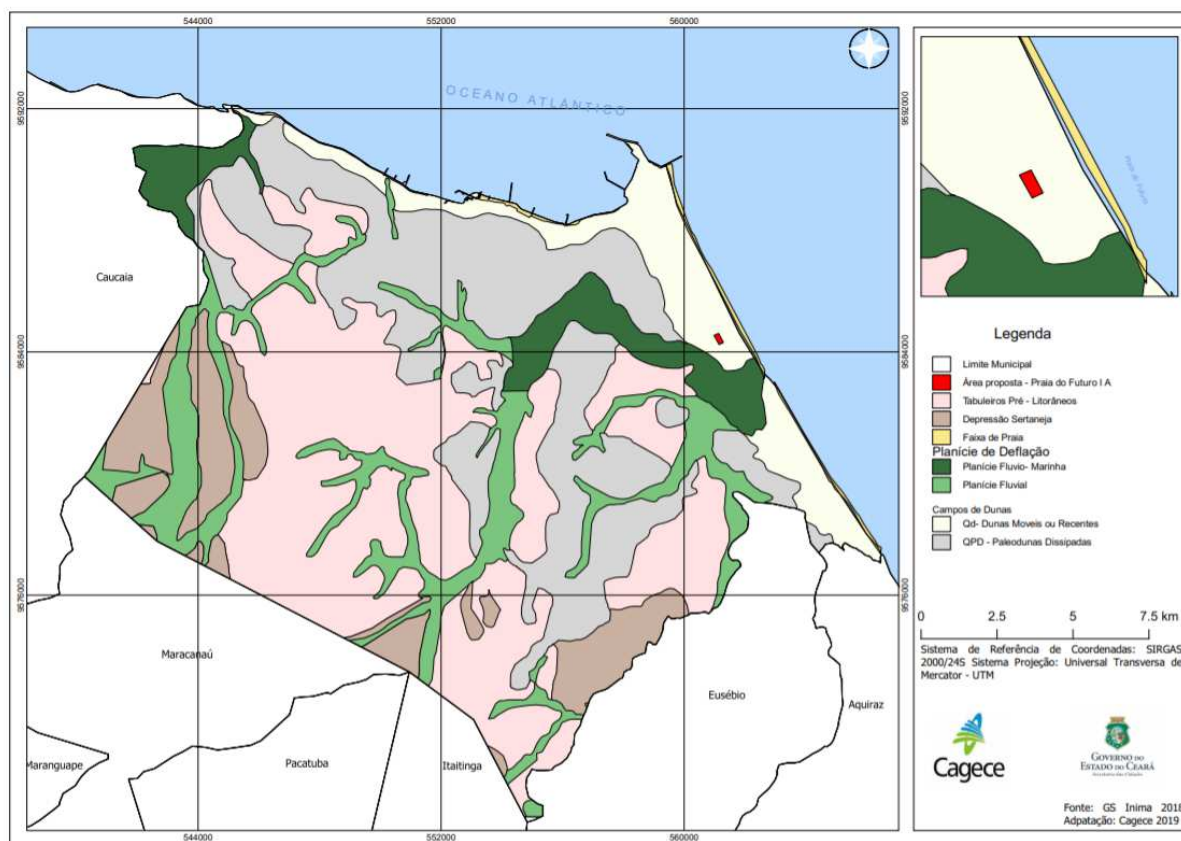
## 19. Attachments

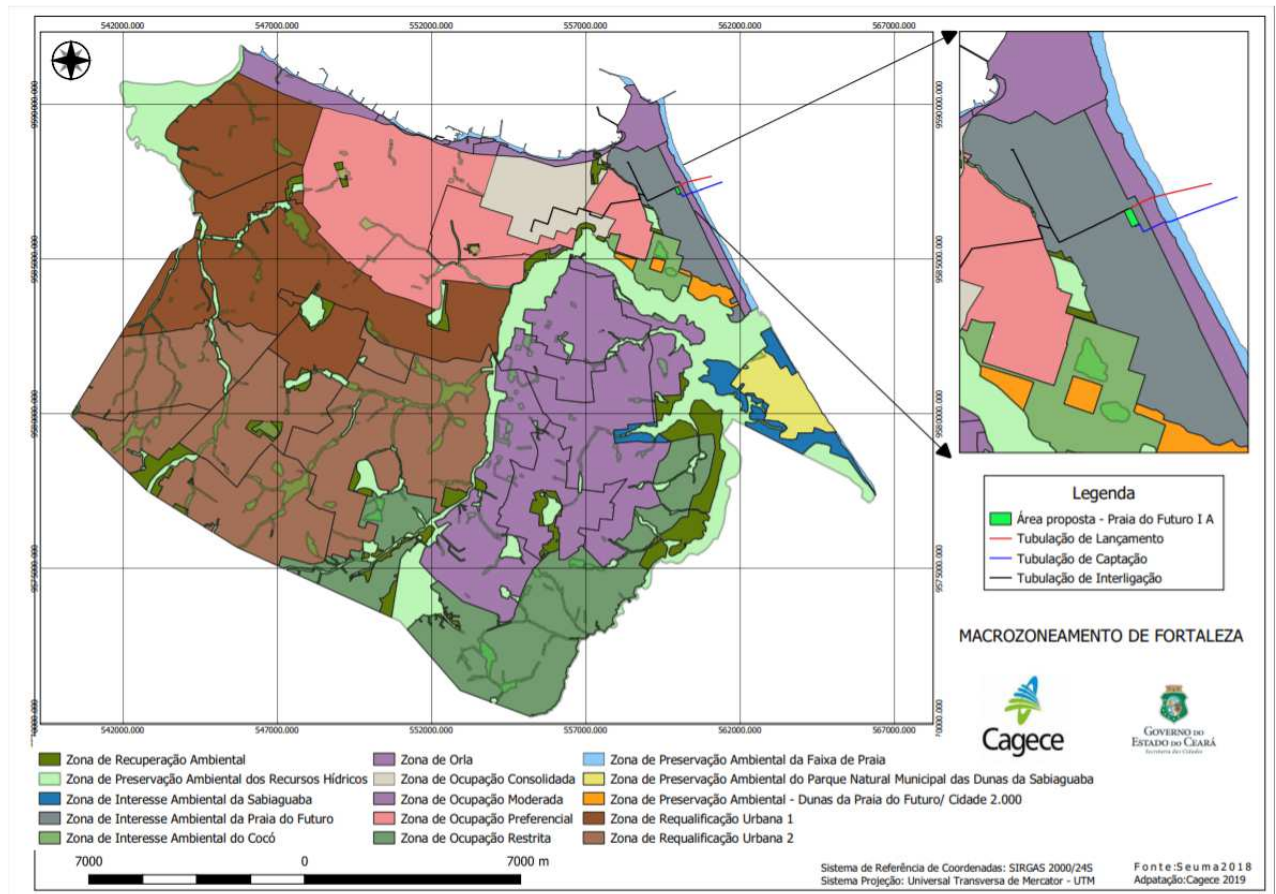


## ATTACHMENT I – Location of Selected Alternative



## ATTACHMENT II – Map of Fortaleza’s Environmental Zoning and Macrozoning





## **ATTACHMENT III – Iplanfor Report**

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**PARECER TÉCNICO nº 02/DIPLA/2019**

**Para: CAGECE**

Fortaleza, 30 de julho de 2019

**ASSUNTO:** Resposta à Consulta prévia sobre a localização da implantação da Planta de Dessalinização no Município de Fortaleza, solicitada pela CAGECE, por meio do Ofício nº 1/19/SSU/DEN.

Considerando o papel do IPLANFOR no planejamento estratégico municipal, se faz necessário que os projetos de impacto significativo no território de Fortaleza sejam integrados às propostas conforme o Plano Fortaleza 2040.

Assim, o presente processo trata da solicitação de anuência sobre as alternativas locacionais da Unidade de Dessalinização para abastecimento humano no município de Fortaleza, obedecendo critérios estabelecidos no edital do Governo do Estado do Ceará para Procedimento de Manifestação de Interesse – PMI nº 01/2017/CAGECE.

Foram expostas cinco áreas para implantação da Unidade de Dessalinização, em resposta, o IPLANFOR apresenta as seguintes considerações. Alternativa 1 (Serviluz), Alternativa 2 (Praia Mansa), Alternativa 3 (Praia da Leste Oeste – EGP), Alternativa 4 (Iplanfor I – Parque das Dunas) e Alternativa 5 (Iplanfor II – Escola Profissionalizante).

A seguir são apresentadas as justificativas das áreas descartadas e da área sugerida para implantação da Unidade de Dessalinização, avaliadas e estudadas pela equipe técnica (IPLANFOR, Consultores e CAGECE).



## ALTERNATIVA 1 - SERVILUZ

Inserido em Zona de Orla Trecho VI – Cais do Porto, com taxa de ocupação de 60%. Enquadrado como Projeto Especial (PE), a ser submetido à Comissão Permanente de Avaliação do Plano Diretor (CPPD), conforme Parecer/Comunicado nº 013-A/2018 – CENOR, emitido pela SEUMA. O Plano Fortaleza 2040 propõe a inserção do corredor de urbanização e linha de BRT, que influencia diretamente a área proposta.

Considerando que o Plano 2040 prevê uma integração do litoral oeste (beira mar/praia de Iracema) com o litoral leste (Praia do Futuro/Sabiaguaba), através da implantação de um corredor de urbanização, interligando a Avenida Abolição com a Praia do Futuro e um plano específico para a atual região da tancagem, onde deverá ser implantado o Parque dos Faróis. A região da tancagem funciona atualmente como uma grande barreira urbana, dificultando a expansão da ocupação da cidade ao longo da Praia do Futuro.

Nesse contexto, esta alternativa de terreno está inserida dentro dos limites do Plano Específico da Praia do Futuro. O Plano Específico da Praia do Futuro equivale ao produto 06 dos 7 produtos contratados à Fundação Cearense de Pesquisa e Cultura - FCPC, entregues ao IPLANFOR, que ainda irão passar por um amplo processo de participação social, reafirmando, assim, aquilo que foi pactuado com a população no Plano Fortaleza 2040 e finalizando o Projeto Multisetorial de Implementação 1 – Fortaleza 2040.

**Figura 1 – Proposta de Parque Ecológico para área nas proximidades do Porto do Mucuripe e Serviluz.**



Fonte: Plano Mestre Urbanístico e de Mobilidade – Fortaleza 2040 (2019).

Como o Plano específico da Praia do Futuro prevê a retirada da área da tancagem para promover um ambiente urbano propício à dinâmica desejada, através da implantação de um grande Parque de Recreação e Educação Esportiva, cujo uso é incompatível com o da unidade de dessalinização. Além disso, uma parte da área dessa alternativa “invade” área prevista para habitação de interesse social de uso misto, também prevista no plano específico, com vistas a beneficiar comunidade consolidada, ali existente. Nesse sentido o Plano Fortaleza 2040 indica que as comunidades do Farol e Titanzinho – hoje situadas em área de risco e grande degradação – deverão ser realocadas de modo a integrarem este parque, deixando de haver, assim, residências nas áreas que hoje sofrem com as ressacas da maré. Já em relação à comunidade do

Serviluz, deverão ser indicadas melhorias de modo a proteger as residências da invasão constante de areia, oferta de serviços públicos e melhores acessos. Entende-se que a localização do terreno proposto traz dificuldades para se realizar essa integração desejada por potencializar ainda mais o uso atual da tancagem com grandes lotes, uso este de impacto negativo à comunidade local e à cidade de Fortaleza. Portanto, tal proposta não é viável pois traz prejuízos à urbanização prevista naquela área.

Diante do contexto, frente ao Plano Fortaleza 2040 e as restrições técnicas e urbanísticas supracitadas as Alternativas 1 e 2 são inadequadas para implantação da Unidade de Dessalinização.

Figura 2 – Área propostas próximo ao Serviluz.



Fonte: Arquivo fornecido pela CAGECE (2019).

## ALTERNATIVA 2 – PRAIA MANSA

Localizada na área aterrada ao espigão do Titan, bairro Cais do Porto, inserido em Zona de Preservação Ambiental 2 - Faixa de Praia (ZPA 2), área não edificante e 100% permeável. Enquadrado como Projeto Especial (PE), a ser submetido à Comissão Permanente de Avaliação do Plano Diretor (CPPD), conforme Parecer/Comunicado nº 013-A/2018 – CENOR, emitido pela SEUMA. Ratificamos que a área apresenta características ambientais sensíveis e possui significativo valor paisagístico. Diante deste potencial, o Plano Fortaleza 2040 prevê a inserção de um Parque Ecológico a fim de explorar o potencial ambiental e paisagístico local, com ganho imensurável para comunidade do Serviluz. Desta forma, julgamos que a implantação da Unidade de Dessalinização nesta área irá comprometer os projetos previstos no Plano Fortaleza 2040 para o local. Ademais, a comunidade é articulada e comprometida com as alterações territoriais propostas, tornando o processo de participação popular relevante.

