ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– PROJECT PRESENTATION AND DESCRIPTION –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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DATASHEET

SPONSOR INFORMATION	
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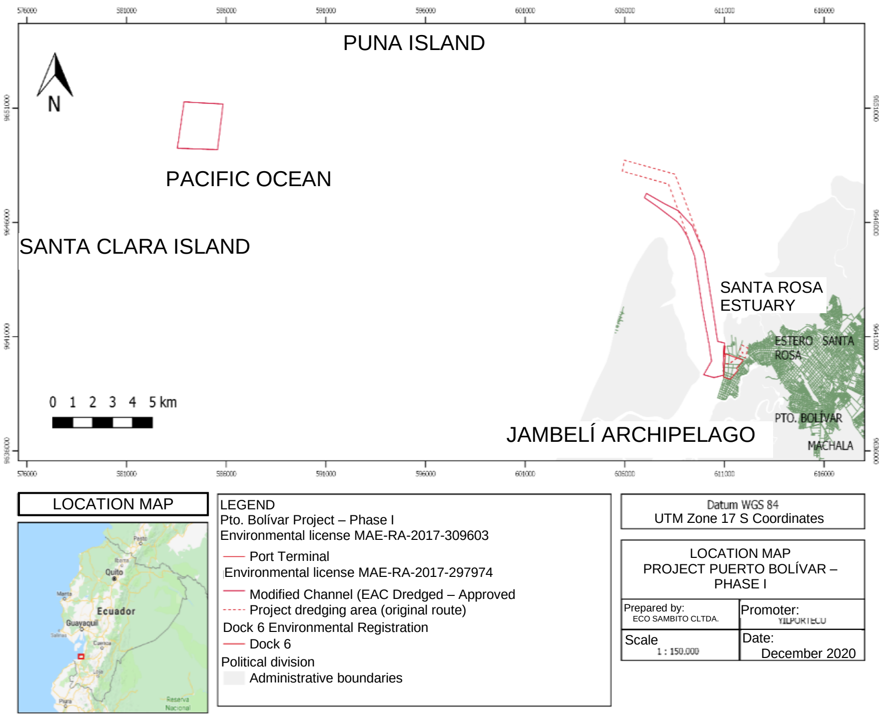
Company type	Public-Private Partnership

PROJECT DATA	
Project name	ENVIRONMENTAL AND SOCIAL ASSESSMENT OF THE PUERTO BOLÍVAR PROJECT – PHASE 1
Environmental permits	• MAE-RA-2017-309603 • MAE-RA-2017-297974 • MAE-SUIA-RA-DPAEO-2019-215758
Project phase	Construction and operation
Principal activities (CCAN Code) [National Environmental Catalog Classification]	• Commercial port construction and operation • River and/or ocean source dredging works construction and/or operation
Location	Parroquia Puerto Bolívar, Machala – El Oro

Location Map



Coordinates

Access channel, maneuvering area, docks and sediment deposit basin, as stated in the Intersection Certificate of the current Environmental License.

Universal Transverse Mercator Projection U.T.M. WGS 84 World Geodesic Reference System - Zone 17 South

Points	Latitude (X)	Longitude (Y)	Description
1	610956	9639311	Polygon 1
2	610478	9639203	Polygon 1
3	609957	9639327	Polygon 1
4	610347	9639925	Polygon 1
5	610216	9640713	Polygon 1
6	609917	9642098	Polygon 1
7	609498	9644527	Polygon 1
8	608686	9646508	Polygon 1
9	608189	9647676	Polygon 1
10	605878	9648244	Polygon 1
11	605974	9648726	Polygon 1
12	608511	9648113	Polygon 1
13	609175	9646587	Polygon 1
14	609970	9644652	Polygon 1
15	610433	9642109	Polygon 1
16	610654	9640792	Polygon 1
17	611014	9640712	Polygon 1
18	610931	9639816	Polygon 1
19	611233	9639806	Polygon 1

Port Terminal

20	611697	9640103	Polygon 1
21	611804	9640152	Polygon 1
22	611854	9640142	Polygon 1
23	611923	9640297	Polygon 1
24	611766	9640387	Polygon 1
25	611866	9640633	Polygon 1
26	612023	9640556	Polygon 1
27	612171	9640506	Polygon 1
28	612139	9640341	Polygon 1
29	612088	9640197	Polygon 1
30	612036	9640065	Polygon 1
31	611852	9640125	Polygon 1
32	611804	9640149	Polygon 1
33	611699	9640100	Polygon 1
34	611234	9639805	Polygon 1
35	610931	9639814	Polygon 1
36	610956	9639311	Polygon 1
1	583544	9649248	Polygon 2
2	583880	9651278	Polygon 2
3	585837	9651184	Polygon 2
4	585560	9649187	Polygon 2
5	583544	9649248	Polygon 2

Dock 6

Points	Latitude (X)	Longitude (Y)	Description
1	611290	9639124	Polygon 1
2	610952	9639220	Polygon 1
3	610966	9639464	Polygon 1
4	611047	9640244	Polygon 1
5	611941	9639964	Polygon 1
6	611608	9639609	Polygon 1
7	611680	9639532	Polygon 1
8	611290	9639124	Polygon 1

Points	Latitude (X)	Longitude (Y)	Description
1	610967	9640593	Polygon 1
2	611029	9640590	Polygon 1
3	611010	9640219	Polygon 1
4	611048	9640217	Polygon 1
5	611044	9640138	Polygon 1
6	610944	9640144	Polygon 1

		7	610967	9640593	Polygon 1

CONSULTING COMPANY	
Company name	ECOSAMBITO C. LTDA.
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Liudys Reyes	Geographer	

PRESENTATION

This document is to comply with the requirements set forth by the International Finance Corporation (IFC) based on Environmental and Social Performance Standards and the Equator Principles, taking into account the Performance Standard Guidance Notes.

This environmental and social assessment is therefore presented in chapters which will comply with IFC requirements. Following is the document structure:

I. Project Presentation and Description

II. Area of Influence and Sensitive Areas

III. Environmental and Social Baseline

IV. Complementary Studies

V. Environmental and Social Impacts Assessment

VI. Alternatives Analysis

VII. Environmental and Social Management Plan

VIII. Consultation and Information Disclosure

APPENDIXES

INTRODUCTION

The Phase 1 Puerto Bolívar Port Terminal Expansion Project (hereinafter Puerto Bolívar Project – Phase 1, or the Project) is seeking to finance the capital expense required for the first stage of an investment plan for the Puerto Bolívar port terminal modernization, operation and maintenance tasks. It is located in the province of El Oro, Ecuador. The investment will expand the port containerization capacity from 120,000 TEU to 600,000 TEU annually and will modernize infrastructure and technology for more efficient operation. The total Project cost is not expected to exceed USD 350 million, which will be financed with loan A from the IDB Group up to USD 100 million. The financing plan will be completed through participation of other commercial banks and/or multilateral organizations and with capital contributions from the Project sponsor and sole shareholder, Yilport Holding S.A.

Ecuador is one of the largest worldwide exporters of bananas and shrimp. It is estimated that almost half of Ecuador's annual banana exports could be captured by Puerto Bolívar due to its strategic location on the Pacific Ocean. Shrimp is a very strategic product for the country, and for the first time in 2017 it was positioned as the most significant product in terms of value contribution (USD 3.038 million compared to USD 3.035 million for bananas) to exports (among those not related to petroleum) of the country. The increase in containerization capacity contributed by this Project will be essential to improve export capacity of the region and the country, especially considering that refrigerated containers (reefers) must be kept empty, and processing prior to shipping occurs in Ecuador.

The Project is part of a public-private partnership process of the Puerto Bolívar Port Authority (APPB – Autoridad Portuaria de Puerto Bolívar) whereby Yilport Terminal Operations, Yilportecu S.A. – Ecuador, acquired the 50-year concession to operate the existing port terminal facilities and to carry out modernization and maintenance. At the end of the concession period, the facilities will be transferred to the Puerto Bolívar Port Authority.

The Project has the environmental regularizations issued by the respective Environmental Authority in charge as required in each case. These are (Environmental Assessments may be found in the appendix section:

- Environmental License No. MAE-RA-2017-309603 for the Project "CONSTRUCTION AND OPERATION OF THE PUERTO BOLÍVAR PORT TERMINAL, OPERATED BY YILPORT TERMINAL OPERATIONS, YILPORTECU S.A." issued by the El Oro Provincial Government under Resolution No. GADPEO-2018-009363-SUIA dated 03 April 2018.
- Environmental License No. MAE-RA-2017-297974 for "DREDGING OF PUERTO BOLÍVAR DOCKS 1, 2, 3, 4, 5 AND 6, MANEUVERING ZONE AND ACCESS CHANNEL" Project issued by the El Oro Provincial Environmental Administration under Resolution No. MAE-DPAEO-2017-009 dated December

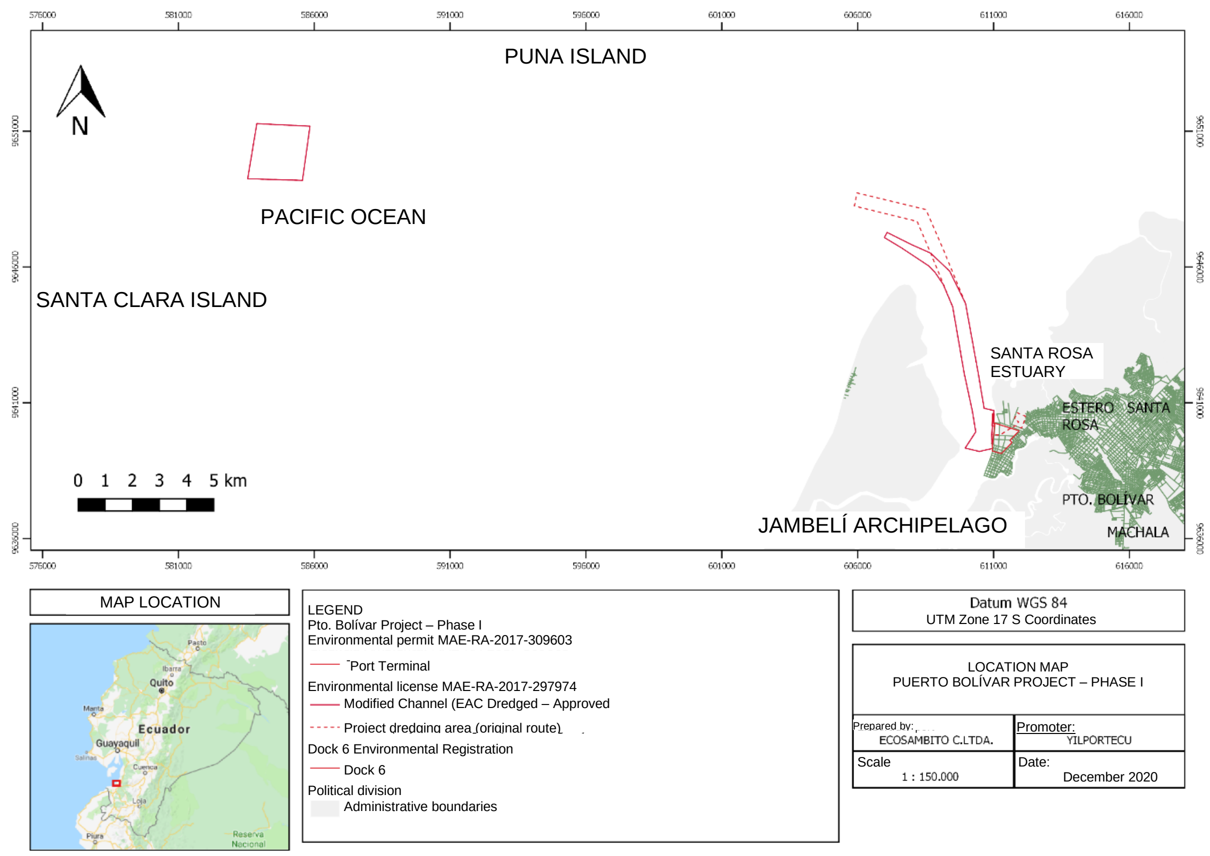
19, 2017.

- Environmental Registration No. 239660 for the "CONSTRUCTION, OPERATION AND ABANDONMENT OF PUERTO BOLÍVAR PORT TERMINAL DOCK # 6" Project, issued on 16 December 2019 by the Undersecretary for Environmental Quality of the Ministry of the Environment.

The first project phase will take approximately 3 years and includes dredging works to increase the basin depth to 16.50 meters, a new 450-meter dock and acquisition of new cargo handling equipment

Illustration 1 shows the Project location and emplacement area.

Illustration 1. Project Location and Emplacement Areas



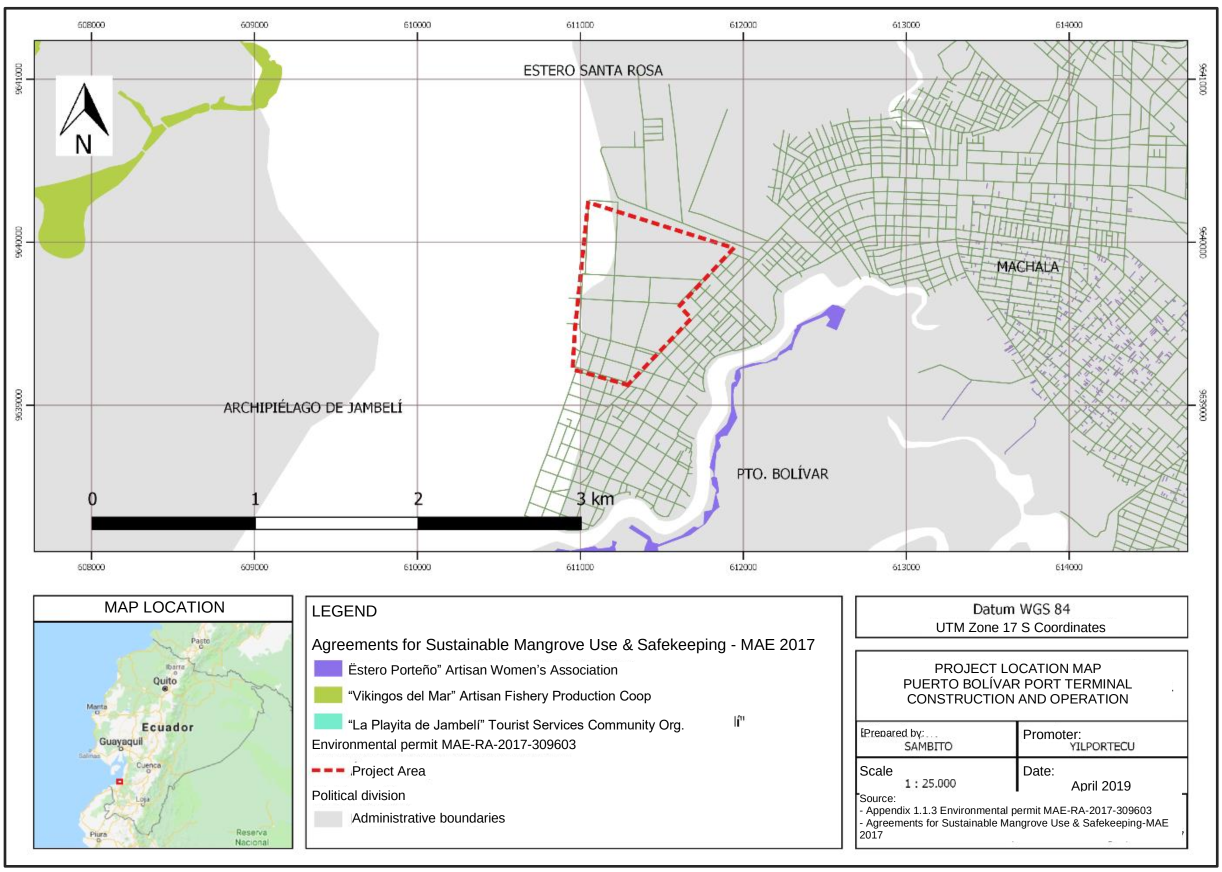
Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020.

1. Port Terminal

The exceptional location of Puerto Bolívar on the Santa Rosa Channel, sheltered by Jambelí Island, offers natural protection for the port and makes it a safe site for vessel mooring and operation in the province of El Oro. The Santa Rosa Estuary channel is 200 m wide, is marked by luminous buoys and provides access to the port and the anchoring area.

If we take into account the total cargo moved nationally during 2017 (including port authorities and all operating port terminals, except oil and gas terminals), Puerto Bolívar contributed 8% of the total cargo moved nationally, almost entirely banana exports (1,617,712 MT) (Ministerio de Transporte y Obras Públicas, 2018).

Illustration 2. Location of the Puerto Bolívar Port Terminal Construction and Operation Project, operated by YILPORT TERMINAL OPERATIONS YILPORTECU S.A.



Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020.

The Project execution area is located on the Santa Rosa estuary and pertains to the navigation axis line to access the Puerto Bolívar Maritime Terminal, maneuvering area and quay of docks 1 through 6 (see Illustration 2), at the following coordinates:

Table 1. Project Coordinates

Points	Latitude (X)	Longitude (Y)
1	611290	9639124
2	610952	9639220
3	610966	9639464
4	611047	9640244
5	611941	9639964
6	611608	9639609
7	611680	9639532
8	611290	9639124

Source: Environmental License No. MAE-RA-2017-309603
Prepared by: Ecosambito, 2020

1.1 Organization and Personnel

YILPORTECU S.A. personnel are described in the following table:

Table 2. Co-workers from YILPORTECU

Department	**Number**
General management	2
Legal department	1
Operations	72
Human resources	4
Administrative	2
Financial department	4
Project technician	3
Maintenance	11
Sales and marketing	4
Industrial safety	2
Information technology	2
Purchasing	2
Security	17
Total	**126**

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.2 Existing infrastructure

The Puerto Bolívar Port Authority owns an area of 72 hectares that is completely fenced and delimited, occupied by warehouses, industrial ships, administrative offices, storage yards, internal roads, maneuvering and parking yards, docks and other infrastructure.

1.2.1 Docks

The ocean front of the port area includes 920 meters of mooring line divided into five docks located as follows:

A. Jetty pier with two docks, each with a 130-m apron that is 30 m wide with a 12.5-m draft, which is connected to land by a 100-m concrete walkway that is 14 m wide, for simultaneous mooring of 2 vessels up to 20,000 DWT (Docks No. 1 and No. 2)

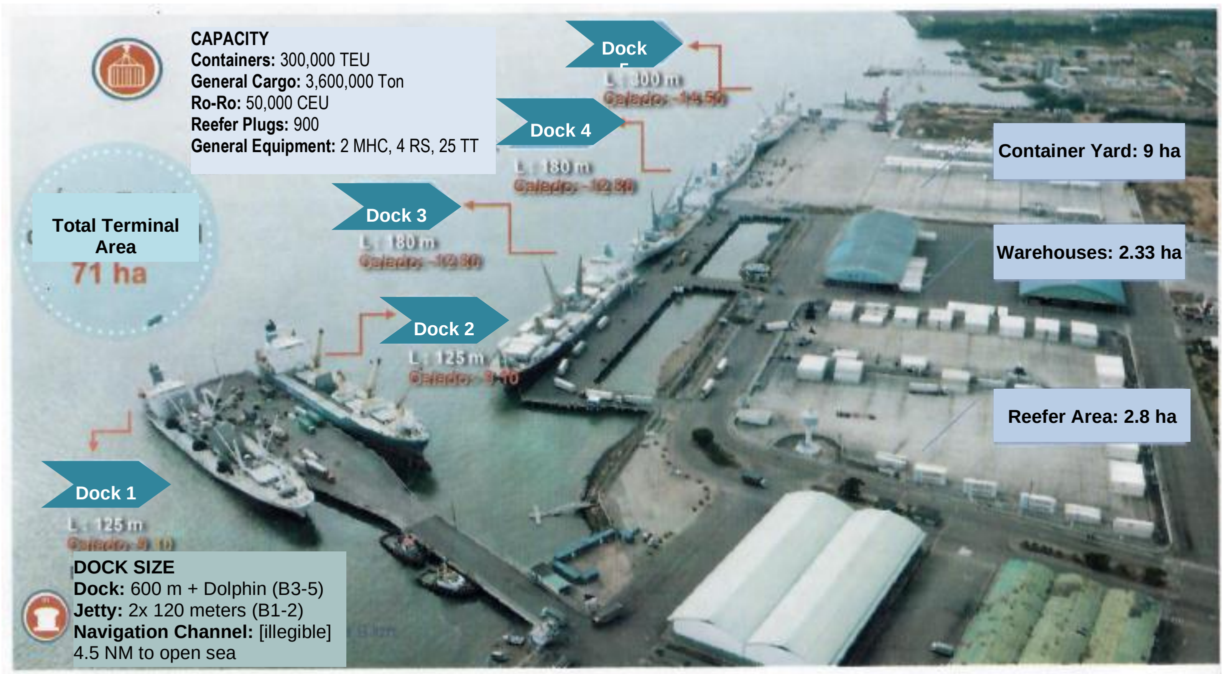
B. Secondary dock, with piles and reinforced concrete slab situated parallel to the coastline, which is 360 m long, 26 m wide and a designed draft of 12.5 m, connected to land by a 3 40-m walkways that are 14 m wide – forming two water mirrors – where 2 vessels up to 20,000 DWT can tie up simultaneously (Docks No. 3 and No. 4)

C. A recent 300-m secondary dock that is 40 m wide with 14.5 m draft connected to land by a continuous, 60-m platform to the storage area (Dock No. 5).

D. “Duque de Alba” for mooring of large vessels (aligned with Dock No. 5).

The Puerto Bolívar Port Terminal also has areas reserved for future development of storage and cargo handling capacity.

Illustration 3. Current Port Terminal Infrastructure Operated by Yilport



Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.2.2 Yards and Warehouses

Port terminal Storage capacity consists of 218,240 m^2 in warehouses and yards.

The open and closed warehouses cover a total area of 26,054 m^2 which is 11.94% of the total storage area and 3.68% total port area (see Table 3).

Open warehouses cover 14,592 m^2 (6.7% of the total), and closed ones cover 11.462 m^2 (5.3%).

Table 3. Storage Warehouses

Name	Area (m2)	Use
Warehouse 1	1,944	General cargo and other products
Warehouse 2	1,993	General cargo and other products
Warehouse 3	2,016	General cargo and other products
Warehouse 4	2,016	General cargo and other products
Warehouse 5	1,140	General cargo and other products
Warehouse 6	324	General Cargo
Warehouse 7	324	General Cargo
Warehouse 8	2,400	Palletized bananas
Warehouse 9	2,400	Palletized bananas
Warehouse 10	2,880	Palletized bananas
Warehouse 11	2,880	Palletized bananas
Warehouse 12	3,694	Palletized bananas and other
Warehouse 13	2,043	General Cargo
Total	**26,054**	

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

The port terminal has 9 yards occupying 192,186 m^2, which is 88.06% of the port area dedicated to storage and 26.7% of the total port area. Surface finishes in the yards may be paved (53.77%) and ballasted (46.23%).

1.2.3 Access Roads

Locally Puerto Bolívar is 10 minutes by highway from downtown Machala. The current system connecting Machala and its port with neighboring areas, production centers, adjacent provinces and the rest of the country is a network in good operating condition.

The main access road to the port is Avenida Bolívar Madero Vargas which, added to Circunvalación Norte and Circunvalación Sur roads, makes up a circulation network that connects the Port Terminal to Av. 25 de Junio and then to the national highway network:

- Crossroad Guayaquil – Machala (Ruta E40 y Ruta E25, distance 197 km, 3h17)
- Crossroad Tumbes – Machala (Ruta E25 y Ruta E50, distance 185 km, 3h)
- Crossroad Cuenca – Machala (Ruta E59 y E50, distance 168 km, time 3h17)
- Crossroad Loja – Machala (Ruta E35, E50 y E25, distance 233 km, time 4h20)

- Crossroad Quito – Machala (Ruta E25 y E87), distance 521 km, time 9h)
- The Puerto Bolívar – Machala – Pasaje – Girón – Cuenca – Paute – Amaluza – Méndez – Puerto Morona highway
- The Puerto Bolívar – Machala – Santa Rosa - Balsas - Chaguarpamba – Loja – Zamora – Yantzatza - El Pangui - Gral. Leonidas Plaza y Méndez route

The port terminal hinterland borders the southern equatorial region, efficiently serving the provinces of El Oro, Azuay, Loja, Cañar, Zamora, the sector closest to the provinces of Guayas and Morona Santiago and northern Peru.

1.2.4 Port Services

Activities performed at the Puerto Bolívar terminal include general services like container handling and specific services like those provided for the banana industry. See Appendix 1 of this document with the complete list of services currently provided at the terminal.

A brief description of the services generally provided by the terminal is provided below. Access and anchoring facility use

1.2.4.1 Use of access facilities and anchorage

Navigability is available for safe vessel entry to the port while offering the use of a safe, protected zone while waiting for a dock, cargo availability or for reasons justified by the competent authority that permits anchoring.

1.2.4.2 Use of docks by ships

This consists of use of docks, apron and facilities of a site to service the ship, craft or naval vessel requested by ship owners, ship agents or their representatives.

1.2.4.3 Full container transfer

Combination of loading or unloading, securing or unfastening, embarkation or disembarkation, internal transport, storage, document issuance for receipt or dispatch of full containers, ship-to-gate, gate-to-ship, ship-to-yard and transshipment container transfer (ship-to-yard-to-ship), and this administration and handling will include all resources and activities necessary to provide such services.

1.2.4.4 General cargo transfers

Includes loading and unloading, securing and unfastening, embarkation and disembarkation, internal transport, storage, document issuance for receipt or dispatch of general cargo (*ship-to-gate and ship-to-yard*) including administration and handling and all resources and activities necessary to provide such services.

1.2.4.5 Banana Cargo Transfer (gate-to-ship)

Combination of activities that includes unloading from land transport, receipt, preparation for embarkation, carriage, embarkation, loading and securing for export bananas not moved in containers.