Figura 3 – Área propostas de implantação na Praia Mansa.



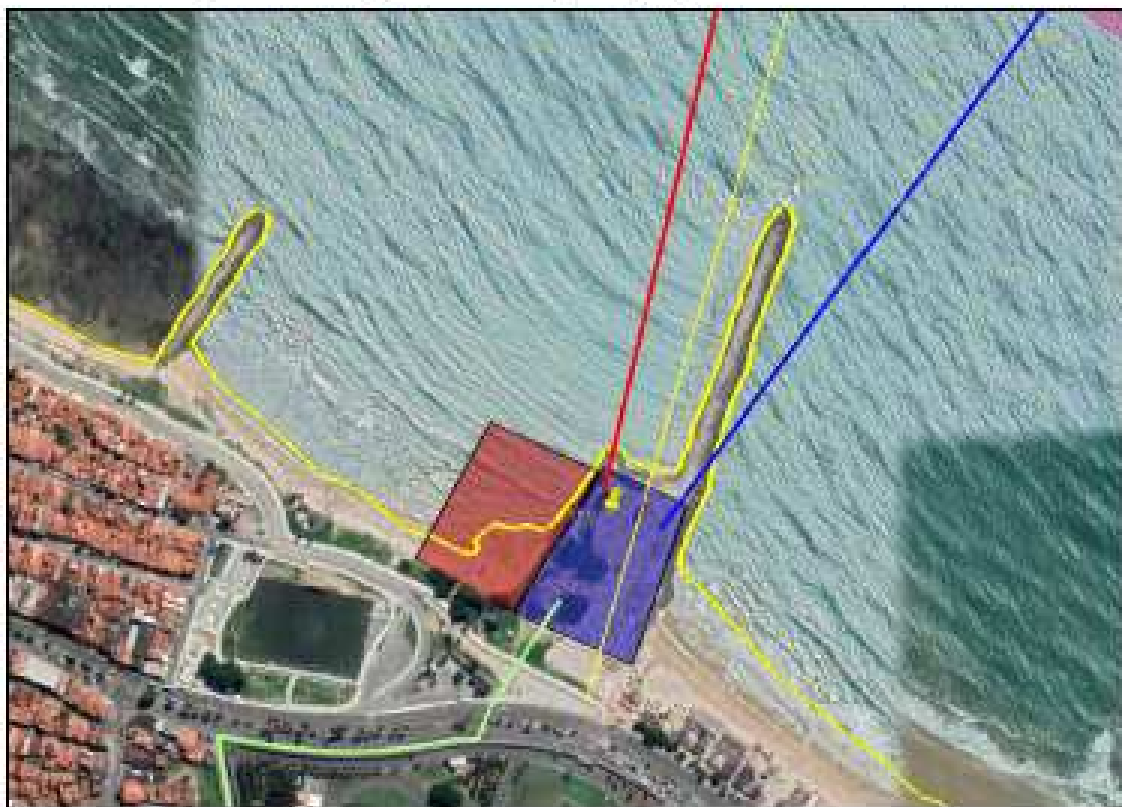
Fonte: Arquivo fornecido pela CAGECE (2019).

### ALTERNATIVA 3 – PRAIA LESTE OESTE (EPC)

A CAGECE apresentou à equipe técnica do IPLANFOR uma área alternativa localizada próximo a praia da Leste Oeste. A área encontra-se em Zona de Orla com alta influência da maré, exige ousado projeto de extensão, que exigiria aterramento da faixa de praia. Os impactos ambientais negativos decorrente de tal processo são considerados impeditivos para sua realização. Considera-se, sobretudo, inadequado o uso industrial para tal zona com privilégios ambientais e urbanísticos de grande potencial. Ademais, sugere-se, no presente Parecer Técnico, alternativas mais adequadas e menos impactantes para implantação da Unidade de Dessalinização.

Esta conclusão foi estabelecida após reuniões, oficinas e visitas técnicas, realizadas pelo grupo de trabalho constituído por técnicos do IPLANFOR e consultores, com acompanhamento da CAGECE.

Figura 4 – Área propostas de implantação próximo à EPC-CAGECE.



Fonte: Arquivo fornecido pela CAGECE (2019).



**Alternativas 4 e 5 IPLANFOR I – Parque das Dunas  
IPLANFOR II - Escola Profissionalizante**

Em momento anterior, Parecer Técnico emitido no ano de 2018, o IPLANFOR sugeriu duas áreas alternativas. Contudo, ao longo do primeiro semestre do ano de 2019, estas alternativas (IPLANFOR I e II do ano de 2018) foram consideradas inviáveis para implantação da Unidade de Dessalinização, por questões técnicas apresentadas pela CAGECE.

Durante o primeiro semestre do ano de 2019, formou-se uma equipe técnica, com participação ativa do IPLANFOR, CAGECE e Consultores. Destes estudos originaram-se duas áreas IPLANFOR I e II do ano de 2019. Ambas na localidade da praia do Futuro, a primeira intitulada **Parque das Dunas** e a segunda intitulada **Escola Profissionalizante** (por estar localizada próxima a escola profissionalizante do Governo do Estado). A seguir serão apresentadas as justificativas de inadequação da Área IPLANFOR II (Escola Profissionalizante) e indicação da Área IPLANFOR I (Parque das Dunas).

A alternativa IPLANFOR II, apresentava forte potencial para uma implantação da planta de dessalinização. Alternativa de terreno pouco ocupado que, apesar de ser limítrofe com uma área de ZEIS, entendemos que a mesma se localiza em área mais afastada do mar e menos impactante para receber um equipamento do porte da unidade de dessalinização. Outro ganho significativo é o fato de que tal terreno seria servido pelo futuro transporte de massa, BRT, previsto no Plano específico da Praia do Futuro, em seu corredor de urbanização. Para o IPLANFOR, esta alternativa poderia ser inserida no Plano Específico com boa integração ao meio urbano. No entanto, após as análises dos técnicos da CAGECE, os mesmos entenderam que fatores como a declividade e a dificuldade com desapropriações e reintegrações de posse de casas consolidadas invalidam esta alternativa.

Desta forma, o IPLANFOR encontrou outras áreas possíveis, juntamente com a CAGECE, denominada, pela CAGECE como IPLANFOR A, B, C e D (Que corresponde à área IPLANFOR I – Parque das Dunas), como alternativas nesta área. Destas, a que mais se mostrou adequada à intervenção da planta de dessalinização foi o IPLANFOR I – Opção A – Parque das Dunas. Esta opção pode ser inserida no contexto do Parque previsto no plano específico, desde que o projeto da planta de dessalinização, preveja a integração efetiva com o Parque e que seja

dada uma contrapartida para viabilizar a urbanização do mesmo, se tornando assim, um equipamento de baixo impacto à realidade circundante que traz ganhos a população que ali reside (Figura 5).

Figura 5 – Área propostas de implantação próximo à Praia do Futuro.



Fonte: Arquivo fornecido pela CAGECE (2019).

Sugere-se que o projeto apresente relação de convivência com a comunidade local e visitantes, por meio de proposta que integre a Unidade de Dessalinização com as dunas fixas remanescentes no entorno do local, se transformando numa proposta de Parque de Dunas, possibilitando que tal componente natural seja preservado e valorizado.

Sugere-se ainda que a aparência industrial, ora inerente aos projetos convencionais de Unidades de Dessalinização, seja substituída por uma Planta que promova a integração e fruição urbana da Unidade, além da inserção de equipamentos que permitam o trânsito de pedestres pelo parque de dunas e demais equipamentos educacionais, de lazer e entretenimento, a exemplo da possibilidade de área externa com fontes de água e um museu da água.

**Figura 6 – Área propostas de implantação próximo à Praia do Futuro.**



Fonte: Plano Específico da Praia do Futuro – Fortaleza 2040 (2019).

## CONSIDERAÇÕES FINAIS

Esta avaliação e sugestão de área não exige todo o procedimento a ser conduzido pelo órgão municipal responsável pelo licenciamento.

O IPLANFOR, neste parecer, propõe abordar especificamente o Plano Estratégico Fortaleza 2040 que transcreve a desejo popular para as áreas da cidade, bem como, o uso dos espaços públicos, considerando o esforço da construção de uma cidade mais acessível e justa para todos.

Para a inserção de uma Planta de Dessalinização em área urbana é necessária uma atenção especial para mitigar o possível impacto negativo na ambiência urbana.

Existem algumas recomendações urbanísticas, que devem ser consideradas, desde que não haja nenhum prejuízo técnico ao funcionamento e segurança da Planta de Dessalinização, de seus operadores e dos usuários do entorno. Uma possibilidade de minimizar o impacto de uma planta de dessalinização é trabalhar com uma zona de amortecimento no entorno imediato da planta, inclusive, caso seja tecnicamente possível, garantindo usos diversos e fachada ativa,

conforme diretrizes do Plano Fortaleza 2040 e da Nova Agenda Urbana Mundial, a fim de estimular maior presença de pedestres, dinamização econômica e segurança no espaço público. Este tipo de intervenção pode representar outra fonte de recurso para o investidor.

Quadras extensas podem gerar barreiras físicas que comprometem a mobilidade urbana. O padrão máximo de testada de quadras permitido em loteamentos residenciais é de 250,00 metros. Considerando que há a intensão de um maior adensamento populacional e diversidade de usos nas áreas propostas para intervenção, seria interessante, caso viável tecnicamente, permitir a fruição pública em grandes quadras.

Portanto, sugerimos, enquanto Instituto de Planejamento de Fortaleza, a área intitulada Parque das Dunas (conforme Memorial Descritivo nº 26/2019) para implantação da Unidade de Dessalinização prevista como alternativa de abastecimento humano para o município de Fortaleza/CE.

Contudo, colocamos que alternativas de abastecimento de água são propostas no Plano de Segurança Hídrica do Fortaleza 2040 com previsão de instalação de uma Unidade de Dessalinização, assim, ratificamos a importância deste processo para a segurança hídrica do município. Entretanto, deve-se observar questões ambientais, urbanísticas e sociais da área de inserção do projeto. Ademais, estamos à disposição para demais consultas e esclarecimentos sobre o Plano Fortaleza 2040.

**Francisca Dalila Menezes Vasconcelos**  
*Analista de Planejamento e Gestão - Eng. Ambiental*

**Ana Elisa Pinheiro Campêlo de Castro**  
*Analista de Planejamento e Gestão - Arquiteta e Urbanista*

**Lia de Sousa Parente**  
*Diretora de Planejamento do IPLANFOR*

## **ATTACHMENT IV – Seuma Consent Request**





**Prefeitura de  
Fortaleza**

Secretaria Municipal de  
Urbanismo e Meio Ambiente

**PREFEITURA MUNICIPAL DE FORTALEZA – PMF**  
**SECRETARIA MUNICIPAL DE URBANISMO E MEIO AMBIENTE - SEUMA**  
**CENTRAL DE ATENDIMENTO DA SEUMA- CA**

**DATAGED - VIRTUALIZAÇÃO DE PROCESSOS DA SEUMA**  
Acesse <http://dataged.fortaleza.ce.gov.br/dataged/>

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**PROCESSO N°.: 105732019 - SEUMA**

**ABERTURA: 16/08/2019 - 10:44:37**

**ORIGEM: CENTRAL DE ATENDIMENTO E PROTOCOLO**

**TIPO/ASSUNTO: OFÍCIO**

**OBS: OFÍCIO N° 8/2019**

**REQUERENTE: COMPANHIA DE ÁGUA E ESGOTO DO CEARÁ**  
**CAGECE**

**DESTINO: COURB-COORDENADOR**

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Ofício nº 8/19/Gemam/DEN  
Fortaleza, 16 de Agosto de 2019

A  
Marina Cavalcante Hissa  
Coordenadoria de Desenvolvimento Urbano - COURB

Prezada Senhora,

Dentre as soluções que possam contribuir com acréscimo de água ao sistema atual de abastecimento da Região Metropolitana de Fortaleza (RMF), a dessalinização de água do mar é a única a permitir o acesso a uma fonte praticamente inesgotável de água e imune às oscilações do regime pluviométrico, sendo seu uso para abastecimento público uma realidade há bastante tempo em vários países. Pensando nisto e na redução dos danos sociais e econômicos à população, causados por anomalias no regime pluvial que venhamos a enfrentar, a CAGECE publicou um edital de manifestação de interesse para seleção de empresa para desenvolver estudos de viabilidade, levantamentos, investigações e/ou pareceres referentes à concepção, ao financiamento, à implantação/construção e à operação de Planta de dessalinização de água marinha com capacidade de 1 m<sup>3</sup>/s.

Fruto deste edital, os estudos desenvolvidos foram utilizados para tomada de decisão e elaboração de minutas de editais e contratos, os quais foram submetidos à consulta pública em fevereiro deste ano. Os resultados desta consulta, somados a recomendações do Governo do Estado do Ceará e da Prefeitura Municipal de Fortaleza, levaram à revisão dos documentos e da área inicialmente selecionada.

Após reavaliação de áreas e critérios originalmente apresentados, inclusive com participação do Instituto de Planejamento de Fortaleza (IPLANFOR), chegou-se a conclusão que a área apresentada no Memorial Descritivo anexo, denominada IPLANFOR I-A e ilustrada na imagem anexa, desponta-se como a mais viável quando se analisa em conjunto os custos de implantação e operação com critérios qualitativos.

Solicitamos avaliação e anuência prévia desta área quanto ao disciplinado pelo Plano Diretor e Uso de Solo Municipal, para fins de solicitação de Licença Prévia à SEMACE.

Atenciosamente,



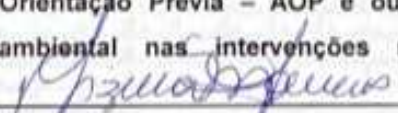
**DELANO SAMPAIO CIDRACK**  
Gerente de Meio Ambiente - Gemam



**Prefeitura de  
Fortaleza**

## **CERTIDÃO**

### **Anuência Para fins de Licenciamento Ambiental**

CERTIFICAMOS, para fins de Licenciamento Ambiental, através do **Processo nº 10573/2019 – SEUMA**, de interesse da **COMPANHIA DE ÁGUA E ESGOTO DO CEARÁ - CAGECE, CNPJ 07.040.108/0001-57**, referente à **Projeto de Implantação da Usina de Dessalinização de Água do Mar**, a ser implantado no **Parque das Dunas**, entre a **Rua Raimundo Esteves, Av. Pintor Antonio Bandeira, Rua Oliveira Filho e Rua Comendador Francisco Di Ângelo**, no **Bairro Praia do Futuro I**, no **município de Fortaleza**, considerando a análise feita pelo corpo técnico da Célula de Normatização – CENOR/COURB, Célula de Diretrizes Ambientais – CEDAM/CPA e Célula de Licenciamento Ambiental – CELAM/COL, atende aos parâmetros da Lei Complementar Municipal nº 236/2017 (Lei do Parcelamento e Uso e Ocupação do Solo no município de Fortaleza), estando localizado em Zona de Interesse Ambiental 2 – ZIA 2, definida no Plano Diretor Participativo do Município de Fortaleza, Lei Complementar Municipal nº 062/2009. **A presente declaração, não exige o responsável de solicitar Análise de Orientação Prévia – AOP e outras licenças e autorizações previstas na legislação ambiental nas intervenções no Município de Fortaleza.** E para constar, EU:  Gizella Melo Gomes – Coordenadora da COL (Coordenadoria de Licenciamento) conferi a presente declaração aos 29 dias do mês de agosto de 2019.

VISTO: \_\_\_\_\_  
Secretária da SEUMA.

Maria Águeda Pontes Caminha Muniz –

  
Maria Águeda Pontes Caminha Muniz  
Secretária da SEUMA

Fortaleza, 29 de agosto de 2019.

## **ATTACHMENT V – SEMACE Analysis Request - Preliminary License Process**



Nº DO PROCESSO: 8258663/2018

DATA: 05/10/2018

HORA: 10:09:21

## ORIGEM

SUPERINTENDÊNCIA ESTADUAL DO MEIO AMBIENTE

## ASSUNTO

**LICENCA / PREVIA**

OBSERVAÇÕES

Solicita Licença Prévia para a(s) atividade(s) : 29.04 - Sistema de Abastecimento de Água com Tratamento Completo;

**AUTOR(ES)**

CAGECE - COMPANHIA DE AGUA E ESGOTO DO CEARA

FAVORECIDO(S)

#### TRAMITAÇÕES DO PROCESSO

[illegible]





Governo do Estado do Ceará  
Secretaria do Meio Ambiente - SEMA  
**Superintendência Estadual do Meio Ambiente - SEMACE**

**Comprovante do DOC Anexo Nº 2996/2019**

O(s) documento(s) listado(s) abaixo foi(ram) entregue(s) de forma virtual em 16/08/2019 às 17:03:46 e será(ão) anexado(s) ao processo de SPU 8258663/2018.

Documento(s) apresentado(s):

- Ofício n 9-19-Gemam-SSU.pdf

Ofício nº 9/19/Gemam/SSU  
FORTALEZA, 16 de Agosto de 2019

Ilmo. Sr.  
Carlos Alberto Mendes Junior  
Superintendente  
Superintendência Estadual do Meio Ambiente - SEMACE

Assunto: NOVA LOCALIZAÇÃO DA PLANTA DE DESSALINIZAÇÃO DE ÁGUA DO MAR.

Prezado Senhor,


Dentre as soluções que possam contribuir com acréscimo de água ao sistema atual de abastecimento da Região Metropolitana de Fortaleza (RMF), a dessalinização de água do mar é a única a permitir o acesso a uma fonte praticamente inesgotável de água e imune às oscilações do regime pluviométrico, sendo seu uso para abastecimento público uma realidade há bastante tempo em vários países. Pensando nisto e na redução dos danos sociais e econômicos à população, causados por anomalias no regime pluvial que venhamos a enfrentar, a CAGECE publicou um edital de manifestação de interesse para seleção de empresa para desenvolver estudos de viabilidade, levantamentos, investigações e/ou pareceres referentes à concepção, ao financiamento, à implantação/construção e à operação de Planta de dessalinização de água marinha com capacidade de 1 m<sup>3</sup>/s.

Fruto deste edital, os estudos desenvolvidos foram utilizados para tomada de decisão e elaboração de minutas de editais e contratos, os quais foram submetidos à consulta pública em fevereiro deste ano. Os resultados desta consulta, somados a recomendações do Governo do Estado do Ceará e da Prefeitura Municipal de Fortaleza, levaram à revisão dos documentos e da área inicialmente selecionada.

Após reavaliação de áreas e critérios originalmente apresentados, inclusive com participação do Instituto de Planejamento de Fortaleza (IPLANFOR), chegou-se à conclusão que a área apresentada no Memorial Descritivo anexo, denominada IPLANFOR I-A e ilustrada na justificativa anexa, desponta-se como a mais viável quando se analisa em conjunto os custos de implantação e operação com critérios qualitativos.

Diante do exposto, solicitamos desta Superintendência a avaliação das justificativas elencadas neste ofício no tocante a área do empreendimento e a readequação do Termo de Referência Nº 249/2018-DICOP/GECON.

Atenciosamente,



Dulce Santana Cidruck  
Chefe de Mesa Ambiente  
SEMACE - CAGECE



**Governo do Estado do Ceará**  
**Secretaria do Meio Ambiente - SEMA**  
**Superintendência Estadual do Meio Ambiente - SEMACE**

**Comprovante do DOC Anexo Nº 2997/2019**

O(s) documento(s) listado(s) abaixo foi(ram) entregue(s) de forma virtual em 16/08/2019 às 17:05:10 e será(ão) anexado(s) ao processo de SPU 8258663/2018.

Documento(s) apresentado(s):

- Planta Dessal.pdf



**Governo do Estado do Ceará**  
**Secretaria do Meio Ambiente - SEMA**  
**Superintendência Estadual do Meio Ambiente - SEMACE**

**Comprovante do DOC Anexo Nº 3020/2019**

O(s) documento(s) listado(s) abaixo foi(ram) entregue(s) de forma virtual em 19/08/2019 às 15:37:46 e será(ão) anexado(s) ao processo de SPU 8258663/2018.

Documento(s) apresentado(s):

- Justificativa Técnica - Alteracao Locacional - LP Planta Dessal (SPU 8258663-2018).pdf

## ATTACHMENT VI – Reference Term – SEMACE





**TERMO DE REFERÊNCIA Nº 95/2019 – DICOP/GECON  
PROCESSO Nº 8258663/2018**



Governo do Estado do Ceará  
Secretaria do Meio Ambiente – SEMA  
Superintendência Estadual do Meio Ambiente – SEMACE

**Assunto:** Estudo de Impacto Ambiental – EIA/Relatório de Impacto Ambiental - RIMA

**Interessado:** Companhia de Água e Esgoto do Ceará - CAGECE

**CNPJ:** 07.040.108/0001-57

**Endereço:** Praia do Futuro – Fortaleza/CE

## **1) OBJETIVO**

Este Termo de Referência tem como objetivo estabelecer diretrizes e normas a serem adotadas na elaboração do Estudo de Impacto Ambiental - EIA e do respectivo Relatório de Impacto Ambiental - RIMA do **Sistema de Abastecimento de Água Dessalinizada do Macrossistema Integrado de Distribuição de Água de Fortaleza/CE.**

Este instrumento estabelece os requisitos mínimos para o levantamento e análise dos componentes ambientais existentes na área do empreendimento e sua área de influência, tornando-se assim, um instrumento orientativo, que a equipe executora deverá utilizar como base para a realização dos estudos sem, contudo, excluir a sua capacidade de inovação e otimização, devendo atender, ainda as normas e procedimentos estabelecidos nas Resoluções Nº 01/86 e nº 237/97 do Conselho Nacional do Meio Ambiente – CONAMA.

Esse Termo de Referência terá validade de 01 (um) ano, a contar da data de seu recebimento por parte do empreendedor, podendo ser renovado a critério da SEMACE.

## **2) CONDIÇÕES DE APRESENTAÇÃO**

O EIA deverá ser encaminhado por meio eletrônico, através da rede mundial de computadores, em sistema próprio da SEMACE, pela parte interessada ou seu representante legal, acompanhado do comprovante de recolhimento do custo relacionado à solicitação de Licença, além de cópia do Termo de Referência e do Cadastro Técnico Estadual dos profissionais responsáveis pela elaboração do Estudo, todos em meio digital, sem prejuízo de outras exigências a critério do órgão, desde que justificadas.

O Relatório de Impacto Ambiental - RIMA será acessível ao público, permanecendo uma cópia para consulta à disposição dos interessados na Biblioteca da SEMACE.



**TERMO DE REFERÊNCIA Nº 95/2019 – DICOP/GECON  
PROCESSO Nº 8258663/2018**



Governo do Estado do Ceará  
Secretaria do Meio Ambiente – SEMA  
Superintendência Estadual do Meio Ambiente – SEMACE

Deverá ser observado, também, os critérios da Portaria Nº 47 de 29 de fevereiro de 2012 emitida pela SEMACE.

### **3) CONTEÚDO DO ESTUDO**

Os estudos ambientais deverão ser elaborados de forma a atender as Resoluções Nº 01/86 e Nº 237/97, do Conselho Nacional do Meio Ambiente - CONAMA, bem como as demais especificações e diretrizes estabelecidas neste documento, tendo como base os aspectos ambientais das áreas de influência direta e indireta do empreendimento e as inter-relações existentes.

O Estudo de Impacto Ambiental - EIA deverá atender aos dispositivos legais em vigor, referentes ao uso e a proteção dos recursos ambientais e deverá ser elaborado tendo como base de referência os tópicos a seguir descritos:

#### **3.1. IDENTIFICAÇÃO DO EMPREENDIMENTO E DO EMPREENDEDOR**

a) Denominação oficial do empreendimento

b) Identificação do empreendedor

- Nome ou razão social;

Número dos registros legais;

CNPJ;

Endereço completo, telefones, fax, e-mail;

Representantes legais (nome, CPF, endereço, telefones, fax e e-mail);

Pessoa de contato (nome, CPF, endereço, telefones, fax e e-mail);

c) Identificação da empresa consultora responsável pelo Estudo Ambiental

Nome ou razão social;

Número dos registros legais;

CNPJ;

Endereço completo, telefones, fax, e-mail;

representante legal (nome, CPF, endereço, telefones, fax e e-mail);

equipe técnica (nome, CPF, formação profissional, registros nos respectivos Conselhos de Classe).