1.2.4.6 Container Storage

This includes storage for containers which is a retention and custodial service provided by YILPORT for cargo that will remain in fixed storage sites until delivery to the consignee or whoever represents them, or for storage, a service consisting of taking care of the cargo for the period in which it remains in company custody pursuant to current law.

1.2.4.7 General Cargo Storage in the Yard

YILPORT retention and custody service provided for cargo that remains in the fixed storage sites until delivery to consignees or their representatives and for storage, a service consisting of taking care of cargo while it is in custody, pursuant to current law, from the time at which it is received until delivery to the consignee or their representative.

1.2.4.8 Storage of Non-containerized General Cargo in Warehouses

Non-containerized general cargo storage that is the retention and custody service provided by YILPORTECU S.A. for cargo in the fixed storage warehouses until delivery to consignees or their representatives and for storage, a service consisting of taking care of cargo while it is in custody of the company from the time it is received until it is delivered to the consignee or their representative.

1.2.4.9 Storage of Non-containerized General Cargo in Special Warehouses

This is the non-containerized general cargo storage site and is the retention and custody service provided for cargo in special warehouses until delivery to consignees or their representatives; and storage, a service consisting of taking care of the cargo while it is in the custody of YILPORTECUA S.A. which will be responsible for custody of the cargo pursuant to current law from the time it is received until it is delivered to the consignee or their representative.

1.2.4.10 Transfer of Empty Containers

A set of loading and unloading, securing and unfastening, embarkation and disembarkation, internal transport, storage, issuance of reception or dispatch documents for empty containers, including administration and handling and all resources and activities necessary to provide such services.

1.2.4.11 Container Restow

Restow via dock: Set of operational activities and the resources necessary to rearrange cargo that must be moved off the ship to the dock and from the dock to the ship. This service varies depending on the condition of cargo, i.e. full or empty containers with a final disembarkation other than the Puerto Bolívar port terminal, issuance of documents that confirm the new location or loading plans, including administration and handling and all resources and activities necessary to provide those services.

Restow on board: Set of operational activities and the resources necessary to rearrange the cargo that must be moved on board the vessel for operational reasons. This service will vary depending on the condition of the cargo, i.e. full or empty containers.

1.2.4.12 Weighing Vehicles

Set of activities for weighing trucks or other transport vehicles, with or without cargo, using a properly calibrated scale and issuance of documents confirming or certifying the weight recorded, including administration and handling. Includes all resources and activities necessary to provide the services.

1.2.4.13 Container Consolidation and Stripping

Consists of providing operational actions and resources necessary to fill, load and secure any type of cargo in a container and will include issuance of documents that confirm the operation. This service generally consists of:

i. Provide an area within the port to perform these operations.
ii. Receipt of cargo in the area provided prior to beginning the operation whenever legal formalities are complete.
iii. Must include personnel and equipment sufficient to fill the container and secure the cargo inside.

The container stripping service consists of the set of activities related to unfastening, unloading and emptying any type of cargo found within a container and includes issuance of documents that certify the operation. This service consists generally of:

i. Provide an area within the port to carry out these operations.
ii. In case of direct delivery of unconsolidated merchandise, cargo may be delivered on a truck platform of the consignee or, if indirect delivery, the merchandise will enter the warehouse for storage.
iii. The container is received in the area provided prior to beginning the operation only when legal formalities are completed.
iv. There must be sufficient personnel and equipment to empty the container.
v. Cutting/removal of security seals on the containers.

1.2.4.14 Power Supplied to Reefers

Consists of connecting and disconnecting reefers with a power source, provision of electricity and monitoring, including issuance of documents that certify the operation, its administration and handling, and all resources and activities necessary to provide these services.

1.2.4.15 Operation to Appraise or Inspect Non-containerized or Containerized General Cargo

This service consists of providing the facilities necessary for physical inspection of merchandise by the cargo owners, their representatives or corresponding authorities and includes equipment, personnel and areas necessary to perform the operation.

This service applies to the following types of cargo: general cargo (AFG) or containerized (AFC). The latter includes opening the container, possible stripping, filling and closing the container.

1.2.4.16 General Cargo or Container Transport

Internal transport or carriage is general (TPG) or containerized cargo (TPC) movement or transport, including collection or removal, loading and offloading in yards and warehouses carried out within the terminal, including all resources and activities necessary to providing the service.

1.2.4.17 Container Reception and Dispatch

Reception: Action of taking containers of ISO dimensions from a means of land transport, moving them and placing them in their storage or collection site(s), including all resources necessary to provide the service.

Dispatch: This means taking containers of ISO dimensions from their storage or collection site(s), moving them and placing them on a means of land transport, including all the resources necessary to provide the service. Securing the containers on the means of transport is the responsibility of the hauler designated by the end customer.

Hazardous cargo, described as such in the system, which does not bear the corresponding labels (one per container side) is not allowed within port facilities.

1.2.4.18 General Cargo Reception and Dispatch

Reception: Action of taking general cargo from a means of land transport, moving it and placing it in its storage or collection site, including all the resources necessary for providing the service.

Dispatch: This means taking general cargo from its storage or collection site and moving it and placing it on a means of land transport, including all resources necessary to provide the service. Securing the loads on the means of transport is the responsibility of the hauler designated by the end customer.

YILPORTECU receive and deliver cargo at the storage site where they will issue the document of transfer of responsibilities called delivery / receipt certificate wherein the status of the cargo at the time of the exchange is indicated.

No IMO class cargo may enter Yilport without being labeled. At the client's request, the service of labeling the IMO containers or packages may be performed.

No refrigerated cargo may enter YILPORTECU S.A. if it does not have the temperature load issued by the exporter which contains instructions regarding cold chain maintenance and/or preservation of the merchandise.

No refrigerated cargo may enter YILPORTECU S.A. if it does not have the temperature load issued by the exporter which contains instructions regarding cold chain maintenance and/or preservation of the merchandise.

1.2.4.19 Use of Tugboat Facilities

This service consists of placing infrastructure and facilities at the disposal of tugboat operators to provide their services to vessels arriving at the terminal. While at the terminal, tugboats will use only the docks provided for this purpose.

1.2.4.20 Additional Services

YILPORTECU S.A. uses specialized subcontractor companies for operation of the port terminal to provide the services described below.

Ship Port Operators (Operadores Portuarios de Buque – OPBs)

These are companies authorized to provide services to ships. They include handling and carrying out activities to assist vessels for access to, stay at and departure from the port, approach and anchoring zone that are necessary for correct navigation and stay.

Cargo Port Operators (Operadores Portuarios de Carga – OPCs)

OPCs are authorized to provide cargo services consisting of handling and operation of cargo movement and storage in port areas and their related activities.

Port Related Service Companies (Empresas de Servicios Portuarios Conexos – ESCs)

These provide support or accompaniment for port services, including provision of supplies, fuel, cleaning and maintenance, hazardous waste handling, and the like.

The number of outside laborers with the service providers ranges from 900 to 1200, depending on the season and demand for services.

1.2.5 Machinery and Equipment

The following machinery and equipment are utilized in providing port services at the terminal.

Table 4. Machinery and Equipment

Type	Number	Description	Capacity
MHC Cranes	4	Gottwald Mobile Harbor Cranes (MHC)	100 t
Tugboat	1	Jubones	1500 HP per motor (2 motors)
	1	Puna	900 HP per motor (2 motors)
	1	Tomebamba	750 HP per motor (2 motors)
	1	Arenillas	400 HP per motor (2 motors)
Container Ship	1	Container ship	45 t
	4	Container ship	35 t
	1	Container ship	10 t
Terminal Truck	1	Truck and platform	35 t
	12	Truck and platform	30 t
	10	Truck and platform	20 t
Forklift	23	electric	2 t
Carretilla Pallet	21	Carretilla Pallet	1 t
Forklifts	12	Forklift CPQYD 30	3 t
	4	Forklift GP30-G/LP	2.8 t
	46	Forklift 6FGU25	2.5 t
	6	Forklift 5FDC20	2 t

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.2.6 Materials and Supplies

Generally, the materials used for port terminal operation include fuel used for transporting and moving cargo within the terminal, lubricants and additives used for crane equipment maintenance. The remainder of materials used includes office supplies (paper, printer toner, hygiene supplies and others) and those used to maintain working conditions in the terminal, including lights, batteries and various parts.

1.2.7 Waste Management

1.2.7.1 Solid Waste

Management of solid waste generated at the port terminal is handled by a contractor (OPERLIMP S.A.) which performs the following activities:

- Sweeping and collecting waste in buildings and on roads, sorting recyclables from non-recyclables
- Collection of beach waste from dock 1 (dragged by the current from outside the port terminal)
- Recyclable waste, mainly plastic beverage bottles, is manually compacted, packaged and delivered to a recycler.
- The remaining waste (non-recyclable and organic) is taken daily to the municipal landfill by a hauler employed by YILPORTECU.

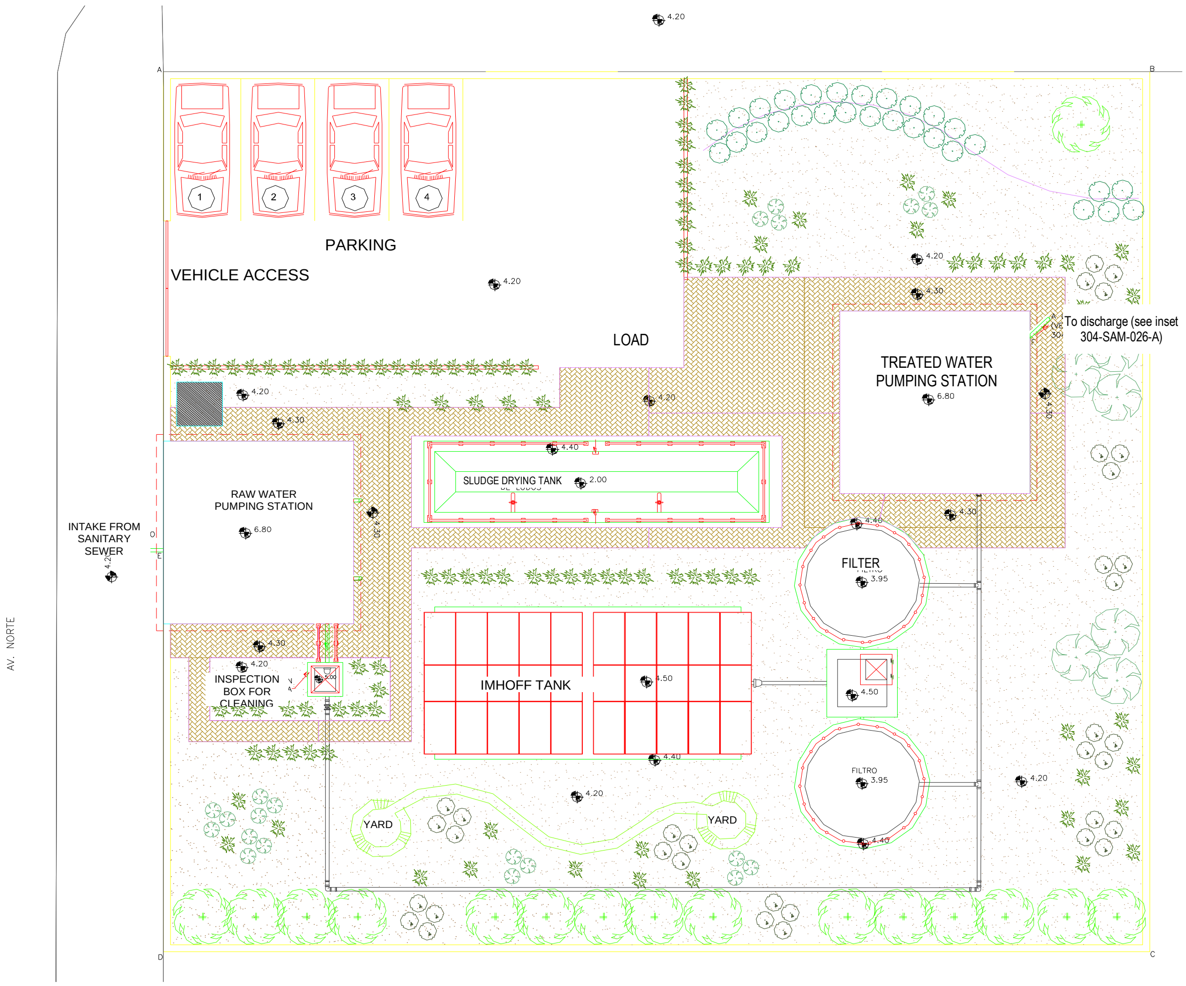
1.2.7.2 Gray Water and Sewage

Wastewater generated by restrooms and toilets as well as the dining room is collected by the wastewater pipe system (as shown in the Hydrosanitary Plan, internal document 304-SAN-002-C) and taken to the current primary treatment plant.

This plant is located in a 728.0-m^2 area and has a collection tank, an IMHOF tank, two wastewater filter tanks and sludge dryer. The wastewater treatment plant (WWTP, PTAR in Spanish) was built in 2009 and was maintained and updated in 2012 and 2013; the facility is fenced with metal mesh with two tube doors and folding metal mesh in good condition. It has two reinforced concrete chambers, the first with bath and three-pump pumping facilities with a raw water tank connected to a pumping system for two pumps with an aluminum and glass partition divider and the other with a clarification system due to lack of liquid chlorine, and a treated water tank. The outside area has an IMHOF chamber with a reinforced concrete tank and lids in a 32-m^2 area where dissolved solids are precipitated, and a sludge dryer with a reinforced concrete tank and a metal structure with a foldable, two-piece metal top, aluminum mosquito netting. The system is complete with two cylindrical gravity tank filters with metal tops.

At the Treatment Plant outflow, wastewater is chlorinated and then piped to the discharge point in the breakwater area of Dock 4.

Illustration 4. Location Diagram of the Primary Wastewater Treatment Plant



Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.2.7.3 Hazardous and Special Waste

For proper management of both liquid and solid hazardous and special waste, Project administration possesses their Hazardous Waste Generator Registry No. SUIA-11-2018-MAE-DPAEO-00446 and has worked on implementing daily logs (for internal hazardous and special waste management and transport); however, they have not yet adopted their own Unique Manifests but use those generated by the authorized environmental agent. This is justified to a degree because of the low hazardous waste generation (see Table 5).

Table 5. 2018 Hazardous Waste Generated

Area Generated	Identification of Waste		Annual Waste Generated		
	Identification of Waste [1]	Key [1]	Year 2018	Year 2019	Year 2020
	Used tires or parts thereof	ES-04			3,728
MN	Unused electric and electronic equipment that have not been disassembled, with components or constituent elements separated	ES-06	0.003	0.002	0.000
MN	Used or spent mineral oil	NE-03	1.045	5.943	5.057
MN	Used lead-acid batteries	NE-07	0.236	0.059	0.000
SAX	Active biohazard waste from medical care provided in company medical centers	NE-10			0.096
MN	Containers contaminated with hazardous materials	NE-27	0.002	0.010	0.181
MN	Personal protective equipment contaminated with hazardous materials	NE-30			0.120
MN	Used mineral oil filters	NE-32	0.300	0.142	0.639
MN	Used or off-spec oil, grease and wax	NE-34			0.150
MN	Lights, bulbs, fluorescent tubes, used power-saving bulbs containing mercury	NE-40	0.023	0.115	0.033
MN	Absorbent material contaminated with petroleum products: wipes, cloth, rags, sawdust, absorbent barriers and other solid absorbent material	NE-42	0.135	0.943	0.698
MN	Absorbent material contaminated with hazardous chemical substances: wipes, cloth, rags, sawdust, absorbent barriers and other solid absorbent material	NE-43			0.250
MN	Oily mixtures, petroleum-water emulsions, cutting fluid waste	NE-45			20.000
MN	Parts of electric and electronic equipment containing electric and electronic assemblies …	NE-46	0.265	0.065	0.000
SAX	Used printer ink or toner cartridges	NE-53	0.072	0.068	0.070

[1] *According to the national list of hazardous and special waste.*

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

The main hazardous waste generated by maintenance activities are MHC crane oil and grease followed by used lead-acid batteries and solids saturated with petroleum.

Hazardous waste management of vessels arriving at the port is handled directly from the storage tanks of the respective vessels to the tanker authorized by the environmental agent within the port terminal without using the Yilport hazardous waste storage facilities.

Specifically for the port terminal, collection of hazardous waste is carried out in three warehouses:

i. Warehouse next to Agrocalidad where electronic and printer toner waste is stored
ii. Hazardous waste warehouse (neighboring the generator area) where varied solid waste is stored (capacitors, batteries, light bulbs, air filters)
iii. Collection Center where liquid waste, grease and oil, solids saturated by petroleum products and oil filters are stored

1.3 New Services

In order to expand their service offerings for the import and export sectors, Yilport is developing new services:

1.3.1 Export of Mineral Concentrates

Mining industry service. Export of sealed containerized copper concentrate is anticipated in a first phase (2019-2021), i.e., the usual container handling with required prevention measures. The option of handling big bags of the material placed in containers is also being considered.

Implementation of rotating containers or rotainers is anticipated in a second phase (2020 and on) to enable bulk cargo in bulk carriers using a spreader that allows flipping the container inside the ship's hold. This technology has a mist system that sprays water particles to avoid raising dust in the environment.

An estimated 136,092 metric tons of concentrate will be moved during the first phase, which represents a monthly load of approximately 12,000 metric tons. Meanwhile in the second phase (beginning in 2022), an increase to 360,000 metric tons annually is anticipated, which represents a monthly load of 30,000 metric tons.

In cases of both containerized and rotainer cargo, no additional infrastructure is required in the terminal to provide the described services other than use of the available storage yards.

1.3.2 Handling Bulk Solids

Yilport may consider building different silos with 45,000 MT capacity for bulk storage and distribution, which would expand up to 75,000 MT if there is demand. Initially dump truck and hopper trucks will be used for horizontal vessel-silo transport (import) changing to conveyor belts later as demand increases.

Open air storage will be used for coal, cement, pet coke or similar bulk products, with tarps for covering if necessary. This will evolve to closed probably dome type silos when justified by demand.

1.3.3 Ro-Ro

Reception and storage of vehicles for southern Ecuador.

2. Port Facility Expansion

The first development phase will strengthen current operational capacity, acquiring new dock and yard equipment, information systems, improved processes and developed of dock length and storage yards. The terminal will increase their annual container capacity to 600,000 TEUs.

The principal characters of the works to be implemented in this phase include:

2.1 Infrastructure

2.1.1 Dock and Maritime Zones

- Dock #6 of 450 m with 16.5-m draft
- Access channel dredged to 14.5 m
- Current storage yards prepared
- Development of new container yards with RTG blocks
- Construction of a refrigerated warehouse for bananas, shrimp and other perishable products

2.1.2 Equipment

- Dock equipment: Acquisition of mobile cranes (MHC) and STS (ship to shore) cranes
- Yard equipment: Incorporation of RTG crane and auxiliary equipment (front loader for empties, reach stackers, tractors with platforms)
- Tugboats: Yilport will supply a new tugboat to improve port operations

In addition, the latest generation of terminal management system technology will be implemented and processes reengineered to improve terminal efficiency. The technology will be described in greater detail in later chapters.

2.1.3 Cold Store

Cold Store of 5600 m^2 with storage capacity up to 3 pallets high that will be constructed in the current reefer yard and will be dedicated to handling and storage of perishable products like banana and shrimp

2.1.4 Services Infrastructure

Generally, in order to ensure operational capacity to provide port services, the following infrastructure will be built at the terminal:

Terminal yard

i. Cleaning and demolition
ii. Yard excavation
iii. Water system piping (potable, sewer, firefighting system)
iv. Electric system cabling
v. Terminal yard fill works
vi. Terminal yard and dock paving
vii. Building area paving

Electric Building and Minor Works

i. Main substation construction
ii. Other substation construction
iii. Light post foundations
iv. Firefighting water tank and pump house foundation
v. Reefer platforms
vi. RTG Sink and settling tank
vii. Gas station
viii. Emergency generator station
ix. Perimeter wall and interior fence

Water Systems

i. Firefighting water tank installation
ii. Pump installation
iii. Tests and drills

Electric Systems

i. Main substation installation

ii. Other substation installation
iii. Light post installation
iv. Tests and drills

Entry Gates

i. Entry gate construction
i. Electric wiring installation
ii. Concrete Works for scales
iii. Scale installation
iv. OCR installation

2.1.5 Machinery and Equipment

Based on the investment plan and purchases completed, the following equipment will arrive at the terminal:

Table 6. Machinery and Equipment to Arrive

Type	Number	Description	Capacity
STS Cranes	2	Ship to shore Cranes	22 lines
	4	Ship to shore Cranes *	24 lines
RTG Cranes	18	Rubber tired gantry cranes **	
ECH Cranes	2	Electric chain cranes	
RS	2	Front loader (reach stacker)	
Tractor	1	Terminal tractor tra*iler*	
Remolcador	1	Tugboat	

**2 units are in advance of Phase II.*
*** 6 units are in advance of Phase II.*

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

2.2 Project Life Cycle

The project was conceived for a 50-year life cycle.

2.3 Work Methods

The Dock 6 Construction Project contractor's work methodology is described below. Details of the work method are in Appendix 7.

2.3.1 Camps and Temporary Works

The following facilities are anticipated during the project construction phase:

- Offices for operational personnel, employer and engineer
- Cafeteria for workers
- Bathrooms and dressing rooms
- Storehouses
- Temporary piling and prefabricated concrete element storage
- Hazardous waste dump with its respective dikes and roofs
- Storage areas
- Fuel and electric plants
- Cement plant for elements cast on site

- Concrete and aggregate sampling laboratory

Offices will be built for the consortium with all their facilities, including all services like electricity, telephone, internet, heating, hygiene services, etc., as well as furniture of a quality that will last for the entirety of the Project.

Preliminarily, a modular 20’ container was proposed as a solution for the offices.

The areas for the Contractor, Employer, Engineer and Subcontractors will also be equipped with bathrooms and showers for administrative personnel. In addition, all operational support areas must be equipped with sanitary facilities.

All work areas must have chemical toilets taking into account that there is a considerable distance from those points to principal facilities, which includes area of maritime work (platform and barges).

Specifications for all toilets and clothing changing facilities are anticipated as follows:

- Containers for shower and bath
- Main area: 7 units (men) + 1 unit (women)
- Prefabricated yard: 1 unit
- Steel yard: 1 unit
- Laboratories area: 1 unit

Bathroom containers (male and female)

- Contractor area: 2 units;
- Employer area: 1 unit;
- Engineer’s area: 1 unit;
- Subcontractor area: 1 unit.

Showers

- Contractor area: 1 unit;
- Employer area: 1 unit;
- Engineer’s area: 1 unit;
- Subcontractor area: 1 unit.

Dressing room facilities

- Principal area: 1unit (female) y 6 units (male)

Workforce Housing

Housing is planned for administrative and operational personnel in the city of Machala near the Project area, taking into account hotel infrastructure and possible dwellings that would serve as accommodations for foreign personnel.

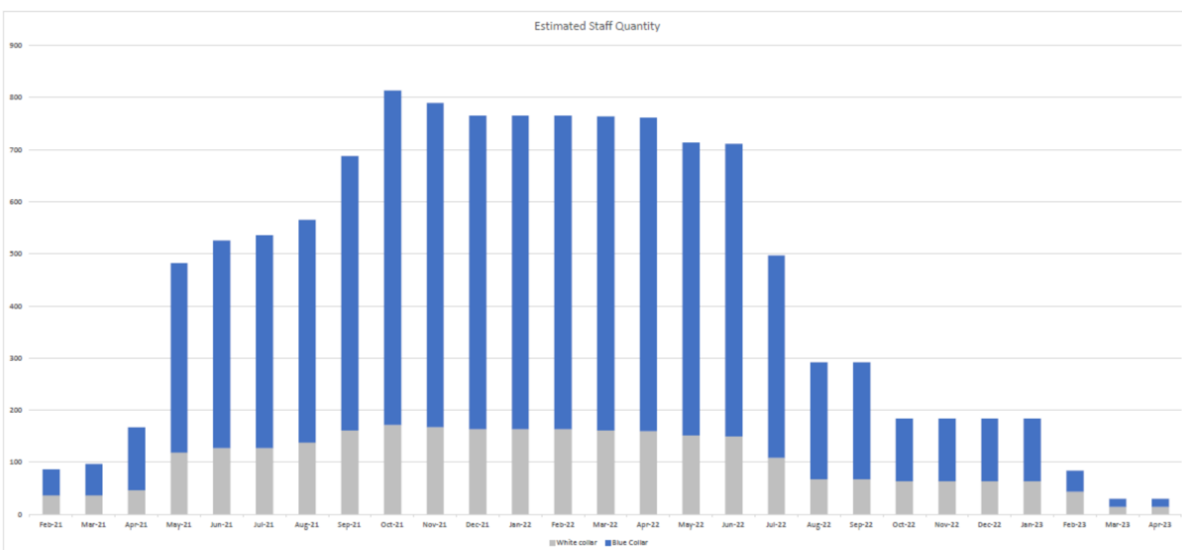
2.3.2 Resource Use for the Construction Stage

2.3.2.1Labor

The labor estimate for the construction stage is shown in Illustration 5. Estimated Labor for the Construction Stage. The stacked bars show the number of blue collar workers (laborers) and white collar workers (technical chiefs and administrative workers)

The peak labor demand is estimated between the months of September 2021 and June 2022.

Illustration 5. Estimated Labor for the Construction Stage



2.3.2.2 Water

Estimated water use is19,000 m^3 during the construction stage.