**OBSERVAÇÃO:** A consultoria ambiental deverá ser cadastrada na SEMACE e apresentar a Anotação de Responsabilidade Técnica - ART do representante legal da referida consultoria.

A SEMACE, a seu critério, poderá convocar o empreendedor ou a consultoria, caso haja necessidade de detalhamento e/ou retificação do Estudo.

### 3.2 DOCUMENTAÇÃO COMPLEMENTAR E ESTUDO BÁSICOS

- Anuência da Prefeitura Municipal de Fortaleza, no que diz respeito ao Plano Diretor Participativo de Desenvolvimento Urbano;
- Anuência da 4ª Superintendência (Ceará) do Instituto do Patrimônio Histórico e Artístico Nacional - IPHAN, em relação ao Patrimônio Cultural Imaterial e Material (Natural e Construído) existente a área do empreendimento em pauta;
- Manifestação da Secretaria do Patrimônio da União – SPU, caso seja área de domínio da união administrada por esta Secretaria;
- Manifestação do IBAMA quanto à competência para licenciar, considerando áreas apresentadas na fase de consulta prévia.
- Mapa da área do Projeto e interface com as áreas de entorno;
- Mapa da área do Projeto e suas áreas críticas e de risco (drenagem superficial, uso do solo e de cheias e inundações);
- Mapa de vulnerabilidade ambiental, em escala de no mínimo 1:2000, definindo potencialidades e limitações, quanto ao uso e ocupação de áreas a serem utilizadas pelo empreendimento, em função das condições naturais do terreno, face às características do uso e ocupação proposto;
- Planta planialtimétrica (na área emersa) e topobatimétrica (na área submersa) com os pontos dos emissários de captação da água salina e das descargas dos efluentes (salmoura), contendo o traçado de interligação com o sistema de interligação da CAGECE, evidenciando a localização de bombas e adutoras. Devendo ser apresentado como impacto na ADA - Área Diretamente Afetada do empreendimento.
- Malha amostral e procedimentos de coleta na área de estudo composta por pelo menos 10 estações de coleta, distribuídas de forma a representar as condições marinhas atuais da área



**TERMO DE REFERÊNCIA Nº 95/2019 – DICOP/GECON  
PROCESSO Nº 8258663/2018**



Governo do Estado do Ceará  
Secretaria do Meio Ambiente – SEMA  
Superintendência Estadual do Meio Ambiente – SEMACE

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prevista para implantação do emissário submarino, considerando ainda as características dos efluentes que serão lançados e as especificidades da tubulação difusora.

- Levantamento das características das embarcações e atividades pesqueiras da região costeira e marinha na área de implantação da usina de dessalinização;
- Processo de tratamento dos rejeitos provenientes do processo da planta de dessalinização e destinação final;
- Estudo de dependência à alta intensidade energética dessas usinas e soluções propostas;
- Estudos Hidráulicos e Hidrológicos - Detalhes dos projetos, com representação dos recursos hídricos;
- Identificar Unidades de Conservação, Áreas de Preservação Permanente e áreas relevantes para a preservação de biodiversidade nas áreas de influência direta e indireta do empreendimento;
- Viabilidade socioeconômica do empreendimento / relação custo x benefício;

**OBSERVAÇÃO:** Apresentar mapa das soluções finais dos estudos requeridos (exceto estudos hidráulicos e hidrológicos) em coordenadas UTM *datum* SIRGAS 2000, incluindo os acessos em nível local, com a descrição das principais vias incidentes, identificação de áreas fonte de sedimentos (se for necessário aterrar alguns trecho da planta) e áreas de descarte de rejeito/bota fora.

O estudo deverá contemplar todas as alternativas tecnológicas e de localização de projeto, incluindo a viabilidade de ocupação dessas áreas. As alternativas devem ser confrontadas com a hipótese de não execução, de acordo com a Resolução CONAMA Nº 01/86. Deverá ser analisado o custo-benefício, considerando aspectos técnicos, econômicos, sociais e ambientais, com enfoque nas restrições de uso de áreas, quanto a existência de núcleos urbanos, cursos d'água, sítios arqueológicos, patrimônios históricos, áreas de preservação permanente e de relevante interesse ambiental.

Para a alternativa locacional selecionada serão considerados apenas coleta de dados primários, referentes aos fatores como temperatura, luminosidade e salinidade, associados com níveis de nutrientes dissolvidos no mar (matéria orgânica); Poluição e processo de eutrofização das águas marinhas; Proliferação das algas diatomáceas; Estudo da hidrodinâmica da zona de arrebentação,





associado ao estudo das fontes difusas de lançamento de efluentes (sazonalidade e volume) ricos em nutrientes e causadores dos “*blooms*” de microalga; Estudo da dinâmica costeira da área de influência do empreendimento, detalhando o balanço sedimentológico da praia e da plataforma interna rasa (até isóbata de 15m), além dos perfis topográficos das praias associado ao estudo do comportamento do clima de ondas, marés e correntes e sua influência na hidrodinâmica, incluindo batimetria até a isóbata sob influência dos pontos de captação de água e descarte (no mínimo até isóbata de 15m).

### 3.3. CARACTERIZAÇÃO DO EMPREENDIMENTO

- a) Objetivo geral: justificativa em termos de importância no contexto econômico e social na área de influência do projeto;
- b) Localização georreferenciada da área selecionada para o projeto, representada em planta planialtimétrica em escala compatível. Apresentar as coordenadas geométricas para fins de georreferenciamento, no Sistema de Projeção UTM e com projeção em *Sirgas* 2000. Na incorporação dos dados geográficos (plantas e imagens georreferenciadas), apresentar os seguintes formatos e extensões: Arquivo Vetorial - SHP e Arquivo de Imagem - TIFF ou JPG, e em KLM ou KMZ;
- c) Descrição do empreendimento compreendendo a indicação dos elementos básicos que nortearão o mesmo nas fases de projeto executivo, instalação e operação, bem como as diretrizes previstas para sua manutenção adequada. Deverão constar dessa caracterização as seguintes informações mínimas:

Elementos constituintes e principais características técnicas;

*Layout* com memorial descritivo do empreendimento, considerando todo o sistema – desde a captação, tratamento, distribuição da água – contemplando a infraestrutura, a superestrutura, o modelo construtivo e os materiais utilizados na construção de todos os equipamentos internos e externos, contendo a distribuição dos setores da planta de dessalinização e o quantitativo da população atendida;

Sistema de segurança do empreendimento, contemplando rotas de fuga para eventuais situações emergenciais coletivas;





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Proposta de funcionamento e manutenção da Planta de Dessalinização no que corresponde ao seu uso, enumerando: quantidade, dimensionamento (com a respectiva capacidade volumétrica), limpeza, com as respectivas fontes de captação e o destino e volume das águas servidas;

Interferência com a infraestrutura existente e com sistemas, tais como redes de abastecimento de água e de esgoto, linhas de energia, telecomunicações, pavimentação etc;

Projeto de remoção das interferências, caso se atinja a infraestrutura existente; Destino final do material a ser retirado, referente ao bota-fora, referente às obras de demolição ou reforma da estrutura edificada existente;

Apresentar o Projeto Elétrico e Projeto Hidrossanitário, junto aos respectivos memoriais descritivos; Caso seja necessário a instalação de subestação para abastecimento energético, apresentar a planta da subestação, ou, o Atestado de Viabilidade Técnica – AVT da ENEL;

Equipamentos utilizados nas obras, com respectivos níveis de ruídos, vibrações, emissão de gases e qualquer outra emissão poluente;

Origem e quantificação da mão de obra empregada;

Empreendimentos associados e/ou decorrentes e a indução de novas ocupações;

Cronograma físico das obras, indicando as áreas atendidas com as respectivas populações beneficiadas, associado ao cronograma de execução das medidas mitigadoras de impacto ambiental e das medidas de controle ambiental;

Localização e *layout* dos canteiros de obras.

Detalhar todos os pontos de localização de cabos submarinos instalados na área de influência do empreendimento;

Detalhar todos os pontos de emissões sonoras, bem como os equipamentos/sistemas que serão utilizados e suas respectivas eficiências esperadas e os monitoramentos que serão realizados;

Detalhar todos os pontos de geração de resíduos, bem como os sistemas de armazenamento e tratamento que serão utilizados e destinação final de cada resíduo, principalmente para os resíduos Classe I - Perigosos;

- Detalhar, qualitativa e quantitativamente, os efluentes líquidos gerados, bem como o tipo de tratamento e a destinação final;



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*Layout* (arranjo geral com indicação das áreas destinadas a implantação dos setores administrativos, de utilidades, de produção, entre outros);

**OBSERVAÇÃO:** Aspectos que, por sua natureza, só possam ser detalhados em fases posteriores do licenciamento ambiental devem ser justificados tecnicamente para uma avaliação da SEMACE.

### 3.4 CARACTERIZAÇÃO DA ÁREA DO EMPREENDIMENTO

Estudo detalhado da dinâmica costeira comparando os dados históricos com as condições atuais, caracterizando as causas e efeitos de processos marinhos erosivos na área, sob a perspectiva de influência física, social, econômica e cultural sobre o empreendimento;  
Delimitação da área do projeto em termos de ecossistema costeiro, permitindo a identificação territorial das áreas de influência.

### 3.5 GERENCIAMENTO AMBIENTAL

Práticas de gerenciamento ambiental a serem adotadas em cada fase do empreendimento: planejamento, instalação e operação;  
Detalhar todos os pontos de geração de resíduos juntamente com uma estimativa da sua geração, bem como os sistemas de armazenamento, tratamento que serão utilizados e a destinação ambientalmente adequada de cada resíduo;  
Detalhar a estimativa qualitativamente dos efluentes líquidos gerados, bem como o tipo de tratamento e o destino final;  
Descrever as rotinas operacionais, de prevenção, manutenção e segurança;  
Apresentar a gestão sustentável para a salmoura (inovações em uso, reúso, dissolução, novas utilizações para o resíduo, etc), além de projetos socioambientais, como foco no desenvolvimento de empreendimentos solidários junto as comunidades envolvidas.

## 4) COMPENSAÇÃO AMBIENTAL





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Apresentar, para fins de cálculo do valor da compensação ambiental, planilha de desembolso físico e financeiro total dos investimentos no empreendimento, relativos aos métodos, tecnologias e ações empregados, justificando, inclusive, os impactos adversos que não podem ser mitigados e sugerir medidas compensatórias que possam ser adotadas na compensação ambiental, atendendo à legislação correlata, notadamente às Resoluções Federais e Estaduais - CONAMA Nº 371/2006 e COEMA Nº 26/2015 e 06/2017.

#### **5) ÁREA DE INFLUÊNCIA DO EMPREENDIMENTO**

Apresentar os limites da área geográfica a ser direta ou indiretamente afetada pelos impactos, denominada área de influência do empreendimento. As áreas de influência deverão conter as áreas de incidência dos impactos, bem como sua caracterização nos âmbitos locais e regionais.

#### **6) PLANOS E PROJETOS CO-LOCALIZADOS**

Relacionar todos os planos e projetos co-localizados e a compatibilização com as políticas setoriais, planos e programas de ação federal, estadual e municipal, propostos ou em execução na área de influência do empreendimento.

Descrever e espacializar os planos e programas governamentais das esferas referidas, bem como projetos públicos e privados propostos e em implantação na área de influência do empreendimento, e sua compatibilidade, como:

- Políticas Públicas Ambientais;
- Planos e Programas de Ordenamento Territorial e Ambiental – Planejamento Macrorregional, Uso e Ocupação do Solo do município, Unidades de Conservação; Área de Proteção de Mananciais, Planos Diretores etc.;
- Compatibilidade com Projetos Regionais e Municipais;
- Plano de Bacia Hidrográfica; e
- Interferências com outros empreendimentos a serem implantados na região.



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Dessa forma, deve-se analisar os eventuais conflitos entre o empreendimento e tais planos, programas e projetos, assim como as alternativas para solucioná-los, se possível.

## **7) DIAGNÓSTICO AMBIENTAL DAS ÁREAS DE INFLUÊNCIA**

Deverão ser considerados os fatores tais como as características geográficas e ambiental do local previsto para o empreendimento; além da natureza, porte e potencial de modificação ambiental do empreendimento proposto e a legislação de uso e ocupação do solo e ambiental pertinentes.

Quanto às áreas de influência, incluindo a Área de Influência Indireta (AII), Área de Influência Direta (AID) e Área Diretamente Afetada (ADA), estas deverão ser definidas, delimitadas e justificadas em relação aos meios socioeconômico, físico e biótico. Estes dois últimos deverão estar contempladas as áreas de influência terrestre e aquática.

### **7.1 Meio Físico**

Caracterizar as condições físico-ambientais da área a ser afetada pelo empreendimento com as seguintes abordagens:

a) Aspectos meteorológicos hidroclimáticos;

- Influência dos ventos predominantes (sistematização temporal e frequência dos dados de velocidade e direção dos ventos);

Influência dos fenômenos naturais, incluindo o El Niño, La Niña, Zona de Convergência Intertropical, que possam ter interferência na área do empreendimento;

Regime de chuvas (dados pluviométricos);

Insolação e evaporação;

Dados da temperatura local (médias, máximas e mínimas anuais).

b) Caracterização da qualidade de ar na região, apresentando as concentrações de poluentes atmosféricos, antes da implantação do empreendimento (*base line*), e descrição dos métodos adotados para sua determinação;

c) Caracterização dos níveis de ruído do ambiente (ruído ambiente), em dB(A), na área de influência do empreendimento e descrição dos métodos para sua determinação;





d) Aspectos Geológicos, Geomorfológicos e Pedológicos

- Geologia local;
- Caracterização da dinâmica costeira e balanço sedimentar da faixa praial. (transporte eólico);
- Geomorfologia costeira e litorânea do entorno do empreendimento;
- Evolução geológica do ambiente marinho estendendo-se até pelo menos a isóbata de 15m.;
- Sismicidade;
- Caracterização dos solos da área potencialmente atingida pelo empreendimento.

e) Recursos Hídricos

- Recursos hídricos superficiais e subterrâneos (avaliação qualitativa, quantitativa e grau de susceptibilidade dos mesmos face ao empreendimento);
- Descargas fluviais;
- Caracterização dos aquíferos subterrâneos e as Interferências de águas subterrâneas, se identificadas na área;
- Apresentação de mapas temáticos em escala compatível (geológico, geomorfológico, pedológico, entre outros);

f) Modelagem de dispersão da pluma de salmoura após o seu lançamento em alto mar, no qual seja possível averiguar ou estimar a que distância do ponto de lançamento no corpo receptor se observa a total diluição dos níveis de salinidade;

g) Estudo da sedimentologia;

h) Demonstrar o tipo de diluição e a porcentagem do efluente em projeto, através de modelação, tendo em vista a possibilidade de aumento de sedimentação e demais sais;

i) Medição dos parâmetros físicos e químicos da água (temperatura, salinidade, potencial hidrogeniônico (pH), oxigênio dissolvido, condutividade elétrica), sólidos em suspensão, as correntes, simulação do comportamento do efluente lançado pelo emissário submarino e a apresentação de plumas de efluentes líquidos, contendo substâncias tóxicas ou poluentes





convencionais, análise granulométrica e composicional, quanto ao teor de carbonato de cálcio, análises quanto ao n alcanos, n-alcanos totais, mistura complexa não resolvida e compostos inorgânicos – Alumínio dissolvido, Arsênio total, Bário total, Boro total, Cádmio total, Chumbo total, Cianeto livre, Cloro residual total, Cobre dissolvido, Cromo total, Ferro dissolvido, Fluoreto total, Fósforo total, Manganês total, Mercúrio total, Vanádio, Níquel total, Nitrato, Nitrito, Nitrogênio amoniacal total, Polifosfatos, Prato, Selênio, Sulfetos, Tálcio total, Urânio, Zinco; Fitoplâncton, Incluindo ainda, outros parâmetros que estejam relacionados com os rejeitos do processo.

## **7.2 Meio Biótico**

Apresentar levantamento faunístico e florístico em detalhe na área de interferência do projeto e seu entorno mais próximo, contextualizada com a caracterização do substrato e da água oceânica, bem como as relações biológicas e ecológicas desenvolvidas no local.

### **7.2.1 Ambiente Terrestre**

#### **7.2.1.1 Flora**

##### **Na Área de Influência Indireta (AII)**

Apresentar a descrição da cobertura vegetal original e atual da região, considerando o histórico de ocupação da área e de interferências antrópicas ou de conservação/preservação, a fim de definir o grau de alteração existente sobre os ecossistemas locais. Para isso deve-se Identificar e caracterizar as tipologias florestais presentes na área de estudo, através de levantamento de campo e complementadas com pesquisa bibliográfica especializada.



### **Na Área de Influência Direta (AID) e Área Diretamente Afetada (ADA)**

Identificar e caracterizar as tipologias florestais, caso sejam presentes na área de estudo, através de levantamento de campo e complementadas com pesquisa bibliográfica especializada.

Apresentar lista das espécies amostradas, deve conter as seguintes informações:

Família, nome científico, nome popular, origem(nativa, exóticas ou invasoras), classes de frequência ou ocorrência (abundante, comum, ocasional ou rara); ameaça de extinção, classificada conforme listas de espécies da flora ameaçada de extinção constante na legislação; endemismo; estágio sucessional (pioneira e não pioneira); Espécies de importância econômica, medicinal, científica, alimentícia e/ou ornamental; Espécies que possam ter algum grau de proteção como as imunes ao corte ou consideradas patrimônio ambiental; Espécies bioindicadoras (com justificativa); Fragmentos e pontos amostrais georreferenciados onde a espécie (endêmica, ameaçada de extinção, de importância econômica, medicinal, científica, alimentícia e/ou ornamental, protegidas, bioindicadoras) foi encontrada.

Com base no levantamento de campo, na análise de fotografias aéreas ou imagens de satélite, discorrer sobre o grau de conservação das tipologias florestais da área de estudo e a importância dos tipos de vegetação para a conservação contendo como base o tamanho, forma, a conectividade e o estado de conservação dos fragmentos florestais nativos remanescentes.

#### **7.2.1.2 Fauna**

A caracterização da fauna da área de estudo deverá ser efetuada através de pesquisa de campo associada a levantamentos bibliográficos.

Quanto ao levantamento de dados primários, este deverá contemplar minimamente os grupos mastofauna, avifauna e herpetofauna. As áreas amostrais e os pontos de amostragem deverão ser descritos e indicados em planta, com a localização do ponto de ocorrência dos indivíduos da fauna observados durante o levantamento. Os resultados deverão ser apresentados em forma de





lista e discutidos à luz das características ambientais da área de amostragem e no momento do estudo (solo, relevo, vegetação, clima, precipitação).

#### 7.2.1.2.1 Quesitos Mínimos

O levantamento a ser apresentado deverá conter no mínimo, as seguintes informações/considerações:

- Descrição da metodologia utilizada em campo (transectos, observação direta ou indireta, cama de pegadas, armadilhas fotográficas entre outras), com justificativa do método adotado, para cada grupo;

Período de realização (data);

Esforço amostral empregado no levantamento de cada grupo faunístico, por metodologia e período sazonal, que deve ser compatível com a interferência em áreas vegetadas e em áreas protegidas; Esforço de campo (horário) de todas as metodologias, respeitando os períodos de maior atividade de cada táxon estudado (matutino, vespertino, noturno e crepuscular);

Condições meteorológicas nos períodos de levantamento;

Equipamentos utilizados e especificações;

Justificativa da escolha dos pontos de amostragem, considerando as características do empreendimento, a paisagem, a história natural das espécies e o potencial de cada tipo de ambiente;

Descrição das características dos pontos amostrais, considerando a área, fitofisionomia, matriz e presença de curso d'água;

Registros fotográficos de animais e vestígios visualizados durante o levantamento, com coordenadas geográficas;

Apresentar, em foto aérea ou imagem de satélite, em escala 1:10.000 ou outra escala com maior nível de detalhes, com resolução mínima de 1m, georreferenciada, os fragmentos florestais e trajetos avaliados, além dos locais de amostragem da fauna (transectos lineares, pontos de armadilhagem e caminhamentos) e, quando existentes, registros fotográficos dos



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indivíduos amostrados (fotos datadas) e vestígios, em especial, das espécies ameaçadas de extinção;

Caso seja necessária a coleta de indivíduos para confirmação taxonômica, deverá ser apresentada proposta prevendo a coleta do menor número de indivíduos possível;

Destaca-se que as atividades de coleta, apreensão, captura, manipulação, marcação, manejo, retirada, extração, translocação e manutenção em cativeiro, deverão ser previamente autorizadas pela SEMACE, após orientações sobre o Programa de Manejo da Fauna Silvestre;

Apresentar lista das espécies levantadas contendo: Nome científico e popular; Ordem; Família; Habitat; Origem (nativa, exótica ou hábitos migratórios); Indicação do tipo de registro (observação, vestígio, relato, contato auditivo etc.); Período de registro (matutino, vespertino, noturno e crepuscular); Indicação dos pontos de amostragem onde foram registradas as espécies; Endemismo;

Identificação das espécies ameaçadas de extinção, segundo listas oficiais, ou legalmente protegidas; das consideradas raras; e das não descritas previamente para a área estudada ou pela ciência;

Nos levantamentos em que forem utilizadas as entrevistas, deve-se considerar pelo menos as seguintes instruções: deverá ser feita por meio de questionários e com a utilização de guias de campo que permitam ao entrevistado confirmar visualmente a espécie descrita por ele; Destacar, entre as espécies listadas nos levantamentos bibliográficos, de campo e nas entrevistas, as que são classificadas como endêmicas e ameaçadas de extinção, analisando seus hábitos migratórios, de vida, de alimentação e de acasalamento/reprodução; Descrever as áreas adjacentes ao fragmento estudado, a fim de caracterizar o uso e ocupação de seu entorno.

## **7.2.2 Ambiente Marinho**

### **7.2.2.1 Caracterização de organismos *plactônicos*, *bentônicos* e *nectônicos***





- Realizar o levantamento das condições ambientais vigentes na área de influência do empreendimento, caracterizando o substrato, a biota, a intensidade e direção das correntes e a qualidade da água oceânica. Apresentar análise dos parâmetros físico-químicos de qualidade da água (utilizar os padrões previstos na CONAMA Nº 357/2005 – Águas Salinas) e sedimentos, correlacionando-se com os nichos ecológicos da biota aquática;
- Realizar inventário das espécies que constituem a comunidade marinha adjacente;
- Apresentar em mapa com escala adequada para análise, as áreas de desova de tartarugas marinhas;
- Apresentar em mapa com escala adequada para análise as rotas de movimentação de tartarugas e botos-cinza;
- Caracterizar os padrões de distribuição das espécies presentes na área de estudo, baseando-se em metodologia validada na literatura científica;
- Apresentar a interpretação dos padrões de distribuição dos organismos bentônicos na área de influência da adutora de disposição do concentrado (salmoura), considerando os seguintes fatores: topografia, marés, natureza do substrato, salinidade, temperatura, oxigênio dissolvido, umidade, luminosidade e fatores biológicos como predação e competição;
- Descrição da metodologia utilizada em campo, com justificativa do método adotado, para cada grupo. Especialmente para os organismos bentônicos, a metodologia adotada deverá contemplar três estações de coleta e uma coleta suplementar a barla mar do ponto de lançamento, incluindo pontos de coleta de água (superfície, meio e fundo);
- Informar a(s) data(s) de início e término da coleta de dados, além do georreferenciamento dos pontos de amostragem, velocidade de percurso, caracterização das embarcações e aparelhos de pesca utilizados (número de armadilhas, tamanho e material utilizado nas redes, quantidade e tamanho dos anzóis, entre outros), indicação quanto a estação sazonal em que foram realizadas as coletas, observações meteorológicas e oceanográficas no momento dos levantamentos, entre outros;
- Esforço amostral empregado no levantamento de cada grupo (indicando a metodologia aplicada, dias e horários de amostragem e o período sazonal);





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Curva de acúmulo de espécies (curva do coletor) de forma a determinar que o esforço amostral empregado foi adequado, acompanhado de avaliação dos resultados obtidos;

Condições meteorológicas nos períodos de levantamento;

Equipamentos utilizados durante as amostragens (paquímetro, trena, balança, aparelhos para medição de parâmetros, dentre outros) e especificações;

Justificativa da escolha dos pontos de amostragem, considerando as características do empreendimento, a paisagem, a história natural das espécies e o potencial de cada tipo de ambiente;

Registros fotográficos da biota registrada durante o levantamento;

Caso seja necessária a coleta de indivíduos para confirmação taxonômica, deverá ser apresentada proposta prevendo a coleta do menor número de indivíduos possível;

Destaca-se que as atividades de coleta, apreensão, captura, manipulação, marcação, manejo, retirada, extração, translocação e manutenção em cativeiro, deverão ser previamente autorizadas pelos órgãos responsáveis nas esferas ESTADUAL e FEDERAL, após orientações sobre o Programa de Manejo da Fauna Silvestre;

Os indivíduos amostrados deverão ser classificados ao menor nível específico possível (preferencialmente ao táxon espécie). Caso não seja possível realizar alguma identificação, deverá ser apresentada devida justificativa para a imprecisão e suas implicações;

Apresentar avaliação e discussão dos resultados obtidos, comparando-os com dados existentes na literatura quando possível;

Apresentar lista das espécies levantadas contendo: Nome científico e popular; Ordem; Família; Gênero, Comportamento (planctônicos, nectônicos ou bentônicos); Habitat; Origem (nativa, exótica ou hábitos migratórios); Indicação do tipo de registro (observação, vestígio, relato, contato auditivo etc.); Período de registro (matutino, vespertino, noturno e crepuscular); Indicação dos pontos de amostragem onde foram registradas as espécies;

Identificação e caracterização das espécies endêmicas, ameaçadas de extinção e quase ameaçadas de extinção (em perigo), segundo listas oficiais, ou legalmente protegidas; das consideradas raras; e das não descritas previamente para a área estudada ou pela ciência;

Indicar medidas de monitoramento da biota aquática adjacente.