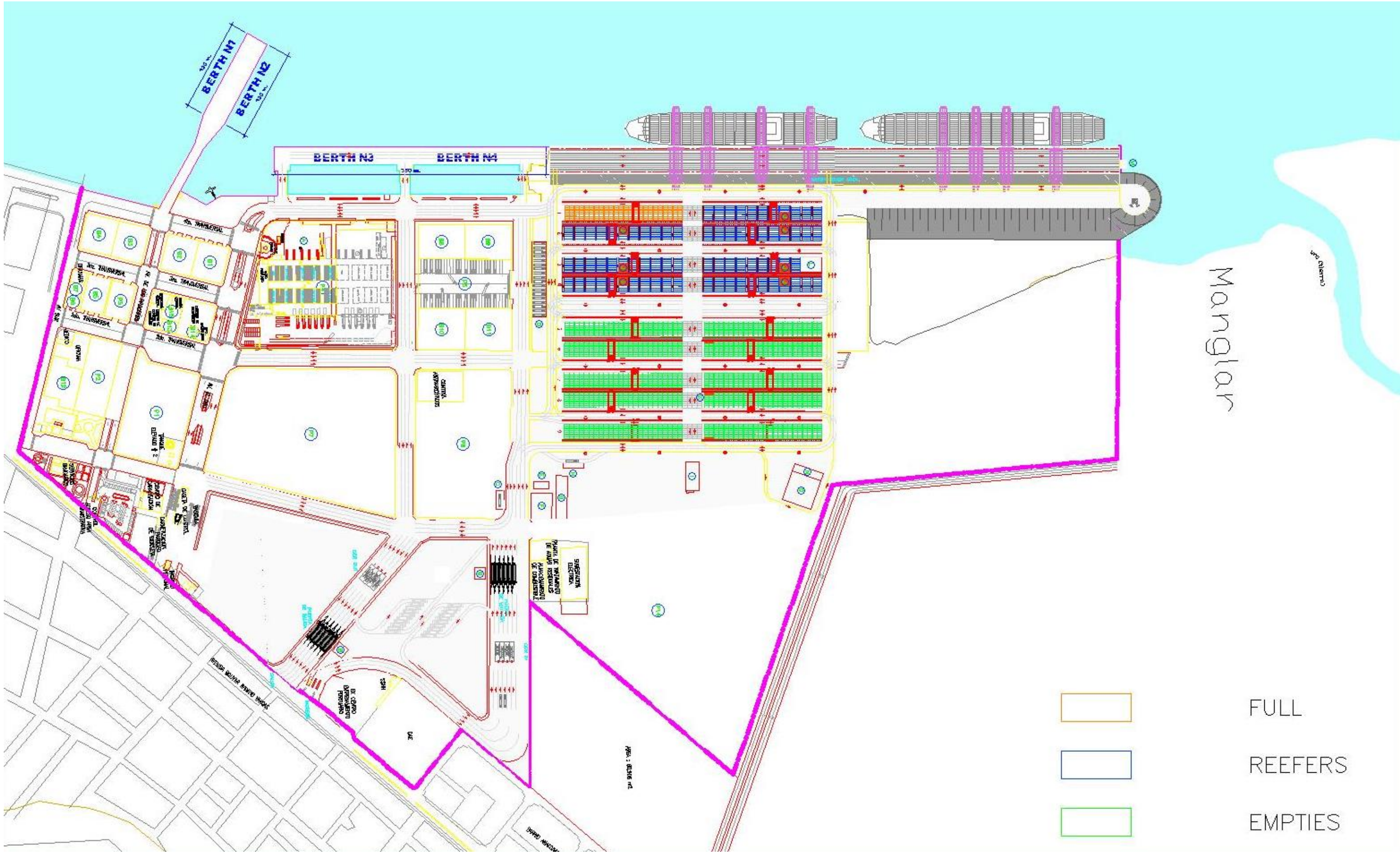
2.3.2.3Electricity

Estimated electricity use is 2,460,000 kWh

2.3.3 Schedule of Construction Activities

The Project execution plan and estimated schedule of the Construction Project Contractor for Dock 6 is shown in Appendix 8.

Illustration 6. Pto. Bolívar - Phase 1 Project Implementation Diagram



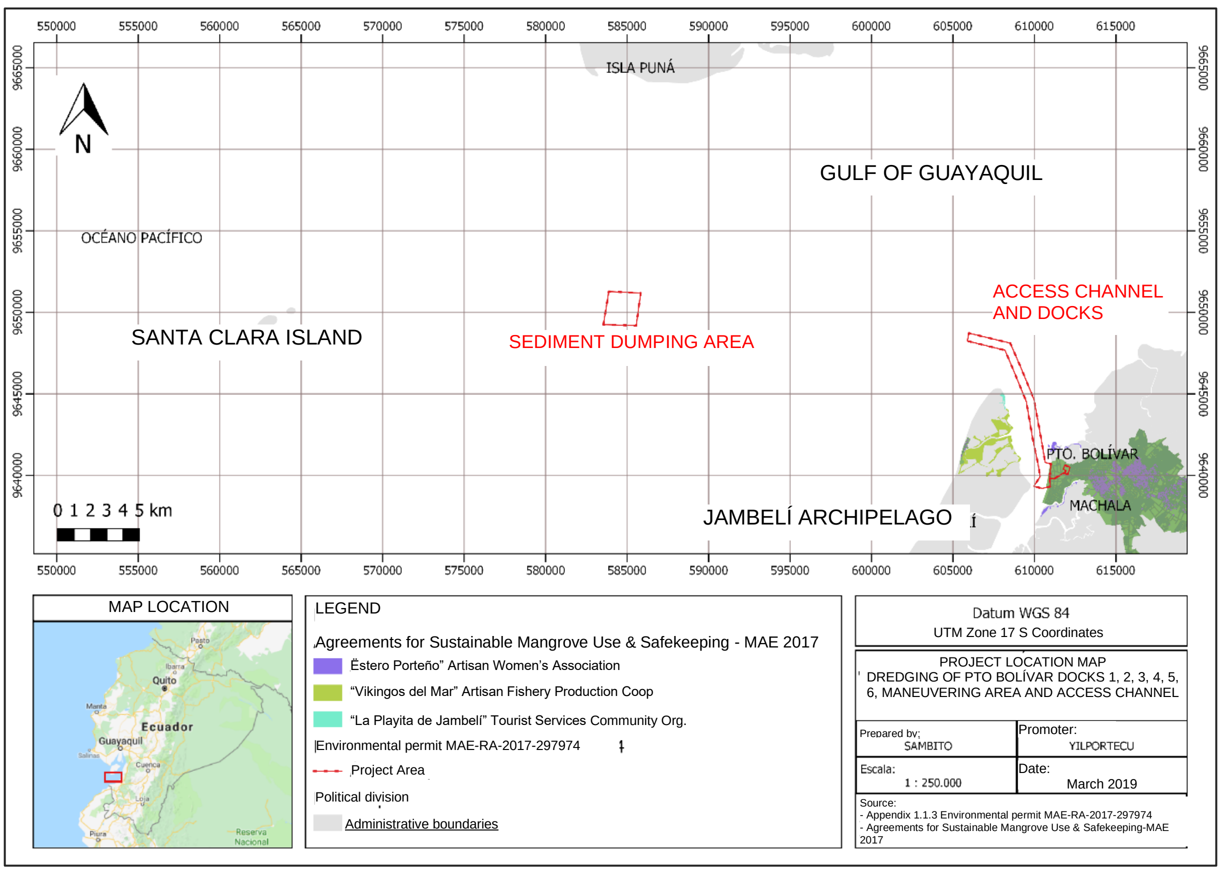
Source: Yilportecu S.A.

3. Project Progress

3.1 Dredging of Puerto Bolívar Docks 1, 2, 3, 4, 5 and 6, Maneuvering Zone, Access Channel

The dredging project includes dredging docks 1, 2, 3, 4, 5 and 6 (9.0 ha) and dredging the maneuvering zone and the port access channel (473.57 ha). The area located in the Santa Rosa Estuary corresponds to the navigation axis line to reach the Puerto Bolívar Maritime Terminal as well as an area for ship anchorage and maneuvering.

Illustration 7. Location of the sediment dumping basin at sea



Prepared by: Ecosambito, 2020

Illustration 8. Dock Dredging Area

Source: (ECOSFERA CÍA.LTDA., 2017)

Photograph taken with MAVIC drone (7 km transmission range, flying speed 64km/h)

Prepared by: *Ecosfera Cia. Ltda., 2017*

Location: *Puerto Bolívar – Machala, El Oro*

Date: *28 April 2017*

Dredging Area ______

Illustration 9. Dredging Area in the Maneuvering Zone

Source: (ECOSFERA CÍA.LTDA., 2017)

Photograph taken with MAVIC drone (7 km transmission range, flying speed 64km/h)

Prepared by: *Ecosfera Cia. Ltda., 2017*

Location: *Puerto Bolívar – Machala, El Oro*

Date: *28 April 2017*

Dredging Area ______

Illustration 10. Dredging Area of the Access Channel

Source: (ECOSFERA CÍA.LTDA., 2017)

Photograph taken with MAVIC drone (7 km transmission range, flying speed 64km/h)

Prepared by: *Ecosfera Cia. Ltda., 2017*

Location: *Puerto Bolívar – Machala, El Oro*

Date: *28 April 2017*

3.1.1 Stages Completed and Volume Dredged

Progress of dredging project is described below:

i. First dredging period completed from March 29 through May 31, 2018

iii. The second dredging period was carried out from April 10, 2019 through Mary 31, 2019

The volume of sediment removed during the first and second stages of Phase I is shown in Table 7.

Table 7. Dredging Progress During the AAC Assessment Period (Phase 1)

Areas	Initial Design Volumes (m^3)		Volume Dredged (m^3)	
	Design Rev 01 pending 1/6	Over-dredged Design Rev01 pending 1/6	Phase I First Stage	Phase I Second Stage
DOCK 1	72,644.7	80,886.2		
DOCK 2	28,584.9	30,316.2	7,428.0	11,564.5
DOCK 3	95,775.4	104,858.0	99,859.1	32,679.5
DOCK 4	63,160.6	70,952.8	66,646.4	19,748.3
DOCK 5	99,502.0	111,876.3	104,755.7	28,637.6
DOCK 6	461,419.5	516,798.4	203,729.3	78,448.4
TURNING AREA	1,231,522.5	1,507,364.3	1,131,061.6	273,589.1
INTERNAL CHANNEL	1.863.196,1	2.180.637,4	1.869.410,3	733.288,1
EXTERNAL CHANNEL	3,677,720.9	4,192,796.4	3,785,636.5	1,386,146.8
TOTAL (m^3)	**7,593,526.6**	**8,796,486.0**	**7,268,526.9**	**2,564,102.3**

Source: COMPLETED WORK TECHNICAL REPORT, DREDGING WORKS PHASE I – SECOND STAGE Puerto Bolívar Port Terminal, Flanders Dredging Corporation 2019.

3.1.2 Sediment Dump Basin

3.1.2.1 Dump Basin at Sea

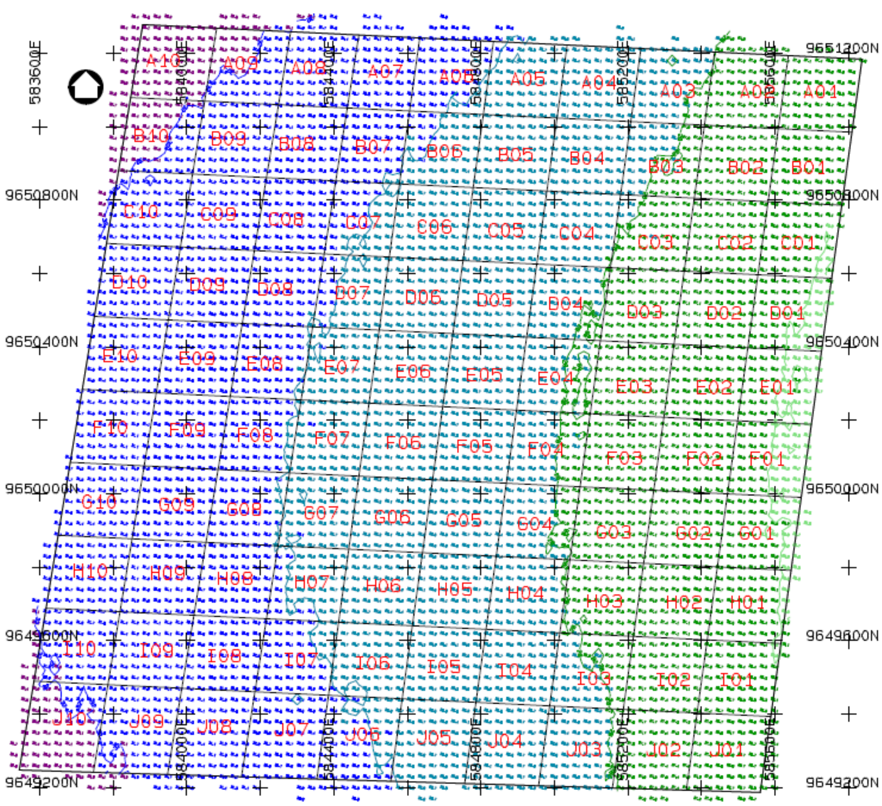
The dump site is located in the Jambelí Channel in the Gulf of Guayaquil located 13.75 nautical miles from the original Access Channel Ocean Buoy alignment and heading 274° RV (true course) where depths range from 26.0 m to 32.0 m and covers an area of 4 km^2. To date all sediment extracted in the first and second stage of Phase 1 dredging is dumped at this site.

The dump area, based on dynamic characteristics of the area such as current speeds, wind, tide, depths and the like, can easily receive the material dredged from the dock area, maneuvering area and access channel, ruling out any impact around the entire area of influence.

An area divider every 200 meters was defined for dumping the dredged material in order to determine a discharge plan for each dredging run and the process will consist of dumping the sediment in each grid defined by coordinates (number, letter), thus ensuring a uniform and equal distribution of material throughout the area, avoiding accumulation of this material at a single site, which was controlled by periodic bathymetric measurements in order to adjust the dumping plan based on those results, if necessary.

The methodology of dumping the material by cells also aids in avoiding possible accidents among dredgers that sail to the site simultaneously. Illustration 11 shows the scale of the division diagram for distribution of the material in the dump area.

Illustration 11. High Seas Sediment Dump Area



Source: FDC Insurvey Dump Area.

3.1.3 Sediment Pools

Sediment pools cover an area of approximately 12.9 hectares located northeast of the port terminal at the old sites of the ISSFA.

However, as anticipated in the Project EIA, these pools have not been used for the purposes described, and technical assessments completed (SURCONSUL, 2017) demonstrate the potential risk of seepage in the east wall of Pool No. 2, that is bordered by an informal urban settlement installed as a result of grading and filling the land where it is located.

These pools are unused and allow an accumulation of rainwater during the winter season.

Photograph Record 1. Sediment Pool Area

General view of sediment pool no. 1

General view of sediment pool nos. 1 and 2

General view of sediment pool no. 3

Source: Yilportecu S.A.

3.1.4 Dredging Methodology

Dredging project activities completed include:

i. **Dredging Preparation -** includes maintenance activities on all equipment (dredgers, pump bank, pipes, couplings, and the like) following manufacturer recommendations to ensure the equipment operates correctly and to reduce their contribution of pollution to the environment as much as possible. The maintenance on mobile equipment must take place at authorized sites that have the respective control equipment and final disposal of waste generated. Pipe maintenance will be planned depending on the dredger operation. Lubricating oil will be changed every 500 hours of work for principal machinery as well as generators, or according to maintenance required by the manufacturer. Used oil generated due to general maintenance of the dredger will be stored in air tight metal containers with later final disposal carried out.

ii. **Fuel Supply** - This operation will be carried out directly with the dredger at the work site, assisted by boats used for this activity. The fuel supplier shall have a contingency plan for oil and gas supply.

iii. **Dredging and storage of sediment material in hopper -** Suction pipes descend to the bottom of the water and their heads are "dragged" over the seabed, suctioning material while the vessel slowly advances (dragging). The dredger head, finally connected to the lowest part of the suction tube, sucks the dredged sediment using teeth and/or water under pressure. The dredger may use different types of heads, depending on floor conditions. A submerged dredging pump pumps the mixture of water and sediment from the seafloor to the hopper, and if required, from the hopper to land. The hopper, which is the ship's hold, receives the mixture and allows evacuation of excess water through the overflow system. The dredged material stays in the hopper during transport until it is dumped.

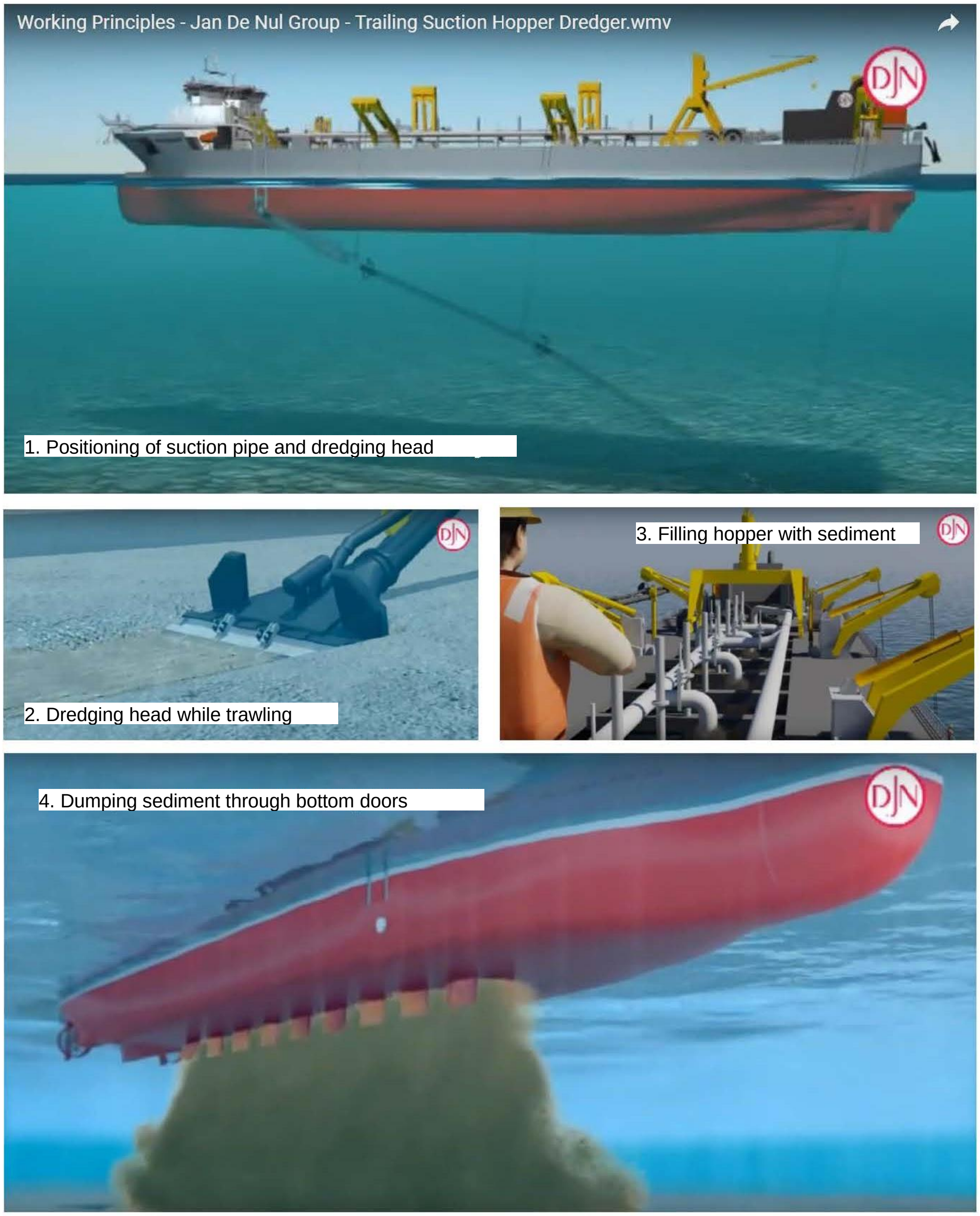
i. **Sailing to the designated point for the dump area on the high seas -** As described in the previous section, sediment is dumped using geo-referencing in the sub-area assigned for the dredger being operated. Once the hoppers are filled with extracted sediment, the ship raises its dredger system (head) to then sail to the sediment dump point indicated in the section.

ii. **Disposal or dumping dredged material (sediment) on the high seas -** Once the hoppers are filled with extracted sediment, the TSHD type dredger raises its dredger system (head) to then sail to the sediment dumping point indicated in the previous section, and once at the site, the dredger opens its discharge doors on the bottom. Once the hoppers are emptied, the vessel returns to the dredging site to begin a new operating cycle.

iii. **Control Bathymetry** - To verify compliance with the level to be reached by the dredging activity, bathymetric measurements are taken at the sites that have been dredged; if the results of the engineering study show that the expected level was not reached, the dredging process must continue.

Illustration 12 shows a graphic representative of the dredging process.

Illustration 12. Sediment Dredging and Dumping Process

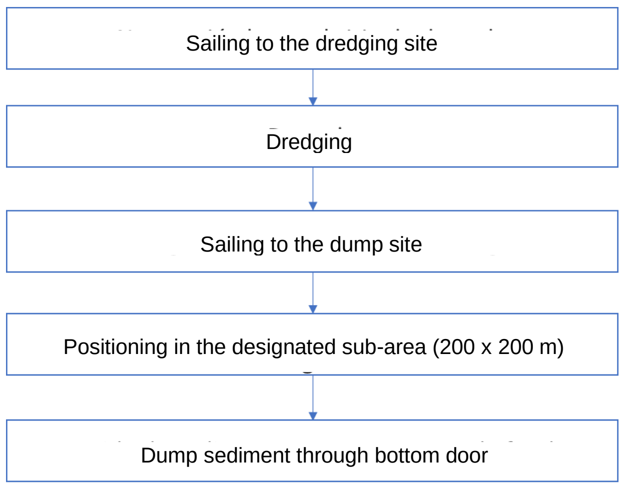


Source: Working Principles - Jan De Nul Group - Trailing Suction Hopper Dredger.wmv, available at https://www.youtube.com/watch?v=shxlh0gFgLw

Prepared by: Ecosambito, 2020

Illustration 13 shows schematically the flow of activities in carrying out dredging

Illustration 13. Flow Diagram of Dredging Activities Carried Out



Source: Document No. FDC1819.MES.81.01.e.01 Method Statement Dredging Operations
Prepared by: ECOSAMBITO C.LTDA.

3.1.5 Sediment Dispersion Model

Sediment dispersion modeling carried out as part of the Environmental Impact Assessment for environmental regularization of the Project considered horizontal and vertical movement of particles by tidal action that affects each level of depth, stratifying three levels:

- 0 – 9 m (surface layer)
- 9 – 18 m (middle layer)
- 18 – 27 m (bottom layer)

It was concluded, based on the results of the sediment dispersion modeling, that the area required for settling fine material under extreme and conservative tidal conditions would not interfere with the activities related to use of the water resource on the shoreline near the dump site area, such as shrimping, since the sediment would move as follows:

- a distance of 1.48 km from the dump site when the tide is in a state of flow at the surface level
- 1.46 km for fine sediment at the mid-level depth

- 1.84 Km at the bottom level due to the characteristics of fine sediment

Similar behavior is evident when modeling the ebb tide state, demonstrating approximate fine sediment displacement of about 6.02 km from the dump site.

3.1.6 Project Life Cycle

The Project to dredge Docks 1, 2, 3, 4, 5 and 6, maneuvering zone and Puerto Bolivar access channel has a life cycle defined by the volume of sediment accumulated in the areas dredged.

Table 8 shows the dredging activities and execution times for each area defined based on type and capacity of the dredger used.

Table 8. Project Life Cycle

Activity	Completion Period	Dump Site	Volume (m^3)
Dock 6	**	Jambelí channel	71,192.40
Maneuvering zones	**	Jambelí channel	1,840,482.60
Access channel	**	Jambelí channel	4,131,787.30

* *Dredging is not carried out from June to October because it is a period when humpback whales (Megaptera novaeangliae) travel through and reproduce.*
Prepared by: ECOSAMBITO C. Ltda.
*** Depends on the type and capacity of the dredger used.*

The Project was planned for completion in two stages, in one of which dredging is performed to a level of 14.5 m MLWS with respect to the level of the syzygy tide and a width of 200 m on the bottom while in the stage 2 dredging will go to a level of 16.5 m MLWS with respect to the syzygy tide and a width of 270 m on the bottom.

As mentioned, new dredging in these areas is anticipated in 2023 among the Port Terminal maintenance operations based on the level of sedimentation detected during future measurements.

3.1.7 Machinery and Equipment

The trailing suction hopper dredging (TSHD) underway is classified as hydraulic dredging and includes dredging equipment that utilizes centrifugal pumps, at least for the dredged material transport process while removing it out of the water or transporting it horizontally to another site. TSHDs are used for a large variety of maritime construction and maintenance projects, such as maintenance dredging in ports and access channels, removing sediment to achieve the required depth. It is used primarily to dredge loose material like sand, clay or gravel.

Normally, a TSHD is equipped with one or two suction pipes to which suction heads are connected that work like huge vacuum cleaners.

The main parts of this type of dredger are:

- Standard installation on the ship: motors, cabins and navigation bridge
- Dredger head connected at the end of the lowest part of the suction pipe
- Submerged dredging pump
- Suction pipe and piping on deck by which the mixture is transported
- The hopper, which is the ship's hold

The main technical characteristics of the THSD dredgers participating in the Project are shown in Table 9.