### 7.3 MEIO SOCIOECONÔMICO (ANTRÓPICO) – PESQUISA

Deverá ser apresentada a caracterização do meio socioeconômico a ser potencialmente atingido pelo empreendimento, através das informações listadas a seguir, e considerando-se tanto as populações existentes na área atingida diretamente, quanto as que apresentarem inter-relações com o meio socioeconômico regional e passíveis de alterações significativas por efeitos indiretos do empreendimento.

#### a. Dinâmica populacional

- Levantamento amostral com coleta de dados primários da comunidade diretamente afetada, contemplando atividades econômicas, educacionais e culturais, sobretudo dos pescadores ribeirinhos, incluindo cais pesqueiro;

Caracterização da população residente e flutuante;

Indicação da distribuição populacional nas áreas circunvizinhas, inclusive residências mais próximas e na área proposta para implantação do empreendimento;

Indicação da distribuição populacional nas áreas circunvizinhas, inclusive residências mais próximas;

Tendências de crescimento demográfico na região;

Detalhamento do processo de desapropriação e/ou remoção, caso haja;

Processo de desapropriação e/ou remoção, caso haja;

Caracterização das atividades econômicas da região, salientando os empregos diretos e indiretos gerados e afetados diretamente pelo empreendimento;

Qualidade de vida da população da região;

Dados sobre a infraestrutura básica e serviços prestados à população das áreas circunvizinhas;

Caracterização sobre a organização social da região;

Histórico da ocupação da área da Praia do Futuro;

Indústrias em operação na área retroportuária do Porto do Mucuripe;

Identificação de lideranças formais e não formais atuantes na área de estudo;

Identificação das formas de comunicação na área de influência direta do empreendimento.

#### b) Caracterização da infraestrutura de saneamento





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- Abastecimento de água;
  - Percentagem da população atendida e origem da água;
  - Qualidade de atendimento;
  - Adequabilidade do fornecimento de água.
- Esgotos sanitários;
  - Percentagem da população atendida por rede coletora;
  - Existência e tipo de tratamento dado aos efluentes domiciliares.

#### Resíduos sólidos

Percentagem da população atendida pelo sistema público de coleta;

Existência e tipo de tratamento dado aos resíduos sólidos (domiciliares, industriais e de serviços de saúde);

Local do destino final - comprometimento com a saúde (presença de vetores, contaminação do lençol freático, entre outros);

Tipo e locais de coleta;

Existência e tipo de sistema de drenagem implantado;

Existência de águas estagnadas;

#### Economia

- Identificação e caracterização das atividades econômicas relevantes na área do estudo, com destaque para a cadeia produtiva da pesca e do turismo;
- Análise das tendências de evolução das atividades econômicas.
- Armazenamento de produtos perigosos;
- Descrever como será o transporte e armazenamento de produtos químicos (projetos de drenagem e contenção de vazamentos-tancagem) para a Planta de Dessalinização.



#### Zoneamento Geoambiental

Definir em mapa, em escala compatível, todas as unidades geoambientais identificadas, com legenda e memorial descritivo, considerando:

Delimitação das Áreas de Preservação Permanente;

Áreas urbanas e de expansão urbana;

Áreas de serviços;

Reservas Ecológicas/Unidades de Conservação;

Áreas protegidas por Lei;

Áreas de risco e de manejo ambiental.

#### 7.4 DIAGNÓSTICO ARQUEOLÓGICO E PALEONTOLÓGICO

Apresentar o diagnóstico com mapeamento dos prováveis sítios arqueológicos e paleontológicos, acordo com a Lei Federal Nº 3.924, de 26 de julho de 1961, e ainda de acordo com a Instrução Normativa Nº 01, de 25 de março de 2015 do Instituto do Patrimônio Histórico e Artístico Nacional – IPHAN, bem como das áreas de interesse científico e de manifestações culturais das comunidades existentes na área; Assim como áreas de edificações de valor histórico e arquitetônico.

#### 8) LEGISLAÇÃO AMBIENTAL PERTINENTE

Descrição e análise da Legislação Federal, Estadual e Municipal correlata ao empreendimento, incluindo as instituições a serem envolvidas e suas respectivas atribuições, bem como uma abordagem, das normas específicas correlatas à tipologia e a fase do licenciamento do empreendimento, considerando os aspectos estruturais e locacionais, as atividades que serão desenvolvidas e os serviços prestados, os diplomas legais relativos ao uso e ocupação do solo e os referentes à preservação de recursos naturais e ambientais. Além disso, avaliar e informar as obrigações, proibições e recomendações, referenciando-as aos instrumentos legais e regulamentos, considerando: as atividades a serem desenvolvidas pelo empreendimento; o



alcance espacial dos impactos ambientais; a área de influência do empreendimento e seus ecossistemas; e processo de licenciamento ambiental.

## 9) IDENTIFICAÇÃO E ANÁLISE DOS IMPACTOS AMBIENTAIS

Com base no diagnóstico ambiental elaborado e no conhecimento da legislação ambiental vigente e das atividades propostas pelo projeto, deverão ser identificados os prováveis impactos que poderão ser gerados durante as fases de implantação e operação do empreendimento.

Descrever as ações potencialmente causadoras de impactos que serão executadas em cada etapa de implantação do projeto, as ampliações e expansões do sistema, considerando os efeitos cumulativos e a sinergia dos impactos com outros empreendimentos existentes na área de influência do empreendimento.

Deverá ser efetuada a identificação, medição e valoração dos impactos ambientais previsíveis, das ações do projeto e suas alternativas nas etapas de construção, instalação e operação, com definição de caráter, previsão dos graus de magnitude, duração, temporalidade, severidade, ordem, reversibilidade e escala, conforme definido na legislação ambiental em vigor, decorrentes das ações referentes à implantação das obras, considerando-se dentre outros os seguintes aspectos:

- Impacto das interferências das obras no processo atual da dinâmica costeira, considerando inclusive os processos erosivos marinhos;

Impactos das obras no processo natural de transporte de sedimentos por via eólica;

Impactos perante a população, residente e ao lazer dos visitantes, nos setores de serviços, entre outros considerados relevantes;

Impacto na paisagem, na atmosfera, no subsolo;

Avaliação dos impactos ao nível de recuo da linha de praia e balneabilidade;

Impactos regionais e locais;

Níveis de ruído;

Malha viária regional e na malha viária de acesso ao empreendimento;

No solo;





Drenagem natural do terreno;

Nos corpos d'água;

Mão de obra local;

Nos serviços de infraestrutura;

Identificar a área do ambiente marinho sujeita a impactos, considerando um estudo de difusão da pluma da salmoura após o seu lançamento em alto mar, no qual seja possível averiguar ou estimar a que distância do ponto de lançamento no corpo receptor se observa a total diluição dos níveis de salinidade;

Impactos na biota terrestre e marinha. Nesse item deverá ser considerada as rotas de deslocamento, a captação da água, o descarte do rejeito, as estruturas projetadas para instalação, com destaque para a população de botos-cinza e tartarugas; deve ser enfatizado ainda, as relações intra e interespecíficas;

Impactos referentes a possibilidade de aumento de sedimentação e sais na biota marinha, pela presença da Usina de Dessalinização;

Previsão da magnitude, considerando graus de intensidade de duração e importância dos impactos identificados, especificando indicadores de impacto, critérios, métodos e técnicas de previsão utilizadas.

Atribuição do grau de importância dos impactos, em relação ao fator ambiental afetado e aos demais impactos, bem como a relevância conferida a cada um deles pelos grupos sociais afetados.

Avaliação da sinergia dos impactos causados pela atividade, considerando a existência das demais atividades em operação na área de influência.

Deverão ser mencionados os métodos de identificação dos impactos, técnicas de previsão da magnitude e os critérios adotados para interpretação e análise de suas interações.

Este item deverá ser apresentado de duas formas:

- a) Uma síntese conclusiva dos impactos relevantes de cada fase prevista para o empreendimento (planejamento, implantação e operação);
- b) Uma descrição detalhada dos impactos (relação causa x efeito) sobre cada fator ambiental, conforme Resolução Nº 01/86 do CONAMA, a saber:

Impactos sobre o meio físico;

Impactos sobre o meio biológico;



Impactos sobre o meio socioeconômico.

## **10) PROPOSIÇÃO DAS MEDIDAS MITIGADORAS**

Neste tópico deverão ser apresentadas as medidas que venham a minimizar ou eliminar impactos adversos identificados e analisados, abrangendo as áreas de implantação e influência do empreendimento, se referindo ainda separadamente as fases de estudos, implantação e operação, as quais sofrerão uma integração posterior com os programas de controle e monitoramento dos impactos ambientais com o respectivo cronograma de execução.

As medidas mais complexas, que envolvam uma metodologia particular de trabalho com a finalidade de obter-se a mitigação e/ou compensação de um ou mais impactos significativos, deverão ser consolidados em um “Programa de Mitigação de Impactos”.

As medidas mitigadoras deverão ser classificadas quanto:

- a) Natureza - Preventiva ou corretiva (inclusive os sistemas de controle de poluição, avaliando sua eficiência em relação aos critérios de qualidade e aos padrões de disposição de efluentes líquidos, emissões gasosas e resíduos sólidos);
- b) Fase de empreendimento em que deverão ser adotadas - Planejamento, implantação, operação, expansão e para o caso de acidentes;
- c) Fator ambiental a que se destina - Físico, biológico e socioeconômico;
- d) Prazo de permanência de sua aplicação - Curto, médio e longo;
- e) Responsabilidade por sua implantação - Empreendedor e/ou Órgãos Públicos envolvidos;
- f) Exequibilidade em termos de meios, recursos, tecnologia entre outros.

Deverão ser mencionados métodos, tecnologias e ações empregados, justificando, inclusive, os impactos adversos que não podem ser mitigados e sugeridas medidas compensatórias que possam ser adotadas na compensação ambiental, atendendo às Resoluções CONAMA Nº 371/2006 e COEMA Nº 26/2015 e Nº 06/2017.

Deverá ser dada ênfase às seguintes medidas: redução das interferências e transtornos resultantes das obras junto à população circunvizinha, prevenção de acidentes incluindo áreas de proteção, disciplinamento do uso do solo, controle de erosão, recuperação paisagística, controle dos impactos





de transportes, manejo, armazenamento e disposição da matéria-prima e dos resíduos gerados no processo, proteção da fauna e flora, dentre outros identificados no empreendimento.

## **II) PROGRAMA DE CONTROLE E MONITORAMENTO DOS IMPACTOS AMBIENTAIS**

Deverão ser apresentadas as medidas que visam minimizar os impactos adversos identificados e quantificados, com detalhamento de processos, métodos, tecnologias e ações que conduzam à eliminação, redução ou compensação dos danos ambientais, justificando, inclusive, os impactos que não podem ser evitados ou mitigados.

Os planos de medidas mitigadoras e o programa básico ambiental deverão conter o cronograma das ações e os indicadores ambientais, para cada medida, que possam servir de parâmetros para avaliar a eficácia das medidas, considerando as fases do planejamento, instalação e operação.

Apresentar, no mínimo, os planos e programas ambientais abaixo relacionados, cuja implementação exigirá seu detalhamento inclusive com cronograma de execução:

- a. Programa de Gestão Ambiental;
- a. Programa de Monitoramento da Biota Marinha, incluindo a definição de frequência de amostragem em função do conhecimento da dinâmica ambiental das áreas a serem monitoradas; elaboração de rotinas de amostragem e análise; definição do período da execução do monitoramento das comunidades marinhas; apresentar análise dos parâmetros físico-químicos correlacionados os dados da qualidade da água e sedimentos entre os índices ecológicos da biota aquática;
- b. Plano de Controle Ambiental das Obras;
- c. Plano de Monitoramento do Nível de Ruídos e Vibrações;
- d. Plano de Recuperação de Áreas Degradadas;
- e. Plano de Proteção ao Trabalhador e Segurança do Ambiente de Trabalho;
- f. Programa de Educação Ambiental;
- g. Programa de Auditoria Ambiental;
- h. Plano de Ação de Emergências para vazamentos de Produtos Químicos;



- i. Plano de Comunicação Social para as comunidades circunvizinhas ao empreendimento;
- j. Programa de Identificação e Resgate do Patrimônio Arqueológico, Cultural e Histórico;
- k. Programa de Gerenciamento de Efluentes, de Gerenciamento de Resíduos, de Controle de Material Particulado, Gases e Ruídos, de Combate à Poluição Sonora e Visual.
- l. Programa de Capacitação dos Operários para Operação e Manutenção da Usina de Dessalinização;
- m. Plano de Monitoramento da Qualidade da Água do Mar;
- n. Plano de Manutenção da Infraestrutura Implantada;
- o. Plano de Eventual desativação do empreendimento, compreendendo a retirada das estruturas e recuperação das áreas impactadas;
- p. Plano de Monitoramento da Atividade Pesqueira;
- q. Plano de Amostragem de Biota Marinha;
- r. Plano de Monitoramento da Dinâmica Costeira na Área de Influência do empreendimento;
- s. Cronograma global das obras e etapas com as medidas mitigadoras.

## 12) ESTUDO DA ANÁLISE DE RISCO

Deverá ser realizado um Estudo de Análise de Risco, concentrando-se nas causas cujas consequências possam gerar danos às instalações, ao público (interno e externo) e ao meio ambiente. Deverão ser discriminados os seguintes itens:

- Análise histórica, levando em consideração acidentes ocorridos com empreendimentos similares dentro e fora do país, e que resultaram em danos ao homem, ao meio ambiente e às instalações;
- Identificação de perigos, com reconhecimento dos sistemas e cenários acidentais mais prováveis com seus efeitos iniciadores e consequências;
- Determinação das tipologias acidentais;



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- Estimativa dos efeitos físicos e análises de vulnerabilidade, incluindo riscos individuais e sociais para pessoal interno e externo e o risco total para o empreendimento. Esta análise deverá ser determinada utilizando-se modelos que fazem uso de funções probabilísticas;
- Estimativa de frequência e ocorrência dos cenários acidentais identificados;
- Estimativa e Análise de Risco, nas formas de Risco Social e Risco Individual e métodos de redução de riscos, envolvendo medidas capazes de diminuir a probabilidade de ocorrência dos cenários acidentais e/ou a magnitude de suas consequências para a comunidade e/ou os ecossistemas;
- Plano de Gerenciamento de Riscos - PGR, contemplando todas as operações e equipamentos, com o objetivo de prover uma sistemática voltada para o estabelecimento de requisitos contendo orientações gerais de gestão, visando a prevenção de acidentes, razão pela qual deverá incluir os seguintes procedimentos:
  - Análise das consequências;
  - Análise de vulnerabilidade;
  - Informação de segurança dos processos;
  - Revisão dos riscos de processos;
  - Gerenciamento de modificações;
  - Manutenção e garantia de integridade de sistemas críticos;
  - Procedimentos operacionais;
  - Capacitação de recursos humanos;
  - Investigação de incidentes;
  - Plano de Ação de Emergência - PAE;
  - Auditorias.

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### **13) ESTUDO DO PROGNÓSTICO DA QUALIDADE AMBIENTAL**

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Definição das diferentes situações resultantes da adoção de cada uma das alternativas tecnológicas e locacionais, considerando a implantação ou não do empreendimento. Deverão ser contemplados, dentre outros, suas implicações na qualidade ambiental da área de influência do empreendimento, aspectos relacionados à qualidade da água, à qualidade de vida da população da região e à adequada prestação dos serviços, segundo os parâmetros normativos e regulatórios, considerando a natureza da Planta de Dessalinização.

#### 14) CONCLUSÕES E RECOMENDAÇÕES

Deverão ser apresentadas as conclusões sobre os resultados das avaliações dos impactos ambientais, incluindo:

- Avaliação prognóstica realizada na área de estudo quanto à viabilidade do empreendimento, bem como a possibilidade de não execução do empreendimento;
- Demonstrativo da alternativa selecionada ser a mais favorável à proteção ao meio ambiente e à relação socioambiental;
- Modificações (ambientais, socioeconômicas) decorrentes da alternativa adotada;
- Benefícios *versus* adversidades socioeconômicas, culturais e ambientais decorrentes da implantação e operação do empreendimento.

#### 15) ANEXOS

Deverá ser relacionada e apresentada toda documentação citada como anexa ao Estudo, devendo esta manter o nível gráfico (fotografias coloridas, textos e mapas legíveis e em escala compatível) e apresentação dos outros conteúdos.

#### 16) RIMA – RELATÓRIO DE IMPACTO AMBIENTAL

O Relatório de Impacto Ambiental - RIMA deverá refletir as conclusões do Estudo de Impacto Ambiental - EIA, com linguagem acessível ao público, de modo que se possam entender claramente as possíveis consequências ambientais do projeto e suas alternativas, comparando as vantagens e desvantagens de cada uma delas.

O Relatório de Impacto Ambiental - RIMA deverá conter:



- Os objetivos e justificativas do projeto, suas relações com os planos e programas governamentais;
- Uma síntese descritiva do projeto e suas alternativas tecnológicas e locacionais;
- Uma síntese dos resultados dos estudos de diagnóstico ambiental da área de influência do empreendimento;
- Análise dos impactos ambientais considerando o projeto, as alternativas, os horizontes de tempo de incidência dos impactos e indicando os métodos e técnicas adotadas para sua identificação, quantificação e interpretação;
- Caracterização da qualidade ambiental futura da área de influência, comparando as diferentes situações de adoção do projeto e suas alternativas, bem como com a hipótese de sua não execução;
- Descrição do efeito esperado com a adoção de medidas mitigadoras previstas para os impactos negativos, mencionando aqueles que não poderão ser evitados, o grau de alteração esperado e as medidas compensatórias;
- Síntese dos programas de controle e monitoramento de impactos;
- Conclusões e recomendações.

## **17) REFERÊNCIAS BIBLIOGRÁFICAS**

Deverão ser relacionadas as referências bibliográficas consultadas para a realização dos estudos, incluindo a citação das fontes pesquisadas (textos, desenhos, mapas, gráficos, tabelas, fotografias, entre outros).

## **18) GLOSSÁRIO**

Deverá constar uma listagem dos termos técnicos utilizados nos estudos.

## **ATTACHMENT VII – IBAMA Competence Analysis**



**Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis**  
DIRETORIA DE LICENCIAMENTO AMBIENTAL  
COORDENAÇÃO-GERAL DE LICENCIAMENTO AMBIENTAL DE EMPREENDIMENTOS FLUVIAIS E PONTUAIS  
TERRESTRE  
COORDENAÇÃO DE LICENCIAMENTO AMBIENTAL DE MINERAÇÃO E PESQUISA SÍSMICA TERRESTRE  
DIVISÃO DE LICENCIAMENTO AMBIENTAL DE EMPREENDIMENTOS AGROPECUÁRIOS, TRANSPOSIÇÕES E  
PEQUENAS ESTRUTURAS

OFÍCIO Nº 206/2019/DTAPE/COMIP/CGTEF/DILIC

Brasília, 17 de setembro de 2019.

Ao Senhor  
Delano Sampaio Cidrack  
Representante Legal  
COMPANHIA DE ÁGUA E ESGOTO DO CEARÁ - CAGECE  
Rua Dr. Lauro Vieira Chaves, 1030 - Aeroporto  
CEP: 60.420-310 - Fortaleza/CE

**Assunto:** Resposta acerca da Ficha de Caracterização de Atividade - FCA nº 147811/2019..

**Referência:** Caso responda este Ofício, indicar expressamente o Processo nº 02001.025096/2019-52.

1. Cumprimentando-o cordialmente e em resposta à Ficha de Caracterização de Atividade - FCA nº 147811/2019 (5832512), que tratou do empreendimento denominado "Sistema de Abastecimento de Água Dessalinizada do Macrossistema Integrado de Distribuição de Água de Fortaleza e Região Metropolitana", informo que a referida FCA foi analisada por meio do Parecer Técnico nº 96/2019-DTAFE/COMIP/CGTEF/DILIC (5961212), que concluiu que "a condução administrativa do licenciamento ambiental do empreendimento em questão não compete ao Ibama". Desta forma, o órgão estadual ou municipal de meio ambiente deverá ser procurado para a realização do licenciamento ambiental do empreendimento em questão.
2. Segue, em anexo, para fins de conhecimento, cópia do Parecer Técnico nº 96/2019-DTAFE/COMIP/CGTEF/DILIC (5961212), que analisou a referida FCA.
3. Por fim, informo que, pelos motivos expostos, o processo em epígrafe será arquivado.

Anexo: Parecer Técnico nº 96/2019-DTAFE/COMIP/CGTEF/DILIC (5961212).

Atenciosamente,

RÉGIS FONTANA PINTO  
Coordenador-Geral

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Documento assinado eletronicamente por **REGIS FONTANA PINTO**, Coordenador-Geral, em 17/09/2019, às 16:13, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.



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**INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS  
DIVISÃO DE LICENCIAMENTO AMBIENTAL DE EMPREENDIMENTOS AGROPECUÁRIOS, TRANSPOSIÇÕES E  
PEQUENAS ESTRUTURAS**

SCEN Trecho 2 - Ed. Sede do IBAMA - Bloco B - Sub-Solo, - Brasília - CEP 70818-900

**Parecer Técnico nº 96/2019-DTAFE/COMIP/CGTEF/DILIC**

Número do Processo: 02001.025096/2019-52

**Empreendimento: Sistema de Abastecimento de Água Dessalinizada do Macrossistema Integrado de Distribuição de Água de Fortaleza e Região Metropolitana.**

Interessado: CAGECE

Assunto/Resumo: **Análise de Competência.**

**I. Introdução.**

1. Por meio da Ficha de Caracterização de Atividade - FCA nº 147811/2019 (5832512), a Companhia de Água e Esgoto do Ceará - CAGECE apresentou as informações iniciais acerca do empreendimento denominado Sistema de Abastecimento de Água Dessalinizada do Macrossistema Integrado de Distribuição de Água de Fortaleza e Região Metropolitana.
2. O presente Parecer Técnico tem por objetivo a análise acerca da competência administrativa para a condução do licenciamento ambiental do empreendimento em questão, bem como dar os encaminhamentos que se fizerem necessários.

**II. Análise.**

3. De acordo com os dados apresentados na FCA, o empreendimento trata-se da implantação de uma Usina de Dessalinização da Água do Mar na área da Região Metropolitana de Fortaleza com capacidade produtiva de 1 m<sup>3</sup>/s em quatro linhas, resultando em uma produção por linha de 0,24 m<sup>3</sup>/s.
4. A FCA informa que a área prevista para implantação da planta de dessalinização é um terreno regular de 2,5 ha, formado por duas quadras desocupadas, localizado no município de Fortaleza na região da Praia do Futuro e que a linha de captação apresenta uma extensão de aproximadamente 1km, mediante uma torre situada na cota batimétrica 16 com a finalidade de captar água do mar de qualidade adequada para o processo de Osmose Reversa.
5. A FCA informa, também, que a interligação com o Sistema de Abastecimento será feita desde a produção integrando o Reservatório do Mucuripe, localizado no Morro Santa Terezinha e um Reservatório já existente localizado na Praça da Imprensa, através de uma tubulação de 1000 mm com aproximadamente 7,83 km de extensão.