Table 9. Technical Specifications of THSD Dredgers

Technical Specifications	**Filippo Brunelleschi**	**Pedro Alvares Cabral (PAC**	**Charles Darwin**
Hopper capacity:	11,300 m³	14,000 m³	30,500 m³
Deadweight:	18,620 ton	26,530 ton	54,140 ton
Overall length:	142.5 m	147.8 m	183.2 m
Beam:	27.5 m	30.0 m	40.0 m
Draft with cargo:	9.1 m	11.20 m	13 m
Maximum dredging depth:	38 / 57.5 / 77 m	43.8 / 52 m	93.5 m
Suction pipe diameter:	1,200 mm	1,300 mm	2 x 3,400 kW
Pump power (trailing):	3,400 kW	4,000 kW	2 x 3,400 kW
Pump power (discharge):	7,500 kW	8,500 kW	15,000 kW
Propulsion power:	2 x 5,750 kW	2 x 7,200 kW	2 x 10,800 kW
Total installed diesel power:	13,110 kW	15,960 kW	23,600 kW
Speed:	15.3 kn	15.7 kn	16 kn
Accommodations:	34	33	42
Built in:	2003	2012	2011

Source: Technical Specifications, available at:
- https://www.jandenul.com/sites/default/files/equipment-item/pdfs/01.tshd_en_-_v2013-2_-_pedro_alvares_cabral.pdf
- https://www.jandenul.com/sites/default/files/equipment-item/pdfs/01.tshd_en_-_v2013-2_-_filippo_brunelleschi_0.pdf

- https://www.jandenul.com/sites/default/files/2020-10/Charles%20Darwin%20%28EN%29.pdf

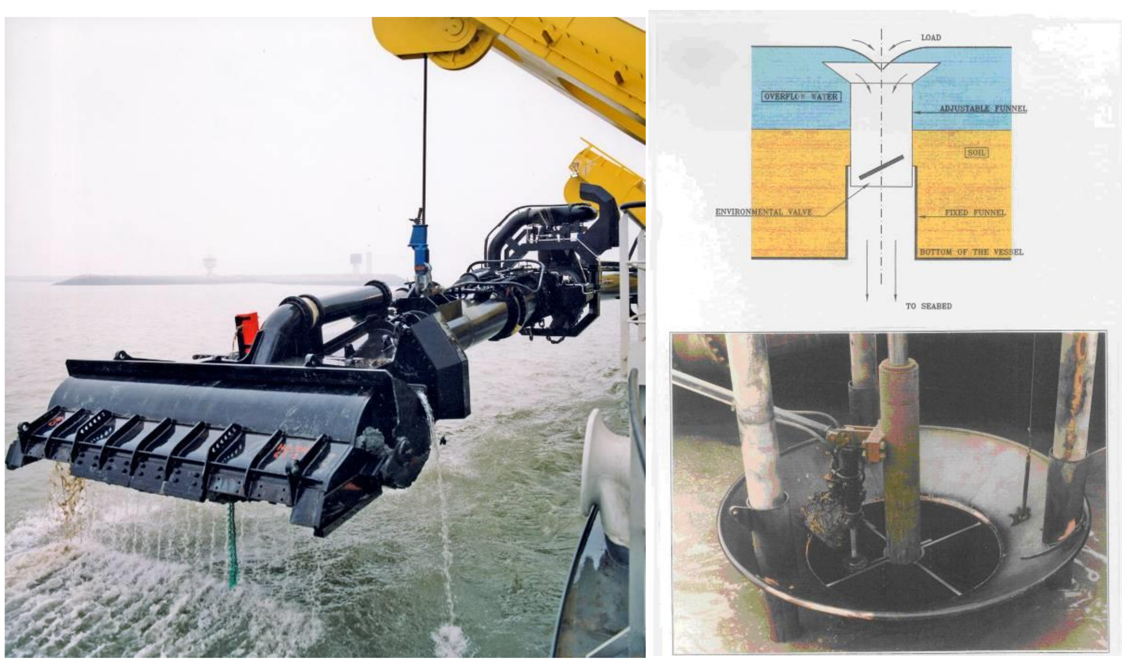
Prepared by: Ecosambito, 2020

Movement of these vessels does not represent an obstacle for others transiting the navigation channel because the dredgers described have their own propulsion and autonomous movement.

The dredging operation is carried out using the following systems: winches, cables and pulleys, hydraulic jacks, pumping system (electric motor and pump), suction system (head and injectors), water under pressure, and hopper doors.

TSHD dredgers that participated in the dredging have overflow funnels (vertical pipes within the hopper used to drain excess water from the hopper through the keel and thus maximize the load in the hopper) with an anti-turbidity valve or “green valve” which is a hydraulic valve installed within the overflow and drastically reduces turbidity caused by excess water drained through the overflow funnels by containing the flow of the mixture entering through the funnel. Thus the height from which it falls into the water is diminished, reducing the amount of air mixed in the overflow and reducing suspension of fine particles (see Illustration 14).

Illustration 14. Dredger Vessel Equipment



Dredger Head *Overflow and "green valve"*

Suction pipe *Sediment Hopper*

Source: Document No. FDC1819.MES.81.01.e.01 Method Statement Dredging
Prepared by: Ecosambito, 2020

Photograph Record 2. General view of the Pedro Alvares Cabral *dredging vessel anchored at Posorja*

Source: Yilportecu S.A.
Location: Pedro Alvares Cabral dredging vessel, Posorja – Guayas, 04 February 2019

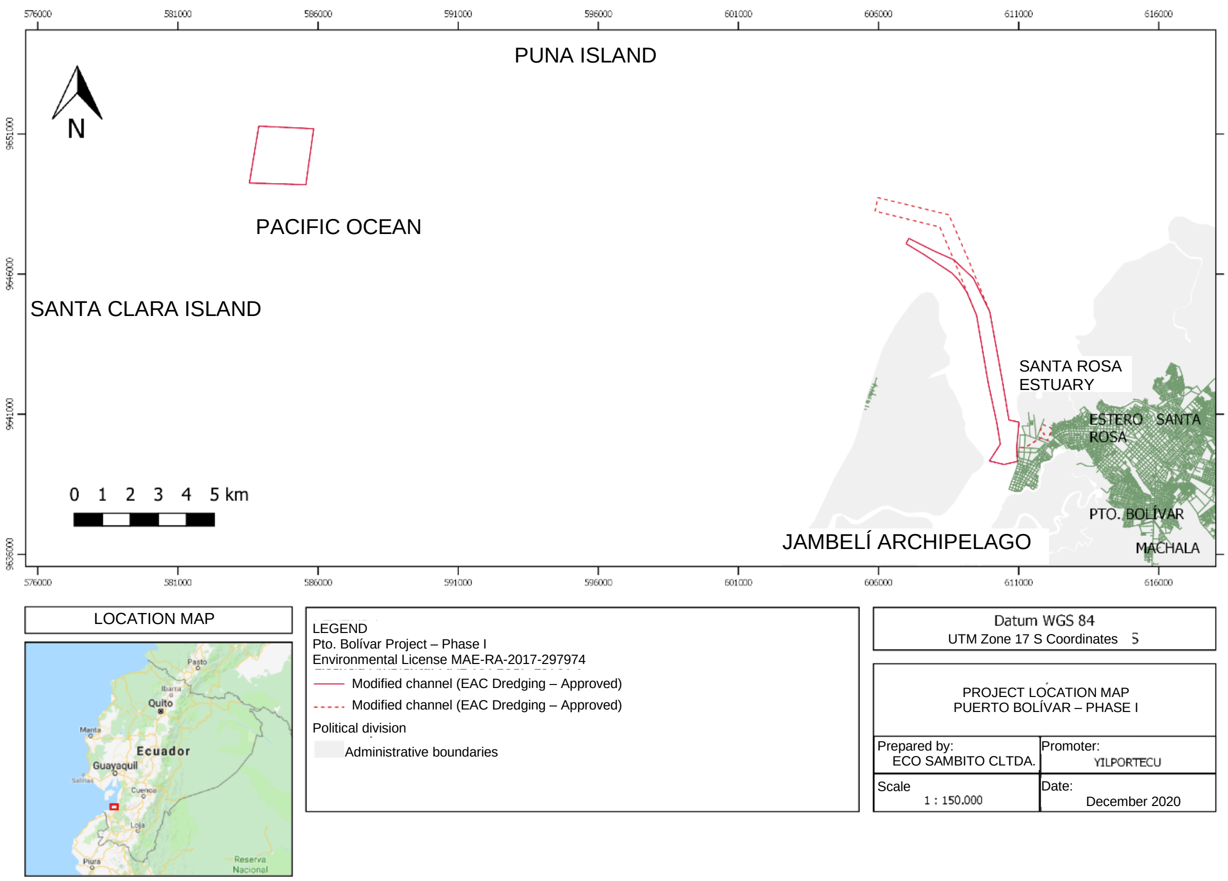
3.2 Modifications to the Dredging Project

Based on sedimentation studies completed by the Dredging Project technical advisor (Royal Haskoning N.V.), YILPORTECU submitted a Complementary Environmental Study (Estudio Ambiental Complementario – EAC) to the Ministry of the Environment (under code MAE-RA-2019-440688), the objective of which was the following modifications to the current Environmental License:

- Change in the navigation channel axis
- Elimination of sediment pools on land from the entire Project area

These changes are reflected in the Project implementation area (see Illustration 15) and the list of coordinates in the area involved (see Table 10).

Illustration 15. Map of the Modified Area Involved in the Previous Complementary Environmental Study



Source: COMPLEMENTARY ENVIRONMENTAL IMPACT STUDY "DREDGING OF PUERTO BOLÍVAR DOCKS 1, 2, 3, 4, 5 AND 6, MANEUVERING ZONE AND ACCESS CHANNEL" PROJECT.

Prepared by: Ecosambito, 2020

Table 10. Coordinates of the Modified Area Involved

ID	X	Y
1	610956	9639311
2	610478	9639203
3	609957	9639327
4	610347	9639925
5	610216	9640713
6	609917	9642098

ID	X	Y
7	609498	9644527
8	609145	9645361
9	608856	9645786
10	608625	9646030
11	607618	9646698
12	606983	9647082
13	607082	9647271
14	607989	9646818
15	608686	9646508
16	609387	9645842
17	609970	9644652
18	610433	9642109
19	610654	9640792
20	611014	9640712
21	610931	9639816
22	610931	9639814
23	610956	9639311
1	583544	9649248
2	583880	9651278
3	585837	9651184
4	585560	9649187
5	583544	9649248

Source: COMPLEMENTARY ENVIRONMENTAL IMPACT STUDY “DREDGING OF PUERTO BOLÍVAR DOCKS 1, 2, 3, 4, 5 AND 6, MANEUVERING ZONE AND ACCESS CHANNEL” PROJECT.

Prepared by: Ecosambito, 2020

The EAC is approved by the Ministry of the Environment and Water (Ministerio del Ambiente y Agua – MAAE), and assignment of the Facility by the MAAE is pending to carry out the Citizen Participation Process.

3.3 Dredging Management Plan

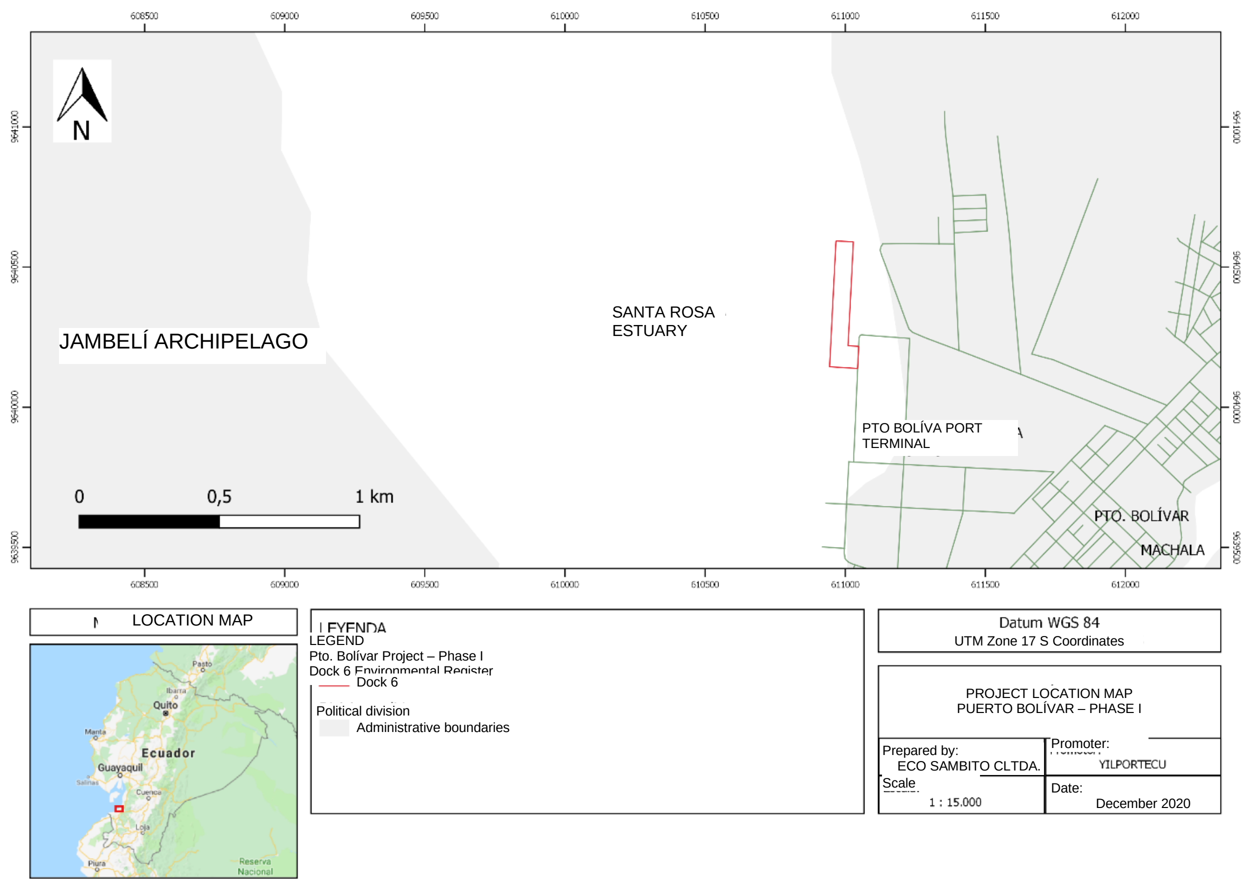
Details of the Dredging Management Plan carried out by the contract company in the dredging activity are found in Appendix 9 and Appendix 10.

3.4 Dock 6

This 450-m dock, designed to receive Post-Panamax vessels, will be connected directly with the current Dock 5 and will be used for container storage and handling.

This new dock will increase the annual container handling capacity to 900,000 TEUs. Moreover, the container yard capacity will be expanded to provide room for them.

Illustration 16. Map of Dock 6 Emplacement Area



Source: Yilportecu S.A.

Prepared by: Ecosambito, 2020

Facility and equipment expansion will be planned based on the amount of demand and its requirements.

3.4.1 Characteristics

The dock's structural configuration is based on a concrete platform supported by steel pilings. The structural configuration is based on lengthwise and crosswise beams to provide sufficient strength to receive container ships with a 197,000-ton deadweight.

The total length of the dock is 450 m and is considered in five 90-m segments which are connected crosswise with each other using shear keys. Total dock width is 62 m.

Structural arrangement of the platform was completed based on anticipated operations and expected cargo including:

- General cargo, containers and bulk cargo using MHC Mobile Port Cranes and small pneumatic unloaders
- STS (ship-to-shore) cranes used for container handling
- Earthquake loads

Piling location must follow in principle the location of large cargos and that control the design.

Ship-To-Shore cranes are normally the equipment causing the greatest off-loading reactions and determine piling alignment position. With a 2.75-m edge beam and rail separation of 30.48 m (100 feet), these rows of pilings must be perfectly defined (with uniform spacing). There are 5 bays of pilings between rails. Therefore, transverse spacing is 30.48/6 = 6.096 m.

Lengthwise spacing of the pilings was defined as 3.0 m for pilings located in the position of the rail beams and 6.0 m for other positions.

The platform over the pilings was designed with the principal beams spaced lengthwise over each line of pilings. The lengthwise beams are 1.50 m high with a variable width of 1.8-m at the lowest point and 2.8 m at the highest. However, these sizes may be modified during final design before building the works.

The 1.5-m height is related to the beam capacity to take vertical loads from the platform while a variable thickness is related to the reduction of the transverse span of the slabs. A slab of 0.60 m is considered between lengthwise beams. Position of the lengthwise beams assures vertical load transmission to the pilings, transverse loads are only required for specific loads such as mooring and berthing loads or to improve capacity of the structure transversally.

In terms of docking loads, it is necessary to consider a transverse beam between the axis on the ocean side of the platform and the first row of pilings. The objective of this is to provide support for defense and transmit loads to the structure.

The function of the shear keys is to avoid differential transverse displacements between dock segments causing mis-alignment between the rails of the STS cranes. Transverse displacement tolerance in the expansion joint is 0.30 m in order to prevent separation of the structural bodies crashing against each other during an earthquake.

Four shear key connections to allow the shear (horizontal loads) to be transferred through the joints and to connect the structures. This load transfer transversally ensures that the different structures work together and have the same horizontal displacement when they are subject to large horizontal loads that can occur during an earthquake. Each shear key consists of one tongue and groove connection.

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5. Appendixes

APPENDIX 1. List of Port Services

APPENDIX 2. Environmental Impact Assessment of the “CONSTRUCTION AND OPERATION OF THE PUERTO BOLÍVAR PORT TERMINAL, OPERATED BY YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.” Project

APPENDIX 3. Environmental Impact Assessment of the “DREDGING OF PUERTO BOLÍVAR DOCKS 1, 2, 3, 4, 5 AND 6, MANEUVERING ZONE AND ACCESS CHANNEL” Project

APPENDIX 4. Environmental Registration of the “CONSTRUCTION, OPERATION AND ABANDONMENT OF PUERTO BOLÍVAR PORT TERMINAL DOCK # 6” Project

APPENDIX 5. Environmental Audit of the “CONSTRUCTION AND OPERATION OF THE PUERTO BOLÍVAR PORT TERMINAL, OPERATED BY YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.” Project

APPENDIX 6. Environmental audit of the “DREDGING OF PUERTO BOLÍVAR DOCKS 1, 2, 3, 4, 5 AND 6, MANEUVERING ZONE AND ACCESS CHANNEL” Project

APPENDIX 7. JV PBO 4.2.1 l) Arrangements & Construction Methods Statements

APPENDIX 8. Execution Plan and Schedule

APPENDIX 9. FDC6808.MES.01.01.e.00-Method Statement

APPENDIX 10. FDC6808.MES.61.01.s.01-Survey Method Statement

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– ANALYSIS OF ALTERNATIVES –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

This document provides an assessment of the proposed alternatives for the existing docks and access channel dredging projects at the Port Terminal, and for expansion through construction of dock 6.

The Integrated Value Model for Sustainability Assessment (MIVES, in Spanish) with significant characteristics such as consistency, facility, use, efficiency, multi-criteria and assessment of heterogeneous alternatives is outlined to that purpose.

On developing the method, it arises the decision tree with economic, environmental and social requirements, each one of which is broken down into indicators enabling to assess the performance of the alternatives in these aspects. To that effect, weights are established for all decision tree levels, and value functions allowing to transform, ratings by attributes, to value functions between 0 and 1. By bringing together the value results of each indicator, a Sustainability Index (SI) is obtained. The greater the SI, higher is the sustainability of the analyzed alternative.

The results show that the sediment deposit dredging alternative in the open sea is the one that has obtained the greatest sustainability index due to lower maintenance costs of this alternative. Therefore, the dock construction and operation alternative with steel piles is the one that has obtained the greatest sustainability index due to lower investment costs of this alternative.

ANALYSIS OF ALTERNATIVES

The analysis of alternatives is carried out for future projects planned to be implemented in the Port Terminal, both in the access channel maintenance dredging, maneuvering zone and docks, and in the construction of the sixth dock of the Terminal.

To select one alternative from the several ones raised when conceptualizing a project, it is necessary to identify the mechanisms leading to a rational decision-making, through criteria being important for the decision maker and/or its stakeholders.

There are multiple mechanisms to perform this type of analysis. The role of the analysis techniques available for the decision making is to overcome the difficulties encountered by the decision-makers in handling great amounts of complex information, consistently. These techniques must be associated with a rational, sequential and repeatable procedure, and must be defensible; in other words, the data, criteria and the performance measures enabling external entities to assess and validate the process, must be clear (Trigueros 2008). The most common are techniques of monetary analysis, methods of multi-criteria analysis, and methods of variable weighting or weight assignment.

A multi-criteria methodology, MIVES: Integrated Value Model for Sustainability Assessment (Viñolas Prat et al, 2009), can be used as a result of its characteristics of consistency, ease of use, efficiency, multi-criteria, heterogeneous alternatives

1. Methodology

The Integrated Value Model for Sustainability Assessment (MIVES) is a combination of techniques whose main characteristic is to allow the decision-makers to prioritize and select among heterogeneous alternatives.

The processes that make it up are the following:

- Decision boundary: definition of the person taking the decision, the system limits and the boundary conditions.
- Definition of the decision-making tree: The aspects to be taken into account in the decision are arranged by branches.
- Creation of value functions: they consist of mathematical functions to obtain valuations from 0 to 1 of all aspects belonging to the last division of the decision-making tree.
- Weight assignment: Definition of the relative importance of each one of the aspects concerning the remaining ones belonging to a same division of the decision-making tree.
- Definition of the alternatives: Election of the alternatives to be analyzed for the decision-making problem raised.
- Assessment of the alternatives: Achievement of value index for each alternative raised.

Performance of the sensitivity analysis: Analysis of the possible change of value index of each one of the alternatives in the event that weights or value functions defined in the first phases change. This phase is optional within the MIVES methodology.

Cross-check of results: Long-term verification that the assessment model continues adjusting to what was intended to originally assess and if the calculations made in each one of the alternatives is as expected. This phase can be considered as a control phase of the model and alternatives, and is also optional within the MIVES methodology. (Polytechnic University of Catalonia 2009).

1.1. Construction of the decision tree

It consists of breaking down the decision problem into more simple components, and its organization by branches and by levels, in accordance with the decision maker's preferences. In the first level, the most qualitative and general aspects of the decision making are located, then, the criteria and sub-criteria, and in the last level, the most unique aspects: the indicators.

Requirements: are the most qualitative aspects and represent a broader vision of the criteria under which the decision is made, in case of an analysis from the sustainability point of view, requirements agree with the three basic sustainability pillars: economic, social and environmental.

The indicators are qualitative or quantitative variables from which the alternative value is quantified through the value functions. For its definition, it is advisable to use teamwork techniques such as "delphi technique,", "decision conferencing", or "brain storming".

1.2. Weight assignment by analytic hierarchy process.

This stage consists of establishing preferences among the elements of a same division, the weights of the indicators are calculated in relation to others belonging to a same criterion, the weights of the criteria are calculated in relation to the remaining belonging to a same requirement, and all requirements are compared to each other (Viñolas Prat et al. 2009). The sum of the weights of elements belonging to a same division is equal to the unit.

Decision matrix: For each comparison block, the construction of a n-by-n square matrix is required, being n the number of elements to be compared (requirements, criteria or indicators of the same division). The value matrix shall have value 1 diagonally, resulting from the comparison between an element with itself (which shall have equal importance). The inverse element of the matrix is the inverse number. For example, if the indicator i with respect to indicator j has an importance of 4, when comparing the indicator j with the indicator i it shall be the inverse value, that is ¼.

1.3. Construction of value functions.

The value function enables to pass from a quantification of a variable or attribute to a dimensionless variable comprised between 0 and 1, where 0 reflects the minimum satisfaction (Smin) and 1 reflects the maximum satisfaction (Smax). Together with the weights calculated for each variable, it enables to obtain the value, firstly for the indicators, then for the criteria, after requirements and finally for each alternative, so that one or several optimal alternatives can be defined.

Definition of the value function trend:

- Increasing, the decision maker’s satisfaction increases with an increased indicator value
- Decreasing, the decision maker’s satisfaction decreases as long as the indicator value increases
- Mixed, the maximum decision maker’s satisfaction takes place in midpoints of the indicator value and the maximum dissatisfaction takes place in extreme points, Gauss curve type

Definition of the points corresponding to the maximum and minimum satisfaction.

These points define the limits of the value function on the x axis and are provided by the quantification or measure of the variables being analyzed Smin (point of minimum satisfaction) and Smax (point of maximum satisfaction). These two points have a satisfaction value or response on the axis and of the function of 0 (Smin) and 1 (Smax), respectively.

These points are established in accordance with three criteria:

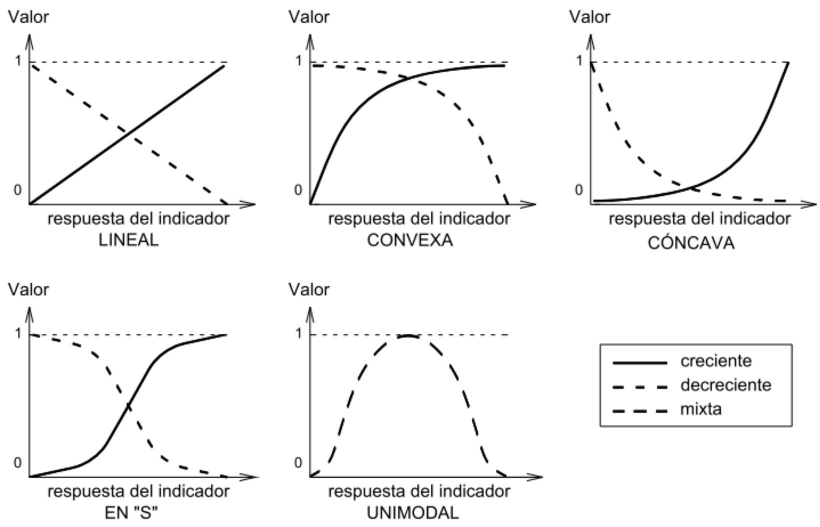
- Rules and regulations: when the variables are regulated by existing rules and therefore, are limited to given values, or the minimum and maximum values included within the interval defined by them.
- Experience with previous projects: values can be determined by the experience, from historical data, from data found in the literature or from data obtained from previous projects. The range of values is slightly more flexible than when rules and regulations are met.
- Value produced by the different alternatives regarding an indicator. In this case, the limits of the value function are provided by the minimum and maximum values of the different alternatives regarding an indicator. Therefore, if a new alternative appears, the limits of the function and the respective value of the indicators can change data:

Definition of the function shape:

- Linear: the increase or the decrease is of constant value along the alternative response range.
- Convex: it presents a great value increase for responses close to the one generating the minimum value if the function is increasing or a great value decrease for responses close to the minimum value if the function is decreasing.
- Concave: it shows a great value increase for responses close to the one generating the maximum value if the function is increasing or a great value decrease for responses close to the minimum value if the function is decreasing

- In S: the maximum value increase or decrease occurs in the central part of the range of responses while it is lower in the points close to the minimum and maximum

Figure 1. Types of value functions



Fuente: Alarcon et al. (2011)

Valor: Value, Respuesta del indicador: Response of the indicator. LINEAL: LINEAR
Value, Response of the indicator, CONVEX
Value, Response of the indicator, CONCAVE
Value, Response of the indicator. IN “S”
Value, Response of the indicator, UNIMODAL
Creciente: Increasing, Decreciente: Decreasing, Mixta: Mixed

Definition of the mathematical function of the value function: The mathematical equation proposed by Alarcon et al. (2011) is the following:

Table 1. Mathematical value function

Increasing function			
Function	**C**	**K**	**P**
Linear	C ≈ Xmin	≈0	≈ 1
Convex	$Xmin + \frac{Xmax - Xmin}{2} < C < Xmin$	<0.5	>1
Concave	$Xmin < C < Xmin + \frac{Xmax - Xmin}{2}$	>0.5	<1
S shape	$Xmin + \frac{Xmax - Xmin}{5} < C < Xmin + \frac{4(Xmax - Xmin)}{5}$	0.2/0.5	>1
Decreasing function			
Function	**C**	**K**	**P**
Linear	C ≈ Xmin	≈0	≈ 1
Convex	$Xmax < C < Xmax + \frac{Xmin - Xmax}{2}$	<0.5	>1
Concave	$Xmin - \frac{Xmin - Xmax}{2} < C < Xmin$	>0.5	<1
S shape	$Xmax - \frac{4(Xmax - Xmin)}{5} < C < Xmax + \frac{(Xmax - Xmin)}{5}$	0.2/0.5	>1

Source: Alarcon et al. (2011)

2. DEFINITION OF ALTERNATIVES

The alternatives raised for the dredging and construction projects of dock 6 are described below. The aforementioned alternatives are those raised in the respective Environmental Impact Studies and the Complementary Environmental Study.

2.1. Dredging

According to the studies performed, the amount of 575.384,84 cubic meters shall be extracted from the Docks Area (Dock 1, 2, 3, 4, 5 and 6), as follows:

Dock #1 = 58.598,56 m^3

Dock #2 = 22.526,22 m^3

Dock #3 = 73.075,41 m^3

Dock #4 = 45.628,87 m^3

Dock #5 = 124.308,33 m^3

Dock #6 = 251.247,45 m^3.

Meanwhile, 7’000.000 m^3 of sediments shall be extracted from the Maneuvering Zone and Access Channel.

ALTERNATIVE 1: Dispose of the sediments from the dredging of docks on land, and the sediments from the dredging of the maneuvering zone and access channel in the open sea.

The sediments extracted from the docks area, would be deposited in the old premises of ISSFA, an area close to the docks of the Puerto Bolívar Terminal, the same in which the dredging material was disposed of in the years 2012 and 2013.

It involves three pools of 12,9 hectares approximately, in which walls and a fourth pool shall be built. The capacity of the pools is 375.000 m3. When this capacity becomes saturated, the material would be removed and delivered for earth filling works.

As this area is close to the dredging area, a land pipe could be installed by following the right side of the road leading to the beginning of Dock 5, and after, it will be installed on the docksides until reaching the beginning of Dock 3, being able from that point to dredge Docks 3, 2 and 1 more easily. Subsequently, the pipe will be cut and the drainpipe will be installed between Dock 4 and 5, the pipe cutting job will be performed in 5 days, and dredging of Dock 4 will continue, which will be finished in about 30 days; finally, Dock 5, which would take 50 days; having a total working time of 162 days.

It is important to highlight that the pipe would not block any area nor cause any type of affectation; in addition, it shall not affect the Dredger maneuvers as it is close to the Project area, the time of dredging will be reduced, reducing the dredge operating costs, as well as the personnel involved in the project.

While the dredging material of the Maneuvering Zone and Access Channel consisting of 7’000.000 m3 approximately, they will be located in an area in the open sea, which, according to the Bathymetric Study performed by the company CONSULSUA Cia. Ltda. is the recommended area. This area has a surface of 4 km^2, is 13,75 miles from the sea buoy (25 km), this area has depths exceeding -30 m MLWS, being able to reach -40m MLWS, the predominant currents at this site are directed towards the Northeast, making that the sediments move in this direction. It is 18 km far from Santa Clara Island and 13 km far from Puna Island.

ALTERNATIVE 2: Dispose of the total dredging in the open sea.

A single deposit area will be considered in the Jambelí channel with an area of 4 km2, this deposit basin corresponds to an area with good depths, for the deposit of material, a grid will be defined in the area divided every 200 meters in order to determine an unloading plan for each equipment and the process shall consist of depositing the sediment in each grid defined with coordinates (number, letter), thus ensuring the distribution of the material uniformly and equitably on the entire area and avoiding its accumulation in a single site. This will be controlled through regular bathymetries and the unloading plan will be adjusted in accordance with the results if necessary, this area is 13,6 nautical miles from the sea buoy (25 km).

2.2. Construction of Dock 6

ALTERNATIVE 1. Driven, steel piles.

For this alternative, the first iteration for the pile diameter is 914 mm with 25 mmm wall thickness (the reduced thickness is 21 mm if the corrosion allowance is considered). The advantage of steel piles is that they can be perfectly driven for soil conditions of the location. The construction process is quick.

ALTERNATIVE 2. Driven, concrete piles

Driven concrete piles work well and the capacity of piles is slightly lower than the steel piles (considering the same diameter of 914 mm). However, considering the embedded depth foreseen for these piles, their weight becomes quite significant and will require heavy equipment for hoisting them.

ALTERNATIVE 3 Drilled, concrete piles

For this alternative, a steel liner can be used and, considering the diameter of the piles, a minimum of 12 mmm pile thickness will be required. Even more, considering the geotechnical conditions: soft and unstable soil layer and they should be buried up to the base of piles, thus avoiding a failure thereof.

3. DEVELOPMENT

This chapter will develop the procedure to obtain the Sustainability Index (SI), structured through a requirements tree based on the MIVES model.

The SI is obtained by adding the value summation obtained for each indicator or criterion assessed IVj (Aj, x), weighted in three levels, composing the relative weight of each indicator, criterion and requirement. The weights of the requirements are obtained from adjusting the values obtained through the AHP process, while the weights of criteria and indicators are the result of the direct assignment.

$$IS = \sum k_{Rt} \cdot k_{Cy} \cdot k_{Ij} \cdot IV_j(A_x)$$

Wherein:

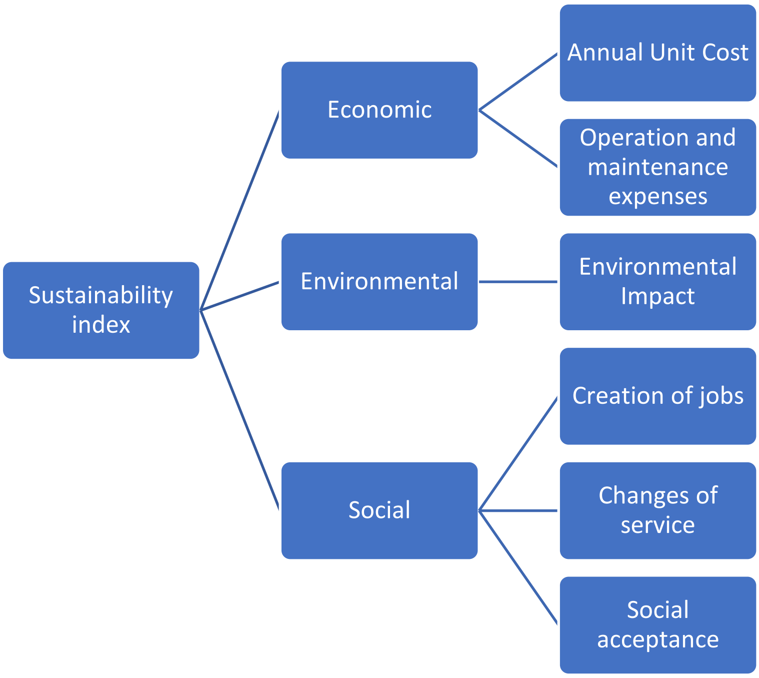
IS is the index of the analysis result index.

Ivj(Ax) is the ith value of x alternative.

k_{Rt}, k_{Cy} and k_{Ij} are the weights of each requirement, criterion and indicator, respectively.

The decision tree will be built on the basis of requirements, criteria and sustainability indicators.

Figure 2. Decision tree



Prepared by: Ecosambito, 2020

Weights of criteria and indicators are the result of the direct assignment.

Table 2. Weight assignment for criteria and indicators

CRITERIA	**WEIGHTS** K_{RT} **(%)**	INDICATORS	**WEIGHTS** K_{CY} **(%)**
ECONOMIC	30	Annual Unit Cost	50
		Operation and maintenance expenses	50
ENVIRONMENTAL	30	Environmental Impact	100
SOCIAL	40	Change of service capacity	30
		Creation of jobs	50
		Social acceptance	20

Prepared by: Ecosambito, 2020

3.1. Economic Aspect

This requirement assesses the use given to the economic resources being at the disposal of the institution.

Annual Unit Cost. It assesses if the investment analyzed is balanced in time and according to the service that shall be provided. It is in accordance with the useful life of the alternative proposed.

$$CUA = \frac{Initial\ investment}{VU_{total}}$$

Wherein:

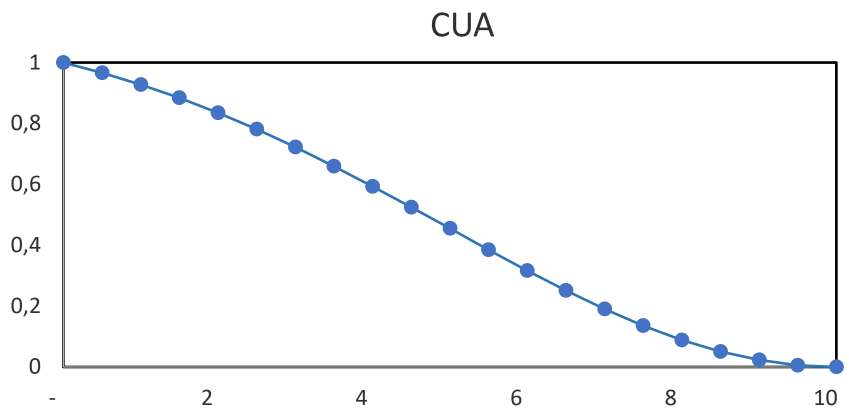
Initial Investment is the total amount budgeted to perform the work.

VU_{total} are the years foreseen to exploit the investment.

Because there is not always real data of the investment to be made, an estimated valuation can be used that enables to differentiate the alternatives that require a greater economic effort from those requiring lower investments, thus, we will establish attributes for this valuation. To that purpose, a valuation from 1 to 10 is proposed, being 10 the most expensive alternative, and 1 the cheapest alternative.

The value function to obtain this indicator is decreasing.

Figure 3. Value function for CUA



Prepared by: Ecosambito, 2020

Operation and maintenance expenses. This indicator represents the long-term economic investment that the Project must ensure so that the investment is still capable of providing the service for which it was created. This change can be positive (increasing maintenance expenses) or negative (if there is a reduction of these expenses). It takes into account the maintenance costs (costs of spare parts and repairs), and operating costs (personnel, inputs, etc.).

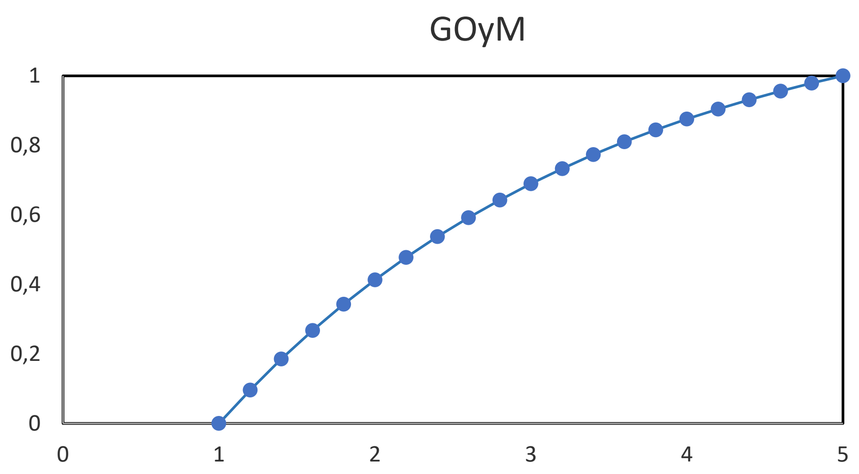
Table 3. Rating by attributes for GOyM

Operation and maintenance expenses (GOyM)		
Attribute	**Description**	**Score**
Large increase	It generates a very large increase of the maintenance expenses	1
Small increase	It generates a small increase of the maintenance expenses	2
Void/marginal	Marginal change of the maintenance expenses	3
Savings	It generates a small savings of the maintenance expenses	4
Large savings	It generates a large savings of the maintenance expenses	5

Prepared by: Ecosambito, 2020

The value, increasing and concave function is shown below:

Figure 4. Value function for OME



Prepared by: Ecosambito, 2020

3.2. Environmental Aspect

Environmental Impact. It is defined as the direct or indirect effects that an investment can cause on the different elements of the environment, and the possible affectation to the interrelations existing among these elements.

For a project to be implemented, there are regulations that require environmental impact studies resulting in a series of measures to prevent, control and minimize the possible negative environmental impacts of the investments. Thus, only the projects meeting these previous requirements can be considered for implementation thereof.

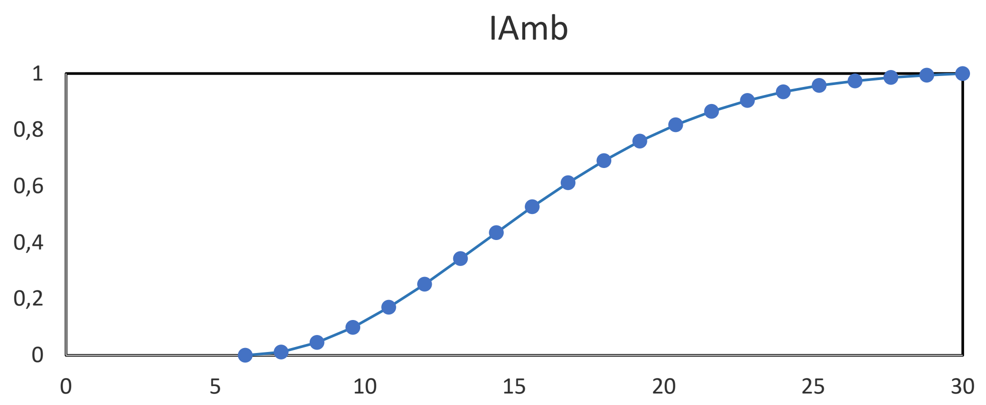
Table 4. Rating by attributes for IAmb

Environmental Impact					
Indicator	**Negative impact**	**With no change**	**Low**	**Medium**	**High**
It considers adaptation aspects to the climatic change	1	2	3	4	5
It considers the use of materials and inputs of proximities	1	2	3	4	5
It keeps the quality of the physical aspects: air, water, soil	1	2	3	4	5
It improves the sound quality	1	2	3	4	5
It preserves the biodiversity	1	2	3	4	5
It preserves the landscape	1	2	3	4	5

Prepared by: Ecosambito, 2020

The value function created has an S shape, and does not return value for entries lower than 6 (negative impacts). The maximum value is equal to 30, which is the maximum possible sum of attributes of this indicator.

Figure 5. Value function for IAmb



Prepared by: Ecosambito, 2020

3.3. Social Aspect

It assesses the project's consequences on the community, and the conceptualization of sustainability is complete for the projects assessed.

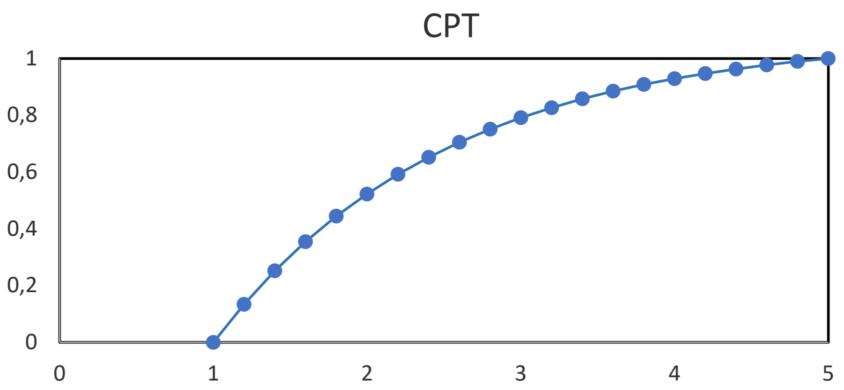
Creation of jobs. It measures jobs in the construction and exploitation/operation stages of the investment. It intends to prioritize those investments that can create more jobs over time. With this purpose, this indicator takes into account the following:

Table 5. Rating by attributes for CPT

Creation of jobs (CPT)		
Jobs in Construction Stage (EFC)	Jobs in Operation and Maintenance Stage (EFO)	Score
0 ≤ EFC ≤ 5	0 ≤ EFE ≤ 5	1
5 ≤ EFC ≤ 25	5 ≤ EFE ≤ 25	2
25 ≤ EFC ≤ 50	25 ≤ EFE ≤ 50	3
50 ≤ EFC ≤ 100	50 ≤ EFO ≤ 100	4
EFC > 100	EFO > 100	5

Prepared by: Ecosambito, 2020

Figure 6. Value function for



Prepared by: Ecosambito, 2020

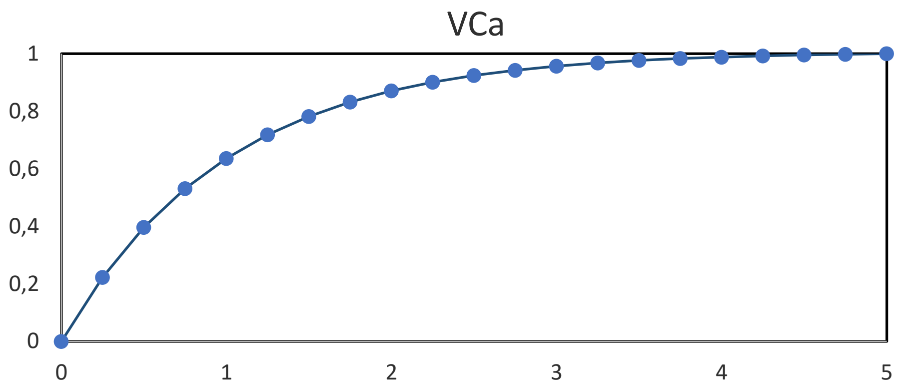
Change of capacity. It assesses the capacity increase, in maximum flow or number of users, which can use a certain infrastructure or service per unit of time, after implementing the project.

Table 6. Rating by attributes for Acs

Social Acceptance (AcS)		
Attribute	**Description**	**Score**
Very low	Demonstrations of opposition by the community or stakeholders.	1
Low	Punctual claim or complaint	2
Normal	There is no position defined by the community.	3
High	Good response and acceptance by the host population.	4
Very high	Excellent response and acceptance in the community	5

Prepared by: Ecosambito, 2020

Figure 7. Value function for VCa



Prepared by: Ecosambito, 2020

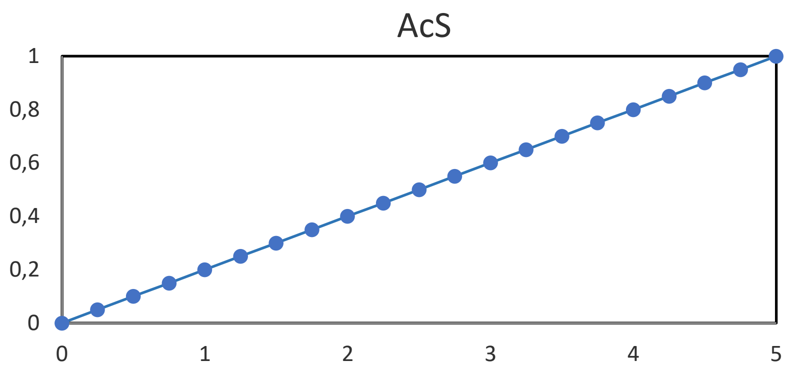
<u>Social Acceptance:</u> Analysis of the degree of acceptance of the social actors, stakeholders and community in general, regarding the proposed alternative.

Table 7. Rating by attributes for VCa

Change of capacity (VCa)		
Attribute	**Description**	**Score**
Very low	The capacity increase if very reduced (Δ Capacity ≤ 10%)	1
Low	The capacity increase is reduced (10% <Δ Capacity ≤ 40%)	2
Normal	The capacity increase is average (40% <Δ Capacity ≤ 60%)	3
High	The capacity increase if significant (60% <Δ Capacity ≤ 80%)	4
Very high	The capacity increase is very significant (Δ Capacity> 80%)	5

Prepared by: Ecosambito, 2020

Figure 8. Value function for AcS



Prepared by: Ecosambito, 2020

4. Results

After assessing the alternatives proposed by using the described methodology, the following results are obtained:

4.1. Dredging

The numerical results of the assessment are shown in the following Table:

Table 8. Analysis result of dredging alternatives

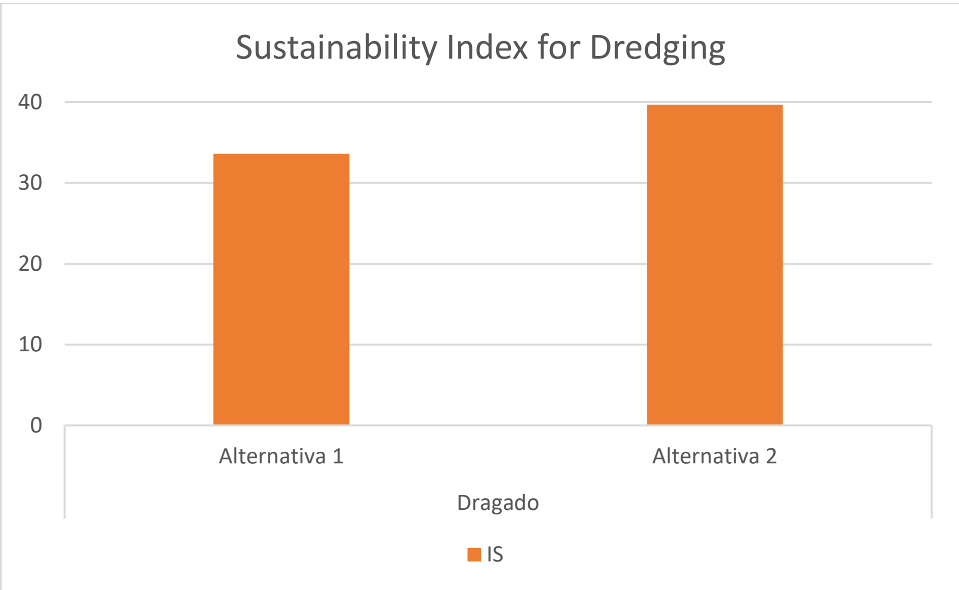
	DREDGING	
INDICATOR	**Alternative 1**	**Alternative 2**
CUA	0,00	0,03
GOYM	0,00	0,13
IAMB	0,08	0,08
CPT	0,10	0,03
CSR	0,10	0,09
ACS	0,05	0,04
	0,34	0,40
SI (%)	33,63	39,69

Prepared by: Ecosambito, 2020

The results obtained show that Alternative 2 “Dispose of the total dredging in the open sea”, obtains a sustainability index greater than alternative 1 “Dispose of the sediments from the dredging of docks on land, and the sediments from the dredging of the maneuvering zone and access channel, in the open sea.”

The contribution of each sustainability criterion is also shown to the total valuation.

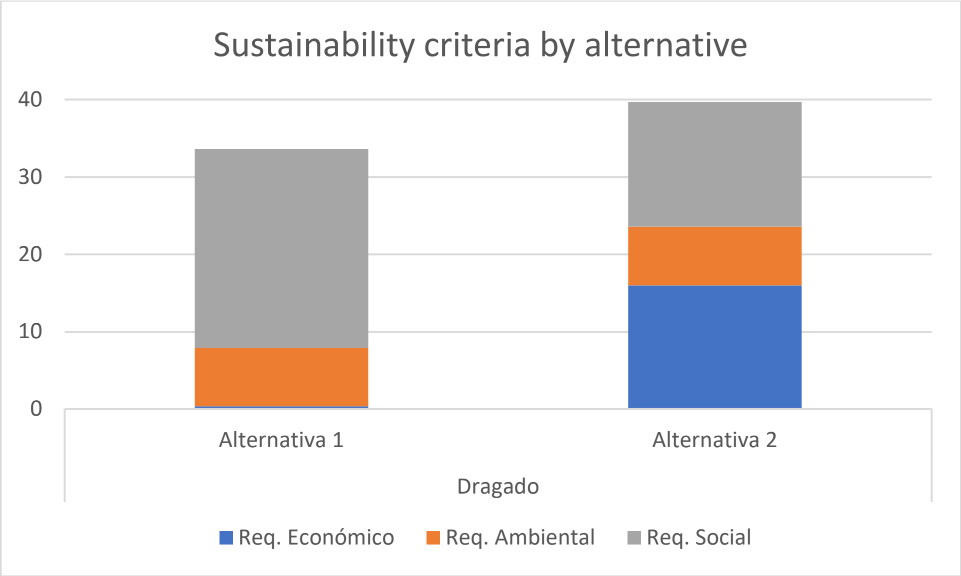
Figure 9. Sustainability Index for Dredging Alternatives



Prepared by: Ecosambito, 2020

Alternativa 1: Alternative 1, Alternativa 2: Alternative 2. Dragado: Dredging, IS: SI

Figure 10. Sustainability index by criterion for dredging alternatives.