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6. Diante das informações mencionadas acima, embora ocorra a captação de água do mar, é possível concluir que as instalações do empreendimento serão localizadas em área urbana no município de Fortaleza, caracterizando-o como empreendimento terrestre e não marítimo.

7. Acerca da competência administrativa para condução dos processos de licenciamento ambiental, a Lei Complementar nº 140, de 08 de dezembro de 2011, estabeleceu em seu artigo 7º que:

Art. 7º São ações administrativas da União:

(...)

XIV - promover o licenciamento ambiental de empreendimentos e atividades:

- a) localizados ou desenvolvidos conjuntamente no Brasil e em país limítrofe;
- b) localizados ou desenvolvidos no mar territorial, na plataforma continental ou na zona econômica exclusiva;
- c) localizados ou desenvolvidos em terras indígenas;
- d) localizados ou desenvolvidos em unidades de conservação instituídas pela União, exceto em Áreas de Proteção Ambiental (APAs);
- e) localizados ou desenvolvidos em 2 (dois) ou mais Estados;
- f) de caráter militar, excetuando-se do licenciamento ambiental, nos termos de ato do Poder Executivo, aqueles previstos no preparo e emprego das Forças Armadas, conforme disposto na Lei Complementar no 97, de 9 de junho de 1999;
- g) destinados a pesquisar, lavrar, produzir, beneficiar, transportar, armazenar e dispor material radioativo, em qualquer estágio, ou que utilizem energia nuclear em qualquer de suas formas e aplicações, mediante parecer da Comissão Nacional de Energia Nuclear (Cnen); ou
- h) que atendam tipologia estabelecida por ato do Poder Executivo, a partir de proposição da Comissão Tripartite Nacional, assegurada a participação de um membro do Conselho Nacional do Meio Ambiente (Conama), e considerados os critérios de porte, potencial poluidor e natureza da atividade ou empreendimento;

8. O Decreto nº 8.437/2015, que regulamentou o inciso XIV, alínea “h”, e o parágrafo único, da LC nº 140/2011, estabeleceu os empreendimentos e atividades cujo licenciamento ambiental são de competência da União. No referido decreto não está incluída no rol de atividades e empreendimentos a tipologia usina de dessalinização.

9. Em consulta ao Cadastro Nacional de Unidades de Conservação (CNUC), realizada em 16/09/2019, foi constatado que o empreendimento não está localizado no interior de Unidades de Conservação instituídas pela União.

10. Em consulta ao site da Fundação Nacional do Índio (FUNAI), realizada em 16/09/2019, também foi constatado que não há a ocorrência de Terras Indígenas no local.

### III. Considerações e Conclusão.

Considerando as informações apresentadas na FCA nº 147811/2019 (5832512);

Considerando que, embora ocorra a captação de água do mar, as instalações do empreendimento serão localizadas em um terreno regular de 2,5 ha, formado por duas quadras desocupadas, localizado no município de Fortaleza na região da Praia do Futuro, caracterizando-o como empreendimento terrestre e não marítimo;

Considerando que o projeto não está localizado em Terras Indígenas;

Considerando que o empreendimento não está localizado no interior de Unidades de Conservação instituídas pela União;

Considerando que o empreendimento não se enquadra em nenhuma das situações mencionadas no artigo 7º da Lei Complementar nº 140/2011;



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Considerando que o empreendimento não se enquadra em nenhuma das tipologias apresentadas no Decreto nº 8.437/2015;

Diante das considerações mencionadas acima, conclui-se que a condução administrativa do licenciamento ambiental do empreendimento em questão não compete ao Ibama.

Assim, recomenda-se que seja encaminhado ofício ao interessado para dar-lhe ciência do teor do presente Parecer e para orientar-lhe a buscar junto ao órgão estadual ou municipal de meio ambiente as providências cabíveis a fim de seu licenciamento ambiental.

É o Parecer que submeto à consideração e deliberação superior.



Documento assinado eletronicamente por **EDVAR RODRIGUES DE OLIVEIRA, Analista Ambiental**, em 16/09/2019, às 16:06, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do [Decreto nº 8.539, de 8 de outubro de 2015](#).



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Referência: Processo nº 02001.025096/2019-52

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**ATTACHMENT VIII – Engesoft Technical Team: Federal Technical Registry  
– CTF/AIDA**



 <div style="text-align: center;"> Ministério do Meio Ambiente  Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis  <b>CADASTRO TÉCNICO FEDERAL</b>  <b>CERTIFICADO DE REGULARIDADE - CR</b> </div> 			
<b>Registro n.º</b>	<b>Data da consulta:</b>	<b>CR emitido em:</b>	<b>CR válido até:</b>
118122	23/04/2018	28/03/2018	28/06/2018
<b>Dados básicos:</b>			
CPF: 057.744.203-10			
Nome: JOAO BOSCO ANDRADE DE MORAIS			
<b>Endereço:</b>			
logradouro: RUA ISRAEL BEZERRA			
N.º: 1040		Complemento: APT 1202	
Bairro: DIONISIO TORRES		Município: FORTALEZA	
CEP: 60182-010		UF: CE	
<b>Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA</b>			
<b>Código CBO</b>	<b>Ocupação</b>	<b>Área de Atividade</b>	
2134-05	Geólogo	Prestar assessoria e consultoria	
Conforme dados disponíveis na presente data, CERTIFICA-SE que a pessoa física está em conformidade com as obrigações cadastrais do CTF/AIDA.			
A inscrição no Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA constitui declaração, pela pessoa física, do cumprimento de exigências específicas de qualificação ou de limites de atuação que porventura sejam determinados pelo respectivo Conselho de Fiscalização Profissional.			
O Certificado de Regularidade emitido pelo CTF/AIDA não desobriga a pessoa inscrita de obter licenças, autorizações, permissões, concessões, alvarás e demais documentos exigíveis por instituições federais, estaduais, distritais ou municipais para o exercício de suas atividades, especialmente os documentos de responsabilidade técnica, qualquer o tipo e conforme regulamentação do respectivo Conselho de Fiscalização Profissional, quando exigíveis.			
O Certificado de Regularidade no CTF/AIDA não produz qualquer efeito quanto à qualificação e à habilitação técnica da pessoa física inscrita.			
<b>Chave de autenticação</b>		G3PW63MFX9YCY1PN	



 <div style="text-align: center;"> Ministério do Meio Ambiente  Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis  <b>CADASTRO TÉCNICO FEDERAL</b>  <b>CERTIFICADO DE REGULARIDADE - CR</b> </div> 			
<b>Registro n.º</b>	<b>Data da consulta:</b>	<b>CR emitido em:</b>	<b>CR válido até:</b>
301619	19/02/2018	19/02/2018	19/05/2018
<b>Dados básicos:</b>			
CPF: 258.487.043-68			
Nome: NAIMAR GONÇALVES BARROSO SEVERIANO			
<b>Endereço:</b>			
Logradouro: RUA LOURIVAL SALES			
N.º:	610	Complemento:	
Bairro:	JABOTI	Município:	EUSEBIO
CEP:	61760-000	UF:	CE
<b>Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA</b>			
<b>Código CBO</b>	<b>Ocupação</b>	<b>Área de Atividade</b>	
2512-05	Economista	Elaborar projetos (pesquisa econômica, de mercados, viabilidade econômica etc)	
<p>Conforme dados disponíveis na presente data, CERTIFICA-SE que a pessoa física está em conformidade com as obrigações cadastrais do CTF/AIDA.</p> <p>A inscrição no Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA constitui declaração, pela pessoa física, do cumprimento de exigências específicas de qualificação ou de limites de atuação que porventura sejam determinados pelo respectivo Conselho de Fiscalização Profissional.</p> <p>O Certificado de Regularidade emitido pelo CTF/AIDA não desobriga a pessoa inscrita de obter licenças, autorizações, permissões, concessões, alvarás e demais documentos exigíveis por instituições federais, estaduais, distritais ou municipais para o exercício de suas atividades, especialmente os documentos de responsabilidade técnica, qualquer o tipo e conforme regulamentação do respectivo Conselho de Fiscalização Profissional, quando exigíveis.</p> <p>O Certificado de Regularidade no CTF/AIDA não produz qualquer efeito quanto à qualificação e à habilitação técnica da pessoa física inscrita.</p>			
<b>Chave de autenticação</b>		6J9S67ZYJ4F6E6E1	





 <div style="text-align: center;"> Ministério do Meio Ambiente  Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis  <b>CADASTRO TÉCNICO FEDERAL</b>  <b>CERTIFICADO DE REGULARIDADE - CR</b> </div> 			
<b>Registro n.º</b>	<b>Data da consulta:</b>	<b>CR emitido em:</b>	<b>CR válido até:</b>
242264	25/04/2018	25/04/2018	25/07/2018
<b>Dados básicos:</b>			
CPF: 379.770.243-49			
Nome: LUÍS GONZAGA SALES JÚNIOR			
<b>Endereço:</b>			
logradouro: RUA PRES. ARTUR BERNARDES, 3550			
N.º:	3550	Complemento:	
Bairro:	JOSE DE ALENCAR	Município:	FORTALEZA
CEP:	60830-095	UF:	CE
<b>Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA</b>			
<b>Código CBO</b>	<b>Ocupação</b>	<b>Área de Atividade</b>	
2211-05	Biólogo	Estudar seres vivos	
2211-05	Biólogo	Inventariar biodiversidade	
2211-05	Biólogo	Realizar consultoria e assessoria na área biológica e ambiental	
2211-05	Biólogo	Manejar recursos naturais	
2211-05	Biólogo	Realizar diagnósticos biológicos, moleculares e ambientais	
<p>Conforme dados disponíveis na presente data, CERTIFICA-SE que a pessoa física está em conformidade com as obrigações cadastrais do CTF/AIDA.</p> <p>A inscrição no Cadastro Técnico Federal de Atividades e Instrumentos de Defesa Ambiental – CTF/AIDA constitui declaração, pela pessoa física, do cumprimento de exigências específicas de qualificação ou de limites de atuação que porventura sejam determinados pelo respectivo Conselho de Fiscalização Profissional.</p> <p>O Certificado de Regularidade emitido pelo CTF/AIDA não desobriga a pessoa inscrita de obter licenças, autorizações, permissões, concessões, alvarás e demais documentos exigíveis por instituições federais, estaduais, distritais ou municipais para o exercício de suas atividades, especialmente os documentos de responsabilidade técnica, qualquer o tipo e conforme regulamentação do respectivo Conselho de Fiscalização Profissional, quando exigíveis.</p> <p>O Certificado de Regularidade no CTF/AIDA não produz qualquer efeito quanto à qualificação e à habilitação técnica da pessoa física inscrita.</p>			
<b>Chave de autenticação</b>		81CGF72JDVG76VYL	

		Ministério do Meio Ambiente Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis <b>CADASTRO TÉCNICO FEDERAL</b> <b>CERTIFICADO DE REGULARIDADE - CR</b>			
		<b>Registro n.º</b>	<b>Data da consulta:</b>		<b>CR emitido em:</b>
		463438	14/09/2018	14/09/2018	14/12/2018
<b>Dados básicos:</b>					
CPF: 115.897.283-00					
Nome: ADONAI DE SOUZA PORTO					
<b>Endereço:</b>					
logradouro: AV. LITORANEA 2040 QUADRA K1 CASA 9					
N.º: 2040		Complemento:			
Bairro: PRECABURA		Município: EUSEBIO			
CEP: 61760-000		UF: CE			
<b>Cadastro Técnico Federal de Atividades Potencialmente Poluidoras  e Utilizadoras de Recursos Ambientais – CTF/APP</b>					
<b>Código</b>	<b>Descrição</b>				
20-13	criação de passeriformes silvestres nativos				
<p>Conforme dados disponíveis na presente data, CERTIFICA-SE que a pessoa física está em conformidade com as obrigações cadastrais e de prestação de informações ambientais sobre as atividades desenvolvidas sob controle e fiscalização do Ibama, por meio do CTF/APP.</p> <p>O Certificado de Regularidade emitido pelo CTF/APP não desobriga a pessoa inscrita de obter licenças, autorizações, permissões, concessões, alvarás e demais documentos exigíveis por instituições federais, estaduais, distritais ou municipais para o exercício de suas atividades</p> <p>O Certificado de Regularidade emitido pelo CTF/APP não habilita o transporte e produtos e subprodutos florestais e faunísticos.</p>					
<b>Chave de autenticação</b>			2CMVICUCV12QW3T6		