Prepared by: Ecosambito, 2020

Alternative 1, Alternative 2, Dredging, Req. Económico: Economic requirement. Req. Ambiental: Environmental requirement, Req. Social: Social requirement

The graph shows that alternative number two has a significant advantage from the economic point of view; this is due to the maintenance costs, which negatively affected the result.

4.2. Dock 6

From the 3 alternatives submitted to the assessment, Alternative 1 (steel piles) obtained a greater sustainability than the other two alternatives.

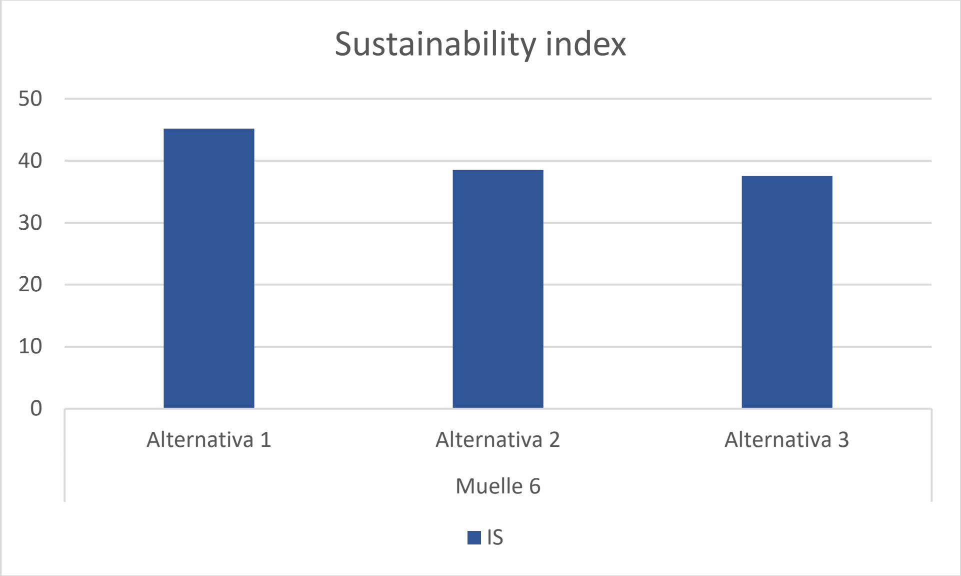
Table 9. Analysis result of alternative of dock 6.

	DOCK 6		
INDICATOR	**Alternative 1**	**Alternative 2**	**Alternative 3**
AUC	0,05	0,03	0,01
GOYM	0,13	0,09	0,10
IAMB	0,12	0,12	0,14
CPT	0,03	0,03	0,03
CSR	0,09	0,09	0,09
ACS	0,03	0,02	0,00
	0,45	0,39	0,38
SI (%)	45,18	38,51	37,52

Prepared by: Ecosambito, 2020

The results are shown below.

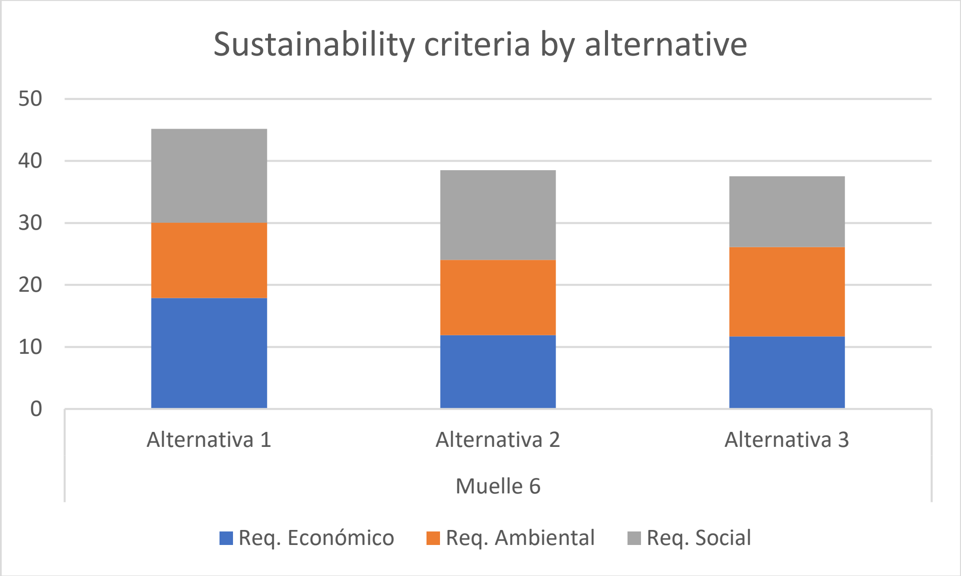
Figure 11. Sustainability index for construction alternatives of dock 6.



Alternative 1, Alternative 2, Alternative 3, Muelle 6: Dock 6, SI

Prepared by: Ecosambito, 2020

Figure 12. Sustainability index by criterion, for alternative of dock 6



Prepared by: Ecosambito, 2020

Alternative 1, Alternative 2, Alternative 3, Dock 6, Economic requirement, Environmental requirement, Social requirement

In case of the construction alternative of dock 6, the factor that provides more sustainability to Alternative 1 is the economic requirement; however, there is also a significant and balanced contribution from the economic and social requirements.

5. Conclusions

A methodology combining several techniques to facilitate the decision making has been used, including several criteria, required for an analysis covering different points of view.

The prepared decision tree includes the sustainability requirements, and in each requirement, indicators enabling to qualify the performance of the alternatives in these aspects were identified.

The analyzed alternatives have very similar characteristics; therefore, the model delivers adjusted results; however, indicators that can be differentiating factors are included, and help to identify the most sustainable alternative.

The Dredging alternative with deposit of all sediments in the open sea is the one that has obtained a greater sustainability index because the maintenance costs of this alternative were lower.

The construction and operation alternative of the Dock, with steel piles, is the one that has obtained a greater sustainability index because of the lower investment costs of this alternative.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

PUERTO BOLÍVAR PROJECT – PHASE 1

– AREA OF INFLUENCE AND SENSITIVE AREAS –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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AREA OF INFLUENCE AND SENSITIVE AREAS

1. Introduction

The areas of direct and indirect influence were defined in order to obtain a comprehensive view of the project emplacement area, as were the areas of sensitivity for each of the environmental components analyzed in this study. This made it possible to identify environmental and social impacts and risks properly. Thus we can comply with the provisions of the Performance Standards (PS) administered by the IFC and to provisions of PS1, which indicates that the area of influence includes cumulative impacts or result of incremental impact on the areas or resources used or affected by the activity.

This transcends the traditional concept of the “area of direct influence” and emphasizes the need to analyze indirect and cumulative effects as well as the need to expand the geographic limits in assessing the impact and/or the time framework used for the analysis.

2. Area of Influence

According to Canter *et al*. (1998), the area of influence is “*The space where possible environmental and social impacts occur that are due to a project’s implementation*”; however, the scope of the area of influence concept may be significantly relative.

The area of influence is the fraction of the environment that interacts with project facilities and activities (resources, raw materials, labor, space) and their output (waste, emissions and jobs). The simple decision of establishing a circle of influence within a more or less broad radius around the unit being studied has no validity (Conesa, 1995), so methodological criteria established by the National Environmental Authority are used as described below.

The basic criterion to identify project areas of influence will be to recognize environmental components and the socioeconomic medium directly and indirectly affected by the activities developed as part of the project in all stages. In this respect, we must take into account that the environmental related to the project includes the physical environment (soil, water and air components) where it exists and where biodiversity develops (flora and fauna components) as well as the socioeconomic medium with their cultural manifestations.

2.1. Area of Influence Methodology

The Technical Guide for Defining Areas of influence prepared by the Undersecretary of Environmental Quality (2015) was considered in determining the area of influence along with the Terms of Reference issued by SUIA (Spanish acronym: Single Environmental Information System) for this project. These methodologies take into account each of the physical, biotic and social components for analysis and definition of the areas of influence and establish methodological criteria for each.

It is important to indicate that the exact determination of the extent of impacts is a complex technical process to undertake; therefore, the area of influence will be divided into area of direct influence and area of indirect influence in order to understand it.

Thus, the following environmental components and criteria will be analyzed to delimit the areas of direct and indirect influence based on the distinctive features of the Project using the methodology indicated:

Table 1: Areas of Direct Influence Selection Criteria

COMPONENT	***AREA OF DIRECT INFLUENCE (AID)***
Physical: Geology, geomorphology soil quality	Methodology to be defined by the environmental consultant based on the areas that could be directly affected by project activities
Physical: Noise and Vibrations	Criteria for the methodology to be used by the environmental consultant to define the AID of this component may consider direct receptors and receptors sensitive to noise and vibration emissions generated by the project works and activities.
Physical: Hydrology and Water quality	Criteria for the methodology to be used by the environmental consultant to define the AID of this component may consider the basin / sub-basin / micro-basin, or hydrographic unit, water body or bodies present, flow, self-purification, consumption and non-consumption use of water, and downstream sensitive receptors, among others.
Biotic: Flora and vegetation	The following flora and vegetation criteria should be added to the methodology to be used by the environmental consultant to define the AID: • Boundaries of natural vegetation areas, protected areas, protective forests and vegetation, Statutory Forestry Heritage, conservation areas (forest partner or others), with an emphasis on native or primary forests and secondary forests in recovery, as the case may be • Physiographic aspects of terrain like brooks, flood zones, paramo (moorland), mangroves, high summit lines, plains, slopes, slope exposure, etc.
Biotic: Fauna	The following fauna criteria should be added to the methodology to be used by the environmental consultant to define the AID:

COMPONENT	AREA OF DIRECT INFLUENCE (AID)
	• Boundaries of natural, medium- and high-sensitivity vegetation areas • Boundaries of protected areas (Heritage of Natural Areas of the State). • Medium- or high-sensitivity areas in protective forests and vegetation with an emphasis on native or primary forests and secondary forests in recovery, as the case may be • Medium- or high-sensitivity areas in Statutory Forestry Heritage with an emphasis on native or primary forests and secondary forests in recovery, as the case may be • Conservation areas (forest partner) and others The following fauna criteria should be added to the methodology to be used by the environmental consultant to define the AID: • Boundaries of natural, medium- and high-sensitivity vegetation areas • Boundaries of protected areas (Patrimonio de Áreas Naturales del Estado, State Natural Heritage Areas) • Medium- or high-sensitivity areas in protective forests and vegetation with an emphasis on native or primary forests and secondary forests in recovery, as the case may be • Medium- or high-sensitivity areas in Statutory Forestry Heritage with an emphasis on native or primary forests and secondary forests in recovery, as the case may be • Conservation areas (forest partner) and others • Biological aspects related to: flood zones, paramo zones, mangroves, migration routes, areas of medium and high biotic sensitivity (areas with endemic species, endangered species, migratory species, salt licks, watering holes, feeding grounds, nesting and reproduction sites), etc.
Social: Levels of social integration	By definition the methodology indicates that "The social area of direct influence is the social space based on direct interactions of one or more elements of the project or activity with one or several elements of social context where the project will be emplaced. The direct project-social environment relationship occurs on at least two levels of social integration: first and second order individual social units and organizations. Individual elements are identified in order to guide the compensation actions while second level identification is carried out according to establishment of compensation actions"

Source: Technical Guide for Defining Areas of Influence. Undersecretary for Environmental Quality (2015)

Moreover, the methodology tells us that delimitation or management of the area of indirect influence will be constructed at least based on the following considerations and inputs:

- Baseline analysis of the project, work or activity reference area
- Description and scope of project activities
- Positive and/or negative impact identification and assessment
- Environmental Management Plan activities

The management area or area of indirect influence corresponds to the spatial area where the promoter will handle positive and/or negative impacts on socio-environmental components caused by their activity and which may be included depending on the distinctive features of the project and the stage where the following occur:

Table 2: Areas of Indirect Influence Selection Criteria

COMPONENT	AREA OF INDIRECT INFLUENCE (AII)
Physical: water resource	Based on the baseline analysis, the scope of project activities, impacts identified and Environmental Management Plan activities, the methodology will be outlined to define and delimit the spatial area where the promoter will manage the water resource; considering application of at least basic principles for prevention and control of water pollution, taking quality criteria into account for different uses.
Physical: soil resource	Based on the baseline analysis, the scope of project activities, impacts identified and Environmental Management Plan activities, the methodology will be outlined to define and delimit the spatial area where the promoter will manage the soil resource; at least considering application of basic principles for prevention and control of soil pollution in order to safeguard natural ecosystem functions in view of human activities which could modify its quality resulting from the various uses of the resource.
Physical: air resource	Based on the baseline analysis, the scope of project activities, impacts identified and Environmental Management Plan activities, the methodology will be outlined to define and delimit the spatial area where the promoter will manage the air resource; at least considering application of basic principles for prevention and control of air pollution due to gas emission, noise and/or disturbances caused by vibrations, taking into account quality criteria, permissibility and ecological and natural resource protection as provided under applicable environmental law.
Biotic: flora and vegetation	Based on the baseline analysis, the scope of project activities, impacts identified and Environmental Management Plan activities, the methodology will be outlined to define and delimit the spatial area where the promoter will manage flora and vegetation where the minimum management elements will be applied to: • Strengthen conservation • Recover ecosystems and wildlife • Maintain ecosystem equilibrium and functionality

COMPONENT	AREA OF INDIRECT INFLUENCE (AII)
Biotic: fauna	Based on the baseline analysis, the scope of project activities, impacts identified and Environmental Management Plan activities, the methodology will be outlined to define and delimit the spatial area where the promoter will manage fauna where the minimum management elements will be applied to • Strengthen conservation • Decrease hunting and poaching • Avoid illegal trafficking in wildlife • Recover ecosystems and wildlife • Maintain ecosystem equilibrium and functionality
Social: levels of social integration	By definition, the methodology indicates that “the area of indirect social influence is the socio-institutional space arising from the relationship of the project with political/territorial units where the project takes place: parish, canton and/or province”. The change to the landscape of the area is also added to the political/administrative location in defining the management area.

Source: Technical Guide for Defining Areas of Influence. Undersecretary for Environmental Quality (2015)

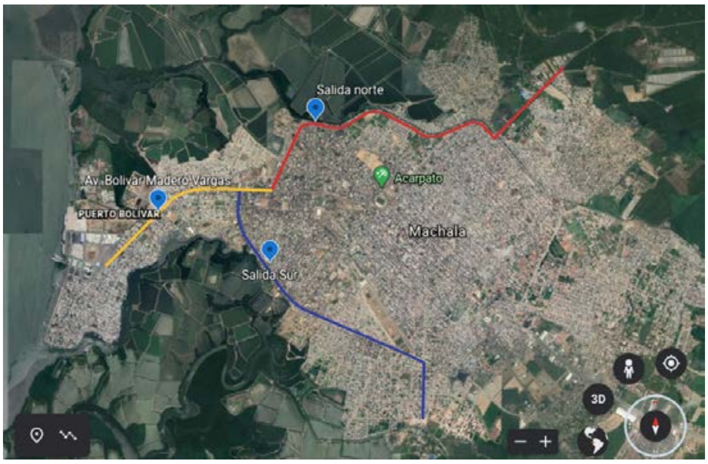
2.2. Definition of Areas of Influence

2.2.1. Area of Direct Influence

The area of direct influence is understood as **“…*the geographic area where environmental and socio-cultural impacts will be apparent*”.**

Before defining these areas it is necessary to have a clear concept of environmental impact which is defined as *favorable or unfavorable alteration in the environment or in a component thereof caused by an activity or action* (Conesa, 1997: 25 et seq.), therefore under the physical criterion of potential environmental impacts the **area of direct influence** was established as the specific site where the project will be emplaced and the social, biotic and physical components that converge around it, as follows:

Table 3: Area of Direct Influence by Component

COMPONENT	AREA OF DIRECT INFLUENCE (AID)
Physical: geology, geomorphology and soil quality	Coastal alluvial environment made up of the Santa Rosa estuary, where several estuaries come together. This is made up of a genetic fluvial group. The area includes current fluvio-marine deposits as well as other non-functional ones generated in different Quaternary epochs (primarily Holocene and Pleistocene): alluvial estuary deposits and mangroves, sand and alluvial estuaries made up of clay, silt and sand. Environmental impacts on soil and subsoil may be localized so the area of port operation and expansion is confined.
Physical: noise and vibrations	Operation: the main contribution to noise and vibration in Puerto Bolívar's area of operations is caused by land traffic of cargo, the influence of which extends to access roads that encircle the city (north and south). Avenida Madero Vargas is the main access road. Cargo trucks must use the perimeter accesses of Av. Circunvalación Norte, which connects directly to the east access to the city (Vía Machala – Pasaje), and Circunvalación Sur, which connects to the south area of the province (Vía Balosa – Santa Rosa) to reach the above-mentioned Avenida Madero Vargas. The urban area is consolidated on these accesses which become urban roads. Traffic flows trouble-free on these avenues, but there can be backups up to 0.8 km on Av. Bolívar Madero waiting for entry to the terminal. Nevertheless, the length of this avenue that receives all the heavy cargo transport (average of 25,000 vehicles per month) to and from the port is 2.3 km. Construction activity: once again, transport will be the principal noise generator with the characteristics described above. 
Physical: hydrology and water quality	Development of large, significant aquifers with generally high permeability and good yield. The Machala Hydrogeological Unit is composed of a principal watershed, basin of the Jubones River and 6 sub-basins: Balao, Gala, Tenguel, Siete, Pagua, Santa Rosa Rivers and Motuche estuary which correspond to a flat to even terrain. There are two deep wells in the area that belong to the Motuche River aquifer or recharge area.

Operation: Water quality in the dock area is doubtless affected by activities like facility, equipment and vessel cleaning and maintenance as well as accidental spills of hazardous substances. A 1-km area next to the docks is considered the area of direct influence.

Dredging: ocean water quality in the sediment dumping area is directly affected by sediment dispersal which was quantified through a dispersion study

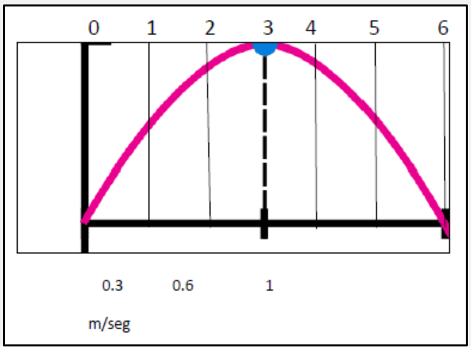
Size	Sedimentation velocity (m/s)	Time to reach the bottom (hours)	Sedimentation distance in rising tide	Sedimentation distance in ebb tide
Fine	3.7 x10-3	2.02	4.78 km	6.02 km
Sand	0.059	0.13	42.03 m	52.91 m
Gravel	14.87	5x10-4 (1.82 seg)	1.19 m	1.42 m

Source: CONSULSUA C. Ltda. 2017

Dispersion during rising tide is to the northeast while at ebb tide it flows to the southeast.

Moreover, the access channel from which the sediment is removed by dredging is not affected to the same extent because the sediment suction is performed. Therefore, the area of direct influence can be considered 500 m from the affected area.

Se considera como The area of direct influence is considered to be the projected area of 15 km from the contour of the maneuvering area polygon and the access channel to be dredged in the Santa Rosa Estuary from the dredging dump basin. This is supported by the fact that local, twice daily tidal currents in the Jambelí channel (2 high tides and two low tides per day) reach speeds of greater intensities every two weeks (currents) with 5.5-hour periods; close to high tide or low tide there is one hour when the water does not move while the speed during the next hour is 0.3 m/s, then 0.6 m/s in the ensuing hour, arriving at 1 m/s at the peak of the rising or lowering water as follows:

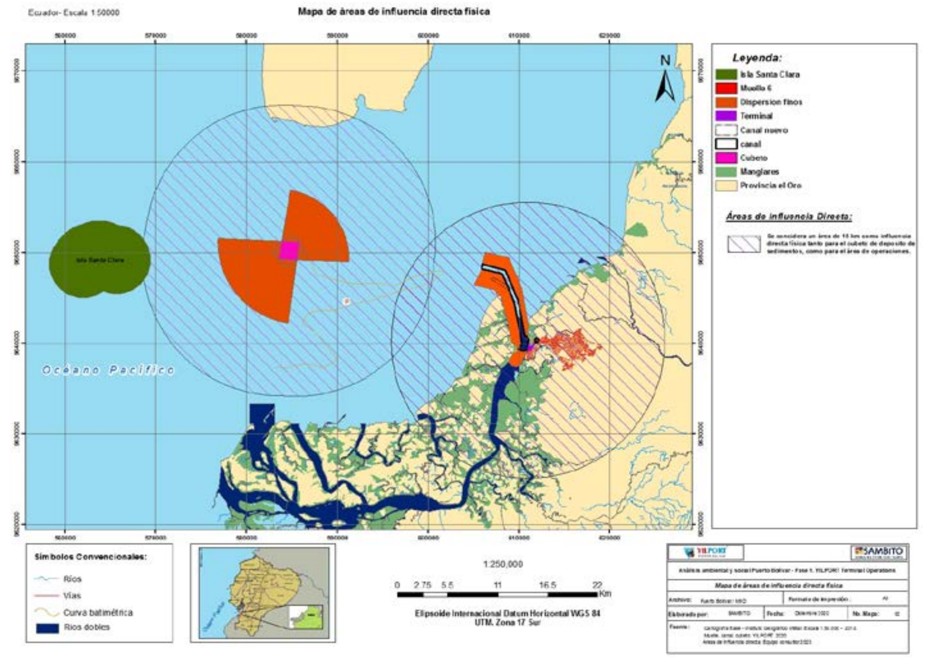


(1.5h * 0.3 m/sec= 1,620m) + (2h*0.6m/sec=4,320 m)+ (2h*1 m/sec=7,200 m)= **5.5h-> 13140m**

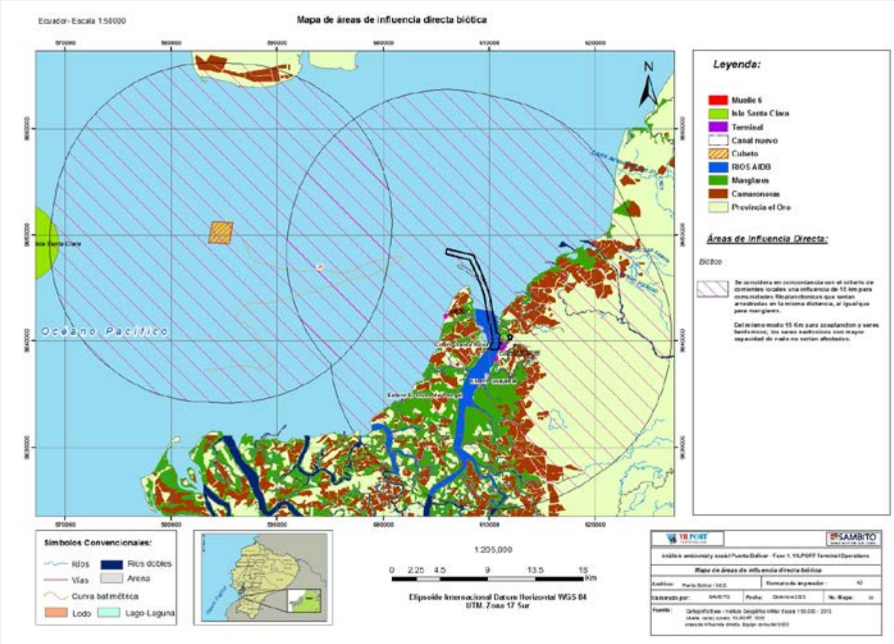
This distance does not consider w suggesting its expansion to **1500 m** or

The map of the physical area of direct influence is shown below :

Map 1: Area of Direct Physical Influence

	 Leyenda = legend: Isla Santa Clara = Santa Clara Island; Muelle 6 = Dock 6; dispersión finos = fines dispersal; terminal = terminal; canal nuevo = new channel; new canal = channel; cubeto = basin; mangroves = mangroves; Provincia el Oro = province of El Oro; Áreas de Influencia Directa = Areas of Direct Influence; Se considera un área de 15 km como influencia directa física para el cubeto de depósito de sedimentos como para el área de operaciones = A 15-km area is considered as direct physical influence for the sediment dump site as the area of operations; símbolos convencionales = conventional symbols; Ríos=rivers; vías = roads; curva batimétrica = bathymetric curve; ríos dobles = double rivers; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia directa física = Map of area of physical direct influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]
Biotic: flora and vegetation	A buffer of 15 km is considered for phytoplankton communities that would be dragged that distance based on the criterion of local currents, likewise for mangroves.
Biotic: fauna	Likewise, 15 km for zooplankton and benthonic organisms; nekton would not be affected with greater swimming capacity.
	The map of the area of direct biotic influence is shown below:

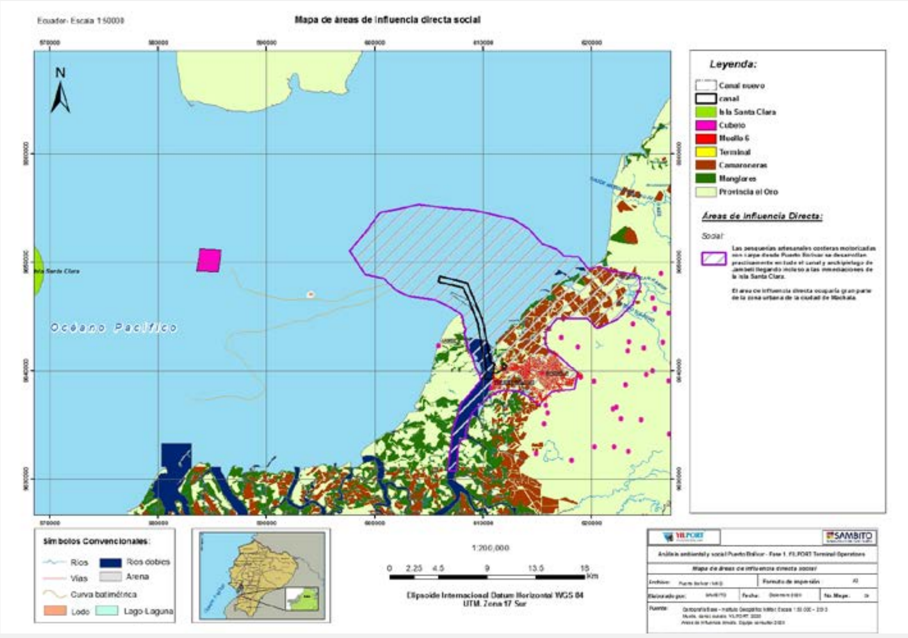
	Map 2: Area of Direct Biotic Influence



Isla Santa Clara = Santa Clara Island; Muelle 6 = Dock 6; dispersión finos = fines dispersal; terminal = terminal; canal nuevo = new channel; canal = channel; cubeto = basin; manglares = mangroves; Provincia el Oro = province of El Oro; Áreas de Influencia Directa = Areas of Direct Influence; Se considera un área [illegible] símbolos convencionales = conventional symbols; Ríos=rivers; vías = roads; curva batimétrica = bathymetric curve; ríos dobles = double rivers; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia directa física = Map of area of direct physical influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

Social: levels of social integration	The parish of Puerto Bolívar in the canton of Machala is considered the area of direct influence. Here stakeholders made up primarily of a group of artisan fishers who have a mangrove concession to collect shells and crabs are found; they are the principal actors as the syndicate of motorized artisan fishers launching from Puerto Bolívar to the area of the channel.
	The map of area of direct social influence is below:

Map 3: Area of Direct Social Influence



Isla Santa Clara = Santa Clara Island; canal nuevo = new channel; canal = channel; cubeto = basin; muelle 6 = dock 6; terminal = terminal; camaronera = shrimping; manglares = mangroves; Provincia el Oro = province of El Oro; Áreas de Influencia Directa = Areas of Direct Influence; Las pesquerías artesanales costeras motorizadas con zarpe desde Puerto Bolívar se desarrollan prácticamente en todo el canal y archipiélago del Jambalí llegando incluso a las inmediaciones de la isla Santa Clara = Motorized coastal artisan fishers launching from Puerto Bolívar work in practical all of the cannel and archipelago of Jambalí even up to the vicinity of Santa Clara Islands; El área de influencia directa ocuparía gran parte de la zona urbana de la ciudad de Machala = The area of direct influence would occupy a large part of the urban zone of the city of Machala; símbolos convencionales = conventional symbols; Ríos=rivers; vías = roads; arena = sand; curva batimétrica = bathymetric curve; ríos dobles = double rivers; lodo = sludge; lago-laguna = lake; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia directa física = Map of area of direct physical influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

Archeology

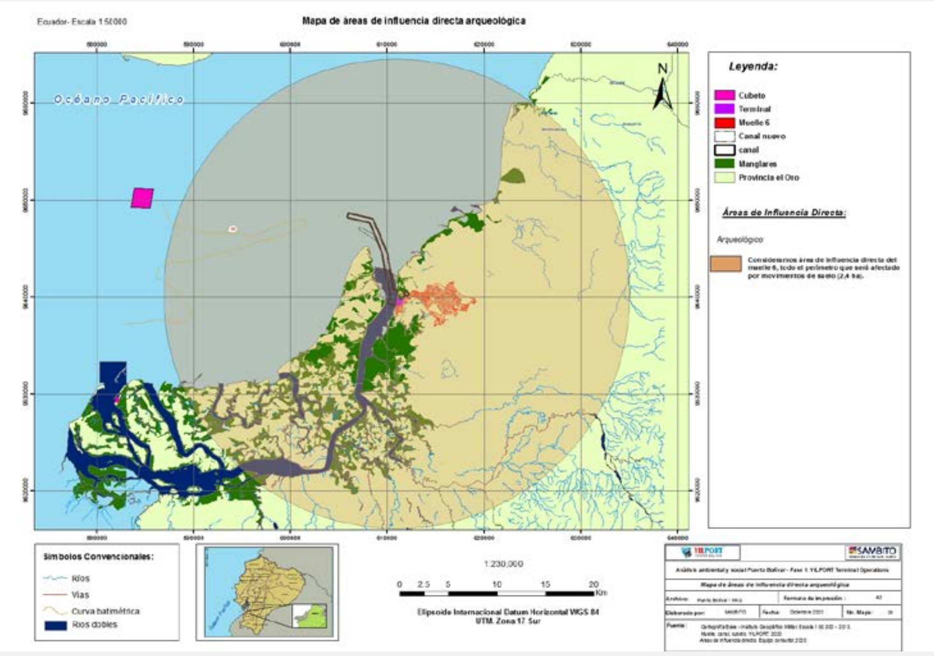
The entire perimeter that will be affected by earth movement (2.4 ha) is considered the dock 6 area of direct influence.

Analytical research or archeological site surveys were not required for previous environmental impact assessments, so any existence thereof is unknown as well as the actual impact thereon. Even though there are nearby archeological sites, the area of Port Terminal emplacement and expansion project has received large volumes of fill over time, thereby burying likely evidence.

Because the Organic Law of Culture (Art. 57 of soil and subsoil works) was not complied with in previous environmental impact assessment, we do not know the real impact on objects of archeological interest that could be present in the area of investigation (dock 6), which is close to archeological sites reported since the middle of the last century. A large part of the Port Terminal has been filled over time. Prior to dredging performed by Yilport, a Geophysical and Geomorphological survey was conducted the length of the access channel and the inner maneuvering channel in order to identify any variation within the soil strata whereby the presence of foreign bodies could be inferred. This resulted in no evidence of archeological remains.

The map of the area of direct archeological influence is shown below:

Map 4: Area of Direct Archeological Influence



Leyenda = legend; cubeto = basin; Muelle 6 = Dock 6; dispersión finos = fines dispersal; terminal = terminal; canal nuevo = new channel; canal = channel; manglares = mangroves; Provincia el Oro = province of El Oro; Áreas de Influencia Directa = Areas of Direct Influence; arqueológico = archeological; consideremos área de influencia directa del muelle 6 todo el perímetro que será afectado por movimientos de suelo (2.4) ha = we consider the dock 6 area of direct influence to be the entire perimeter that will be affected by earth movement (2.4) ha; símbolos convencionales = conventional symbols; Ríos=rivers; vías = roads; curva batimétrica = bathymetric curve; ríos dobles = double rivers; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia directa arqueológica = Map of area of direct archeological influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

Source: Field work 2020.
Prepared by: Ecosambito, 2020.

2.2.2. Area of Indirect Influence

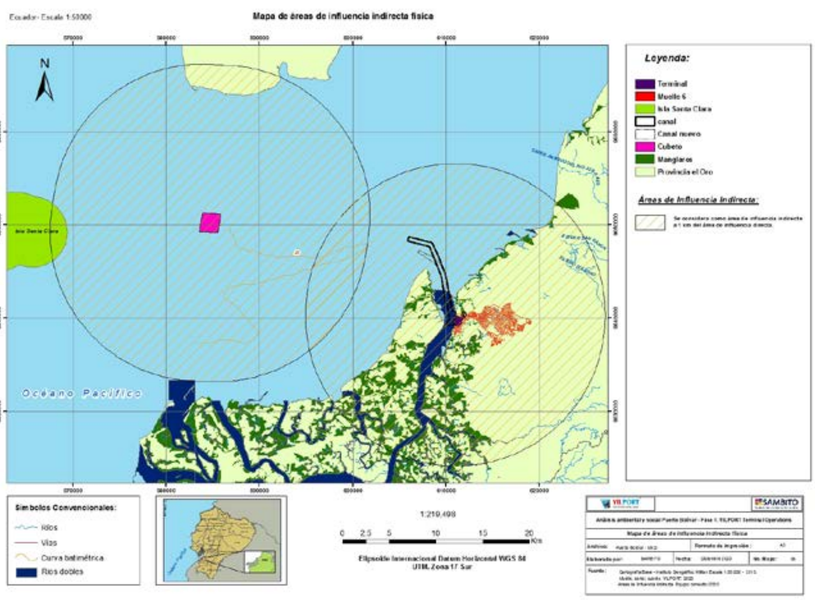
The **area of indirect influence** is the territory where indirect or induced environmental impacts; i.e., those that occur at a different site from where the action causing the environmental impact occurs and at a different time compared with the time when the action causing the environmental impact occurred.

The area of indirect influence of the project has the following segments:

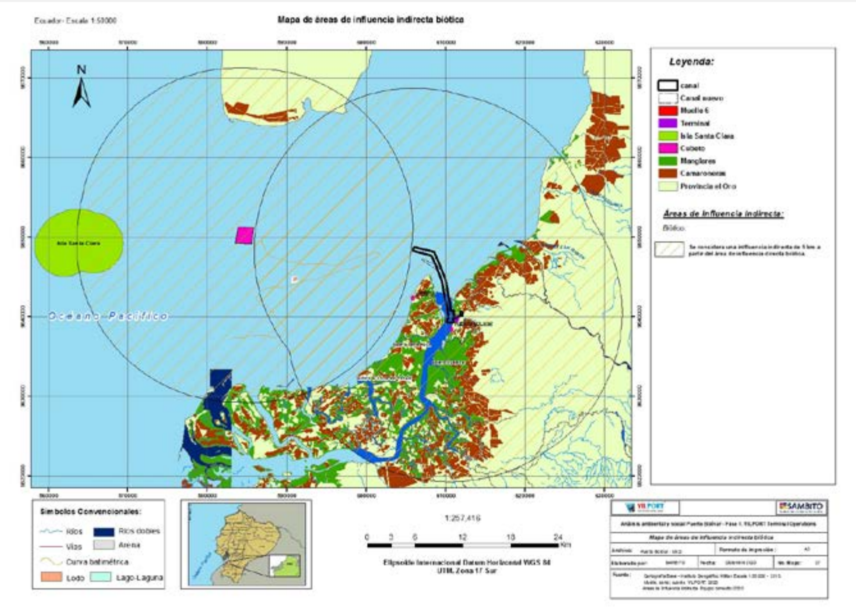
Table 4: Areas of Indirect Influence

COMPONENT	AREA OF INDIRECT INFLUENCE (AII)
Physical: water resource	1 Km around the area of direct influence. Considering adverse climate conditions like storms or strong (gale force) winds, the area of indirect influence is considered with a buffer of 30 km projected from the polygons of maneuvering areas in the Santa Rosa estuary and the dredged material dump basin.
Physical: soil resource	1 Km around the area of direct influence
Physical: air resource	1 Km around the area of direct influence
	The map of the area of indirect physical influence is shown below:

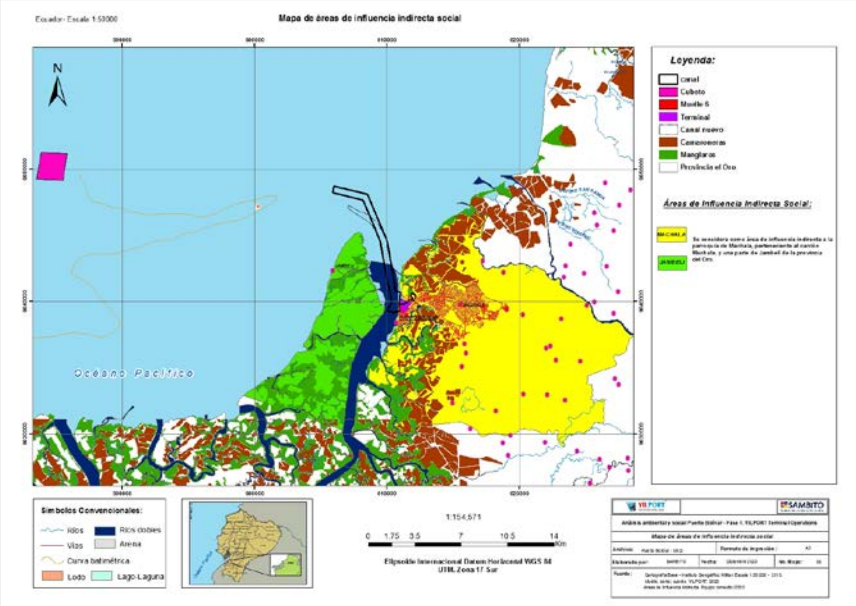
Map 5: Area of Indirect Physical Influence



Leyenda = legend; terminal = terminal; muelle 6 = dock 6; isla Santa Clara = Santa Clara Island; canal = channel; canal nuevo = new channel; cubeto = dump site; manglares = mangroves; provincia el Oro = province of El Oro; área de influencia indirecta = area of indirect influence; se considera como área de influencia indirecta a 1 km del área de influencia directa = the area of indirect influence is considered to be 1 km from the area of direct influence; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal

	data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia indirecta física = Map of area of indirect physical influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]
BIOTIC: FLORA AND VEGETATION	The same physical oceanographic criterion
BIOTIC: FAUNA	Considering that there are species with swimming capacity should an anomalous event occur, such as oil spills, 30 km is considered an area of indirect influence.
	The map of the area of indirect biotic influence biótica is below: **Map 6: Area of Indirect Biotic Influence**  Leyenda = legend; canal = channel; canal nuevo = new channel; muelle 6 = dock 6;terminal = terminal; isla Santa Clara = Santa Clara Island; cubeto = dump site; manglares = mangroves; provincia el Oro = province of El Oro; área de influencia indirecta = area of indirect influence; biótico = biotic; se considera como área de influencia indirecta biótica a 5 km del área de influencia directa = the area of indirect biotic influence is considered to be 5 km from the area of direct influence; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; arena = sand; lodo – sludge; lago-laguna = lakes; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia indirecta biótica = Map of area of indirect biotic influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]
SOCIAL: LEVELS OF SOCIAL INTEGRATION	Comprised of the Cantonal Head of the canton of Machala, given that the main meeting centers are in this area, activities of the artisan fishers through the Jambelí Archipelago are also important, and even reach the vicinity of Santa Clara Island.

Map 7: Area of Indirect Social Influence



Leyenda = legend; canal = channel; cubeto = dump site; muelle 6 = dock 6; terminal = terminal; canal nuevo = new channel; camareneros = shrimping; manglares = mangroves; provincia el Oro = province of El Oro; área de influencia indirecta social = area of indirect social influence; se considera como área de influencia indirecta a la parroquia de Machala, perteneciente al cantón Machala, una parte de Jambelí de la provincia del Oro = the area of indirect influence is considered to the parish of Machala belonging to the canton of Machala, a part of Jambelí of the province El Oro; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; arena = sand; lodo – sludge; lago-laguna = lakes; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de influencia indirecta social = Map of area of indirect social influence; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

Source: Field work 2020.
Prepared by: Ecosambito, 2020.

3. Definition of Sensitive Areas

3.1. Methodology and Determination of Areas of Physical Sensitivity

The analysis completed in the Baseline – Physical Component Chapter of this analysis selected the most significant elements within the characterization in terms of vulnerability to project actions in order to determine the area of physical sensitivity.

Three categories of sensitivity were defined in order to provide a qualitative assessment, which are shown in the following table:

Table 5: Sensitivity Categories for the Qualitative Assessment

CATEGORY	DESCRIPTION
HIGH	The environmental components are unchanged.
MEDIUM	The environmental components are semi-changed.
LOW	The environmental components are changed.

Source: Metodología Consulsua, 2012.

The sensitive areas are described below according to the socio-environmental component evaluated:

Table 6: Physical Areas of Sensitivity

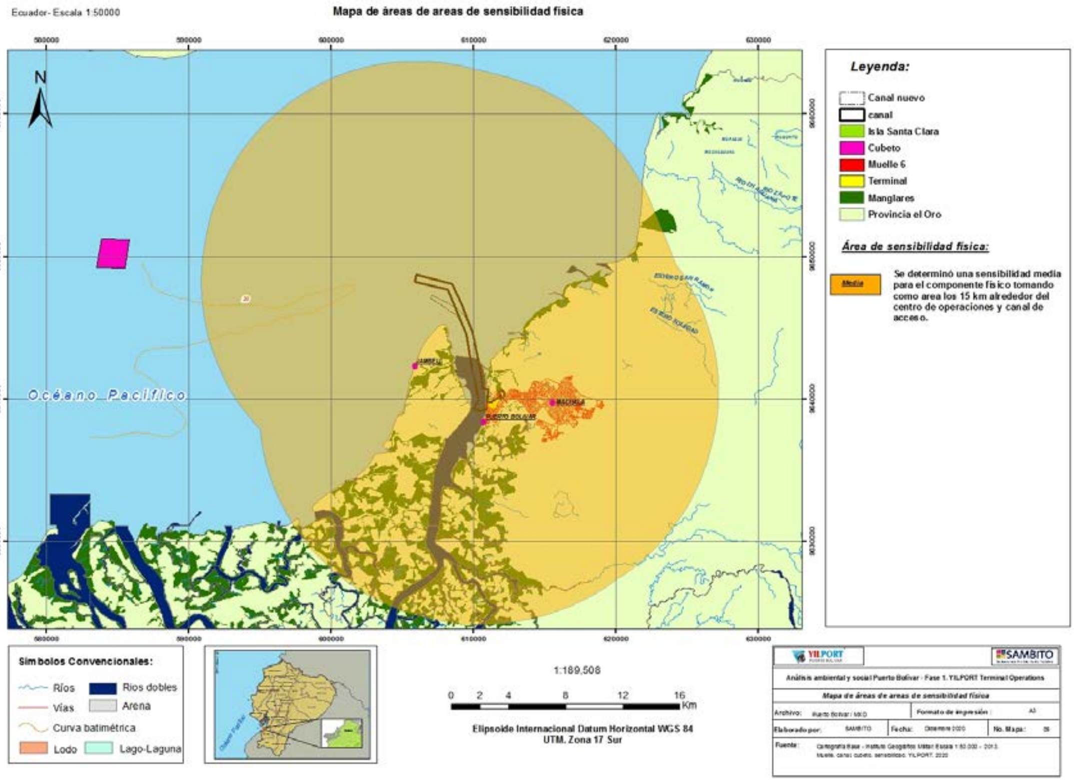
COMPONENT	PHYSICAL AREAS OF SENSITIVITY	CATEGORY
Physical	Considering that the Port Terminal is already established, it can be assumed that the characteristics of the physical environmental components (water, soil and air) have been modified from their characteristics prior to project construction and operation; however, it should be taken into account that the project has their environmental authorization and environmental audits carried out have shown compliance with the Environmental Management Plan, so changes in the physical environmental components have not been extreme. Because of the aforementioned, the physical sensitivity is set as Medium, and the following criteria are considered based on the analysis of the areas of influence: - Variations in the soil component will occur locally in the area of port operation and expansion without changing soil conditions outside these areas. - The air component is principally affected by the noise contribution due to land traffic. We also consider emissions due to land traffic as well as river traffic since those emissions may be dispersed by wind action; nevertheless, considering that emissions concentrations reported during air quality monitoring that was carried out are always below the levels allowed under the law. This factor will not enter into this assessment. - Considering that the project is developed on a body of water, the environmental component most sensitive to being altered and taking into account that, as mentioned in the Environmental Impact Assessment, the project is in a zone at high risk of flooding, a band maneuver in	MEDIUM

COMPONENT	PHYSICAL AREAS OF SENSITIVITY	CATEGORY
	operational activities could drastically affect the conditions of the environment and speed up the process of flooding; any (chemical or sediment) spell could also cause changes in water conditions. Based on the analysis of the dimensions established in the area of direct physical influence (AID), the area of physical sensitivity at the greatest distance considered in the physical AID is defined, i.e. 15 km from the contour of the maneuvering area polygon and the access channel to be dredged in the Santa Rosa Estuary of the dredged sediment dump basin.	

Prepared by: Ecosambito, 2020.

The map of the area of physical sensitivity is shown below

Map 8: Area of Physical Sensitivity



Prepared by: Ecosambito, 2020.

Leyenda = legend; canal nuevo = new channel; canal = channel; isla Santa Clara = Santa Clara Island; cubeto = dump site; muelle 6 = dock 6; terminal = terminal; mangroves = mangroves; provincia el Oro = province of El Oro; área de sensibilidad física = area of physical sensitivity; Se determina una sensibilidad media para el componente físico tomando como área los 15 km alrededor del centro de operaciones y canal de acceso = A medium sensitivity is determined for the physical component taking the 15 km around the operations center and Access channel as the area; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; arena = sand; lodo – sludge; lago-laguna = lakes; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de sensitivity física = Map of area of physical sensitivity; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

3.2. Areas of Biotic Sensitivity

Sensitivity is the degree of vulnerability of a determined area in view of an action that brings about impacts, effects or risks.

According to the biotic component (flora and fauna), sensitivity is related to the presence of natural ecosystems and the presence of species with particular characteristics from en ecological point of view, such as vulnerable species, protected species under IUCN, CITES and flora and fauna Red Books, which could be altered by possible impacts generated by concession activities.

Sensitive areas for the biotic component were those, which, depending on the conservation status of the natural ecosystem and the presence of important species of flora and fauna, whether endemic or rare for sciences, may be vulnerable to possible impacts concession activities could cause.

3.2.1. Methodology and Determination of Sensitive Biotic Areas

Criteria from the Flora Component Study – Oglán (PUCE 2012) and the indications of Torres and Navarrete 2010 described below were used to categorize the sensitive areas.

Sensitive areas around this area were established based on previous studies of the edge effect that a platform may have on its environment (Torres and Navarrete 2010), establishing the following zones:

- 0 to 150 m - Very High Sensitivity
- 150 to 300 m - High Sensitivity
- 300 to 450 m - Medium Sensitivity
- Greater than 450 m-Low Sensitivity

Specific sites of ecological importance were determined by direct observation making tours of coastal navigation near the shoreline in a small vessel, geo-referencing sites that are later entered on maps.

Therefore, the following table indicates the biotic sensitivity of sectors and sites of ecological importance identified in coastal marine ecosystems of the area of influence**:**

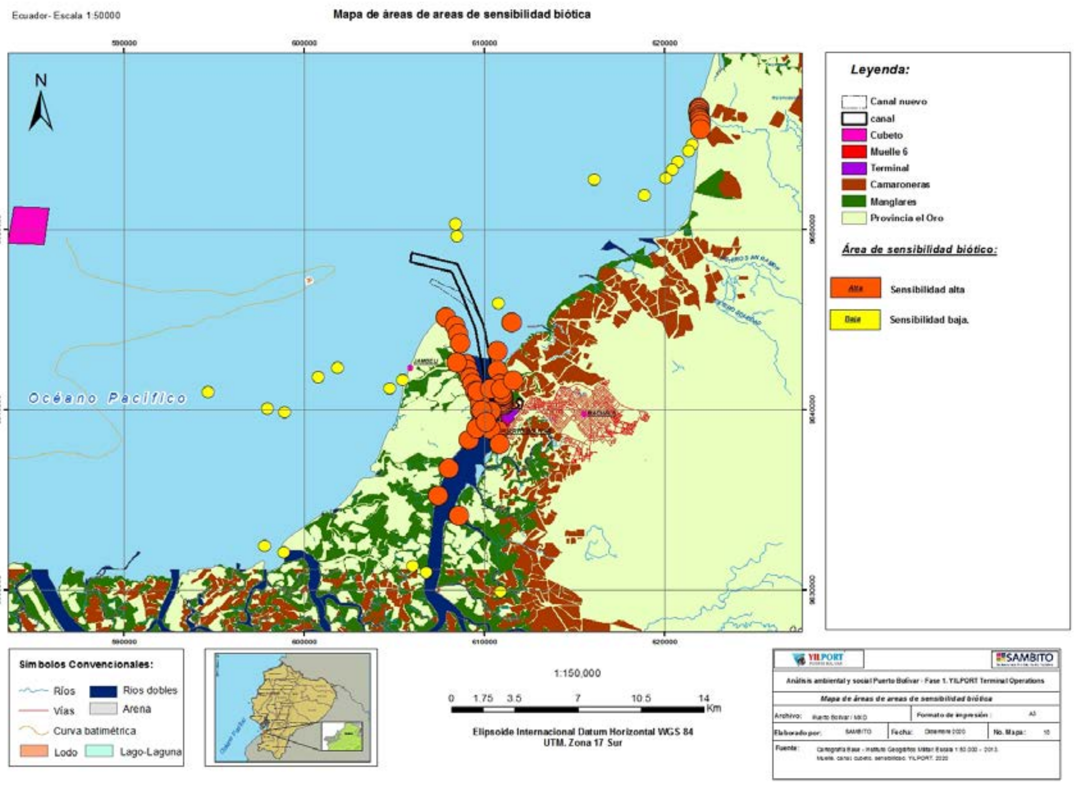
Table 7: Biotic Sensitivity

SECTORS	BIOTIC SENSITIVITY
MANGROVES	Medium-High
TRADITIONAL PACM FISHING GROUNDS (PACM = COASTAL MOTORIZED ARTISAN FISHING)	Medium-Low
ARTISAN PEDESTRIAN FISHING (PAP PESCA ARTESANAL PEATONAL)	Low
SITES OF STATIONARY ARTISAN FISHING (PAF PESCA ARTESANAL FIJA)	Low
BIRD GATHERING SITES	Low
PHYSICAL STRUCTURES THAT ACCOMMODATE ENCRUSTING COMMUNITIES	Low
MOUTHS OF BODIES OF FRESH WATER OR INLETS	Low

Source: Field Work 2020.
Prepared by: Ecosambito, 2020.

The map of the biotic sensitivity area is shown below:

Map 9: Area of Biotic Sensitivity



Prepared by: Ecosambito, 2020.

Leyenda = legend; canal nuevo = new channel; canal = channel; cubeto = dump site; muelle 6 = dock 6; terminal = terminal; camaroneras = shrimping grounds; manglares = mangroves; provincia el Oro = province of El Oro; área de sensibilidad biótica = area of biotic sensitivity; sensibilidad alta = high sensitivity; sensibilidad baja = low sensitivity; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; arena = sand; lodo – sludge; lago-laguna = lakes; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de sensitivity biótica = Map of area of biotic sensitivity; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

3.3. Area of Socioeconomic and Cultural Sensitivity

Socioeconomic and cultural sensitivity relates to the fragility of a population faced with external factors that can compromise or disturb their living condition; the level of this sensitivity is defined by the possible weakening of the factors that make up their social structure.

3.3.1. Methodology and Determination of Areas of Social Sensitivity

In the case of social composition of established groups in the area of influence of this project, the conditions of sensitivity establish the status of the set of socioeconomic and cultural relationships that make up the general social system of the area. The way the local society is integrated with regard to national society involves a status of influence and determination that was historically constituted as part of the social structure of settlements existing in the study area.

The degree of susceptibility of the area of influence is determined based on the levels of influence based application of the project on top of the current condition of the factors that make up the social system of influence. This socioeconomic and cultural susceptibility is defined, first, by the unstable spheres that could disability and conflict because of the project's existence and by measuring the degree of vulnerability of the affected factor. In order to characterize the status of sensitivity, three levels of susceptibility are considered:

Low Susceptibility. Insignificant effects on social spheres involved. No essential modifications are produced regarding living conditions, social practices and symbolic representations of the socioeconomic component. These are considered within the normal evolution of the project.

Medium Susceptibility. The intervention level transforms the economic and social conditions moderately and these can be controlled with socio-environmental management plans.

High Susceptibility. The consequences of the project involve profound modifications to the social structure and interfere with the logic of social reproduction of the groups in the area of influence.

Aspects like measures to control impacts considered in the project, acceptance of the project by the population, demands made of the agents, future possibility of expansion and occupation of the project area of influence and adverse effects on groups involved must be taken into account in rating the levels of sensitivity. In short, the degree of sensitivity is determined from the relationship of the general sensitivity condition with a project's execution.

The table below details and rates the levels of susceptibility based on the specific sensitive sphere:

Table 8: Sociocultural Sensitivity in the Project Area of Influence

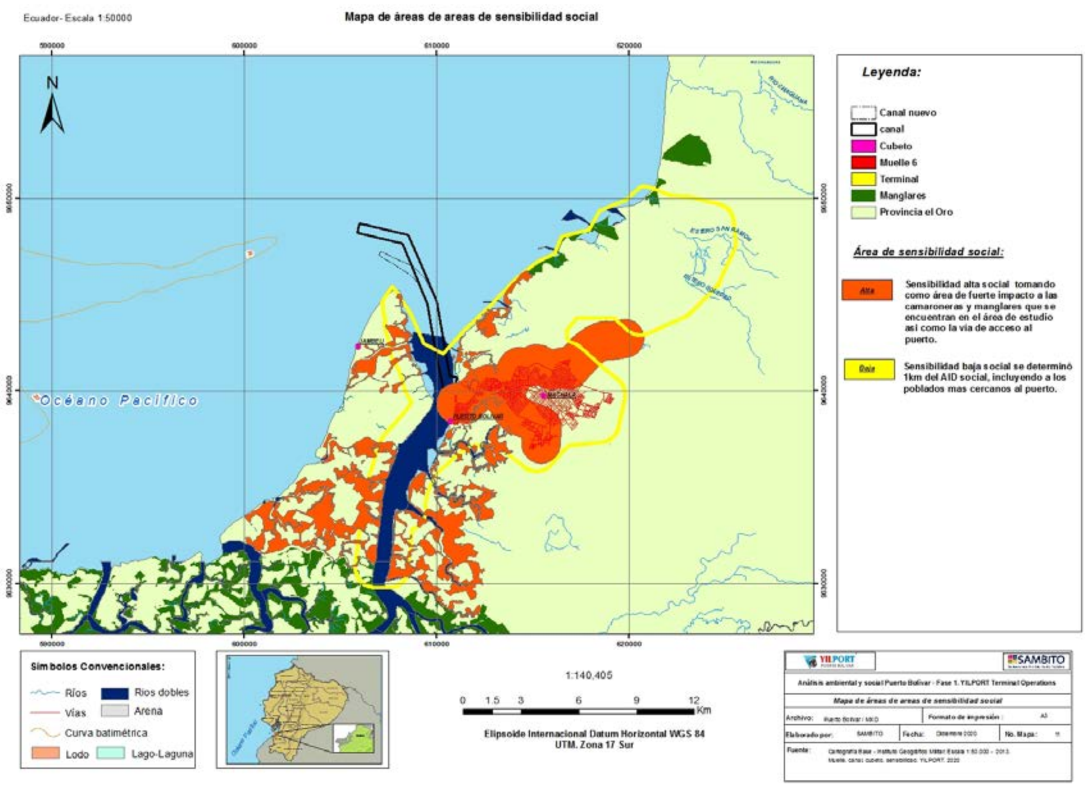
FACTOR	SENSITIVITY	DETAILS
Jobs	MEDIUM	Temporary effect on fishing in the area of the dredging sediment dump basin. Temporary jobs will be created in connection with the dock 6 construction works and other works considered in implementing Phase I.
Infrastructure and Basic Services	LOW	Basic services and infrastructure will not be affected by dock 6 construction works developed by the project and other works considered in implementing Phase I.
Social Organization and Conflict	HIGH	The lack of coordination and communication with affected parties and stakeholders may generate conflicts in regard to the dock 6 construction works, dredging activities and other works considered in implementing Phase I.

FACTOR	SENSITIVITY	DETAILS
Natural Landscape	LOW	Change in the landscape by maritime traffic
Land Transport	MEDIUM	Road bottlenecks and risks for pedestrians
Health and Public Safety	MEDIUM	Risks of traffic accidents, occupational accidents during the construction stage
Archeology	LOW	Low likelihood of remains on the beach, however, monitoring should take place continuously during the construction stage.

Prepared by: Ecosambito, 2020.

The map of the area of social sensitivity is shown below:

Map 10: Area of Social Sensitivity



Prepared by: Ecosambito, 2020.

Leyenda = legend; canal nuevo = new channel; canal = channel; cubeto = dump site; muelle 6 = dock 6; terminal = terminal; mangroves = mangroves; provincia el Oro = province of El Oro; área de sensibilidad social = area of social sensitivity; sensibilidad alta social tomando como área de fuerte impacto a las camaroneras y manglares que se encuentran en el área de estudio así como la vía de acceso al puerto = high social sensitivity taking as the area of strong impact on shrimping and mangroves that are in the study area as well as the port access road; sensibilidad baja social se determine 1 km del AID social, incluyendo a los poblados más cercanos al puerto = Low social sensitivity is determined 1 km from the social AID, including towns nearest to the port; símbolos convencionales = conventional symbols; ríos = rivers; vías = roads; curva batimétrica = bathymetric curves; ríos dobles = double rivers; arena = sand;

lodo – sludge; lago-laguna = lakes; elipsoide internacional datos horizontal WGS 84 UTM Zona 17 Sur = international ellipsoid horizontal data WGS 84 UTM Zone 17 South; Análisis ambiental y social Puerto Bolívar – Fase 1 = Puerto Bolívar Phase 1 Environmental and Social Analysis; mapa de área de sensitivity biótica = Map of area of biotic sensitivity; archivo = file; formato de impresión = print format; elaborado por = prepared by; fecha = date; no. mapa = Map number; Fuente = source; cartografía [illegible]

4. Conclusions

- Based on the analysis of the area of physical influence, it is considered that the project activities may have a greater impact on the sub-component of water since it is most sensitive to environmental impacts that can also be carried toward zones outside the project area by the currents.
- A buffer of 15 km was established for the analysis of the biotic area of influence based on the effect of local currents on phytoplankton, zooplankton and benthic organisms. It should be mentioned that nekton organisms are not considered since they have a better ability to swim and would not be affected.
- Although the activities of the position directly or indirectly affect the population in the whole canton of Machala, the area of direct social influence would be composed primarily of the group of artisan fishers that have the mangrove concession near project activities.
- According to the methodology presented, the area of physical sensitivity was considered a Medium category since the environmental components are partially altered due to other contributors of pollution like agro-industrial, mining and urban activity due to the direct influence of polluting processes arising from activities in the area (discharges from shrimping pools, discharge from the Huaylá Estuary) and due to the fact that the project is in operation, with water being the most sensitive component.
- For the biotic sensitivity analysis, the sector most sensitive to project activity is the mangroves which is a valuable ecosystem threatened by clearing and changes in land use. Nevertheless, environmental monitoring and control reflect that, to date, this ecosystem has not been affected by port activity.
- The social factor that shows the greatest sensitivity is social organization and conflict to which the External Communication Plan must be applied, which will improve communication with stakeholders.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT

PUERTO BOLÍVAR — PHASE 1

– ENVIRONMENTAL AND SOCIAL BASELINE –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

Content Table

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT

PUERTO BOLÍVAR — PHASE 1

– ENVIRONMENTAL BASELINE AND DETERMINATION OF ENVIRONMENTAL LIABILITIES —

Prepared for:

YILPORT PUERTO BOLIVAR

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

SAMBITO
Soluciones Ambientales Totales

ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

ECOSAMBITO C.LTDA. has carried out an Environmental Baseline, which includes a study of the identification of environmental liabilities (Environmental Site Assessment - Phase I, ESA) of the sites that are part of the Project “Puerto Bolivar - Phase 1”, located at Av. Bolivar Madero Vargas S/N, Port Terminal of Puerto Bolivar, township of Machala, El Oro Province, at the request of YILPORT TERMINAL OPERATIONS — YILPORTECU S.A.

The ESA was conducted in accordance with the scope and limitations of the American Society for Testing and Materials (ASTM) Practice E 1527-13, and has been performed by an environmental professional (see Annex VII.) as described in ASTM and 40 C.F.R. Section 312.10.

The property in question is owned by the Port Authority of Puerto Bolivar (hereinafter APPB, by its acronym in Spanish), is located in Av. Bolivar Madero Vargas S/N, Port Terminal of Puerto Bolivar, in the township of Machala, El Oro Province, in a mixed-use area (residential and commercial). As shown in Annex II, the implantation area consists of an irregular inverted trapezoidal plot of land with an area of 72 hectares; a rectangular plot of 3.1 hectares where Pier 6 will be built. Additionally, although not owned by APPB or YILPORTECU S.A., the areas corresponding to the Access Channel and Maneuvering Area of Puerto Bolivar, as well as the offshore sediment tank, were assessed, in accordance with the areas included in the Intersection Certificate No. MAE-SUIA-RA-DPAEO-2017-207553, issued by the Ministry of Environment in April 2017.

The current breakwater Pier (Piers 1 and 2) was built in 1962, and in 1970 the Port Authority of Puerto Bolivar was created, which from that date took over the administration of the Port Terminal. Within its administration, work was carried out aimed at gaining and consolidating land by means of breakwater walls, which were then filled and improved. In 5 decades of existence, improvements and expansion of capacities and service facilities have been made, the latest in 2012 with the construction of Pier 5.

In August 2016, the DELEGATED MANAGEMENT CONTRACT FOR THE "DESIGN, FINANCING, EQUIPMENT, EXECUTION OF ADDITIONAL WORKS, OPERATION AND MAINTENANCE OF THE PORT TERMINAL OF PUERTO BOLÍVAR" was signed.

In March 2017, YILPORTECU takes over the physical administration of the Port Terminal of Puerto Bolivar.

Since the start of operations by YILPORTECU S.A., improvement works have been carried out, including those of the Maintenance Plan, such as remodeling in certain warehouses and buildings, re-roofing of tracks, changing rails at Pier 5; as well as complementary studies, equipment and software, which are part of the works contemplated in the Investments for the development of Phase I. In addition, the Terminal has made its own investments to improve its performance.

As part of the investments contemplated in the development of the implementation of Phase I, two dredging campaigns have been carried out in the access channel and maneuvering area, for a total of 9,832,628m^3, which have been dumped in their entirety in the offshore sediment deposit tank.

The findings of this assessment are summarized below:

- This assessment has revealed no evidence of Recognized Environmental Conditions (REC) in relation to the project area.
- A de minimis condition is a condition that generally does not present a threat to human health or the environment and would generally not be the subject of an enforcement action if reported to the appropriate governmental agencies. This assessment has not revealed evidence of de minimis conditions.
- A Historical Recognized Environmental Condition (HREC) refers to an environmental condition that would have been considered an REC in the past, but which, based on subsequent assessment and/or remediation performed. The present evaluation has not revealed evidence of HREC in relation to the project area.
- Conditions that could affect the environmental professional's ability to identify RECs in the project area include the lack of or availability of technical reports and/or handover certificates describing the technical specifications of the hydrocarbon and other storage facilities that have been built, as well as the lack of certificates of integrity of the fuel storage tanks.
- Another conclusion of the evaluation is that there have been uses and events in the area of influence of the project that could have generated environmental liabilities outside the APPB properties evaluated.

Recommendations and Conclusions

Based on the information provided in this report, it is recommended that an Environmental Site Assessment - Phase II (as defined for ASTM Standard Practice E1903 - 19) be performed to establish the adequacy of their fuel storage and spill containment facilities and the existence of environmental liabilities in the sediments of the Santa Rosa estuary and the existence of environmental liabilities in the sediments of the Santa Rosa estuary.

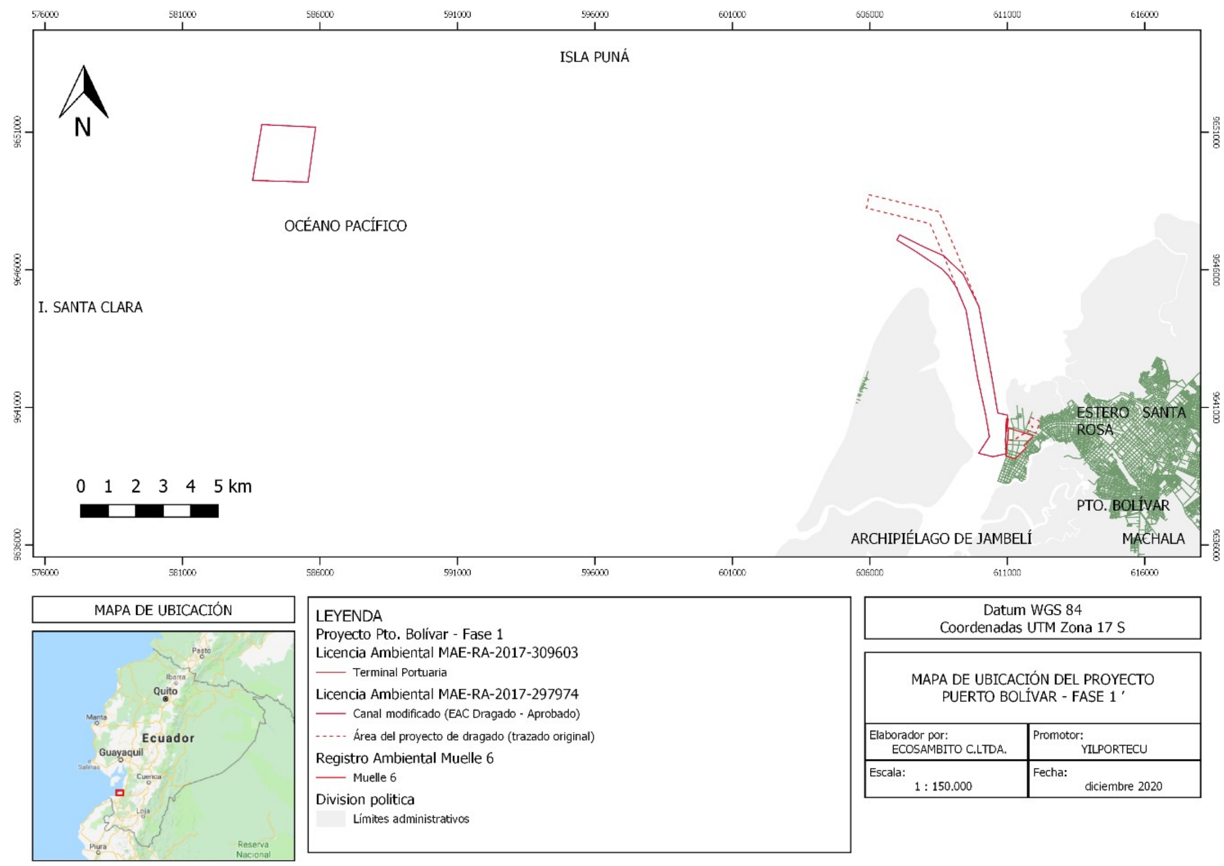
ENVIRONMENTAL BASELINE

1. Site diagnosis and characterization

1.1 Area evaluated

The area subject of this assessment is the total area included in projects with current environmental regularization of YILPORT (the User), that is: Dredging of Piers 1, 2, 3, 4 and 5, 6, the maneuvering Area and Access Channel of Puerto Bolivar[1], the Port Terminal and, the area where Pier 6 will be built. This is equivalent to the minimum search area (AMB, by its acronym in Spanish), see Figure 1.

Figure 1 . Puerto Bolivar Phase 1 project implementation area



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[1] The analysis includes the modified path of the access channel, carried out by a Complementary Environmental Assessment. To date, this process is awaiting the assignment of the Social Facilitator by the Ministry of Environment and Water (MAAE, by its acronym in Spanish).

Location map

Key
Puerto Bolivar Project - Phase 1
Environmental License MAE-RA-2017-309603
Port Terminal
Environmental License MAE-RA-2017-297974
Modified Channel (EAC Dredging - Approved)
Dredging project area (original layout)
Environmental Record Pier 6
Pier 6
Political Division
Administrative Boundaries

Datum WGS 84
UTM coordinates Zone 17 S

Puerto Bolivar Project Location Map - Phase 1
Prepared by: ECOSAMBITO C.LTDA
Promoter: YILPORTECU
Scale:
1 : 150.000
Date:
December 2020

The limits defined for the Puerto Bolivar project area are as follows:

1.1.1 North: Jambelí Naval Lyceum, Jambelí Marine Corps Battalion (BIMJAM, by its acronym in Spanish), mangrove area under AUSC of Aso. Porteño Estuary, an informal populated area adjacent to the east side of the sediment pools, and the Virgen del Cisne neighborhood.

1.1.2 South: APPB, populated area of Puerto Bolivar (Rafael Morán Valverde, Virgen del Cisne, Centenario, and Atahualpa neighborhoods.

1.1.3 East: Populated area of Puerto Bolivar (Virgen del Cisne II, Harry Álvarez, El Pacífico, La Unión, Primero de Abril, Amazonas, Portuaria Luis Felipe Sánchez, and Puerto Nuevo neighborhoods).

1.1.4 West: Santa Rosa estuary, Jambelí island (opposite shore).

1.1.5 For the activities carried out in the water body of the Santa Rosa estuary: offshore sediment tank, access channel, maneuvering area and pier apron, the limits correspond to the outer perimeter of the intervention area defined by the polygons included in the current Intersection Certificates.

1.2 YILPORT Infrastructure

In this section, we will focus on the storage infrastructure for fuels, hydrocarbons in general, hazardous waste storage, and others that provide services inside the port terminal, and that use hazardous substances for their operation that are considered to have a potential impact on the environment due to accidental spills.

This infrastructure was evaluated on the basis of available information (design plans, technical report, inventory description, etc.) and by visual inspection.

1.2.1 Generation and distribution of electric power

1.2.1.1 Electrical Substation

In this area there are two clearly differentiated areas: the substation that receives electrical energy from the national distribution system (69kV) and has 2 transformers with a capacity of 10,000 KVA each; and the bank of step-up transformers (4 units of 2,000 KVA each) that receive the energy generated by the generators in the Cell Room 1.

1.2.1.2 Cell Room 1

There are facilities for 5 diesel generators for emergencies, although to date only 2 generators are installed. The room has 3 tanks of 300 gallons each, for daily fuel supply, which are located inside a concrete tank.

It is the first emergency power generation station implemented at the port terminal, and consists of an electrical substation, an emergency generator, and a semi-buried steel tank for diesel fuel storage. At present, it has in its outer left area, an area under cover and a tank for the temporary storage of hazardous waste.

1.2.1.3 Cell 1

This includes facilities for 3 diesel generators for emergencies, of 680 KV each. These are fed by 3 tanks of 300 gal each, which in turn are supplied from the main tank located outside. It has a 2000 KVA electric transformer.

1.2.2 Fuel Area

In this area there are 3 steel tanks, each with its own tank and maneuvering area. The largest capacity tank (11,000 gal) is the one that supplies the daily tanks of Cell Room 1 by underground metal pipe, which covers a distance of approximately 40 m. It is assumed that this pipe is fitted, however, this has not been proven, as there is no technical memory of its installation.

The other 2 tanks, of less capacity, are employed by companies providing services to supply their machinery operating in the port.

All main fuel tanks (Tanks 1, 2, and 3 in the Fuel Area, and Cell 1 tank) are supplied from the diesel supplier's tankers.

1.2.3 Collection of hazardous wastes

It occupies part of Cell 1, mainly its maneuvering yard on the left side, and has an area with a tank and a free area, both under cover. Its storage capacity is reduced (9 m^2) so it must be evicted on a quarterly basis. Mainly stored here: spent or used oils (NE-03)[2], used mineral oil filters (NE-32)[2], adsorbent material contaminated with hydrocarbons and others (NE-42 and NE-43)[2].

1.2.4 Areas where machinery maintenance is performed

The only authorized sites for carrying out machinery and/or container maintenance activities are:

[2] Ministerial Agreement 142, Official Register Supplement 856 of 21/12/2012, NATIONAL LIST OF HAZARDOUS CHEMICALS HAZARDOUS WASTE.

1.2.4.1 Yard 9

Assigned to OPSC[3] ARETINA, who carry out container maintenance activities (metalworking, painting, insulation, and refrigeration equipment), and where minor maintenance is performed to the company's container ship equipment. As waste, they mainly generate NE-03, NE-32, and NE-42. They have environmental regularization of the Ministry of the Environment for their operations inside the terminal. The yard has no gutters or effluent collection wells, so that water contaminated with hydrocarbons (a mixture of water from washing containers and stains from dripping and/or small spills of grease and oil from maintenance work) and paint run off over the sidewalk into the gutters of the rainwater system. As part of ARETINA's commitment, the latter must implement an effluent collection and treatment system, to be implemented until the end of 2020.

1.2.4.2 Yard 2

Assigned to OPC[4] OROESTIBAS, who carry out cargo handling activities inside the terminal, and use this yard for the maintenance of their road and cargo handling equipment (container ships, forklifts, others). As waste, they mainly generate NE-03, NE-32, and NE-42. They have a washing area and a wall for effluent collection, a grease trap with 3 chambers and a pre-sand trap, which is connected to the terminal's AASS network, and a container adapted for the storage of hazardous waste. They have environmental regularization of the Ministry of the Environment for their operations inside the terminal.

1.2.4.3 Warehouse 12

Assigned to the YILPORT maintenance department, this warehouse is mainly used for metal-mechanical work, electrical maintenance (lights and other minor items), and the collection of supplies for the operation of the quay cranes (various lubricants), and some types of solid waste such as scrap metal (NE-09), lights and light bulbs (NE-40), adsorbent material (NE-42) and other minor items, until they are handed over to the environmental manager. The site has an effluent collection channel with a sand trap and step grease trap, and connected to the AASS system.

1.2.4.4 Pier 5

This site is intended for docking ships and handling cargo to and from ships, and this is where YILPORT's two RTG cranes operate. Due to the size of the cranes, routine maintenance — including oil and filter changes — must be performed on site, taking the respective precautions. Pier 5 does not have facilities for maintenance or collection of effluents or spills.

[3] Port operator of related services.

[4] Port cargo operator.

1.2.5 Stormwater and sanitary sewers and effluent treatment plant

The original sewage system of the port terminal was of the combined type, that is, it functioned as both a stormwater and sanitary sewer.

In 2006, studies were carried out for the design of the new sewage system (CAMINOSCA C. LTDA., 2006). In its design, the observations made by APPB to Alternative 1 (presented by CAMINOSCA in Phase II — Analysis of alternatives) are collected, which establish:

- Use the existing combined sewer system as a stormwater sewer system, with the necessary modifications (required at the time by APPB);
- That the final layout of the sanitary sewage system, as far as possible, go on the sidewalks;
- Carry out the design of the treatment system (PTAR) presented as Alternative 1 by CAMINOSCA and approved by APPB, consisting of:
    - Raw Water Pumping Station, which has an equalization chamber for ½ hour of retention at peak flow of 3.5 l/s, two submersible pumps that lift the water to the pumping plant and the electrical components such as starters, protectors and meters.
    - The inspection and cleaning chamber, which serves to eventually remove foreign materials from entering the system, and to ensure that the water enters the plant free of solids.
    - Treatment tank, IMHOFF, which is the place where the actual treatment takes place. It is covered with removable tiles to check operation anywhere and remove creaming and foams.
    - Two up flow filters, composed of gravel, which serves to polish the treatment achieved in the tank. It has a valve chamber to be able to independent the operation of each one.
    - Treated Water Pumping Station, which has an equalization chamber for ½ hour of retention at peak flow of 3.5 l/s, two submersible pumps that lift the water to the discharge well, with a residual pressure of 3 m, in order to optimize the opening of the swing check valve. Of these pumps one is kept in reserve. Additionally, the station has electrical components such as starters, protectors and meters.
    - Pumping line. It is the one that leads the treated water to the discharge, composed of a 110 mm diameter PVC pumping pipe; and a discharge well with a swing check valve that prevents the entry of seawater at high tide and a discharge structure.

For sewerage systems in general and the treatment plant, a 25-year period has been considered; and the existing concrete pipes and manholes were adopted for the stormwater sewerage design, and for the sanitary sewerage, PVC pipes with PVC inspection manholes. The network has been designed with minimum depths of 1.10 m to 4 m with respect to the natural ground level.

1.2.6 Onshore sediment pools

The sediment ponds correspond to an area of approximately 12.9 hectares located northeast of the Port Terminal, on the former ISSFA premises.

However from what was foreseen in the EIA of the Project, these pools have not been used for the described purposes, and in technical evaluations carried out (SURCONSUL, 2017), the potential risk of infiltrations in the east wall of Pool No. 2, which is adjacent to an informal urban settlement installed as a result of the flattening and filling of the land where it is located.

These pools remain in disuse, and their presence has allowed rainwater to accumulate during the winter season, posing a latent risk for the generation of pests in the sector.

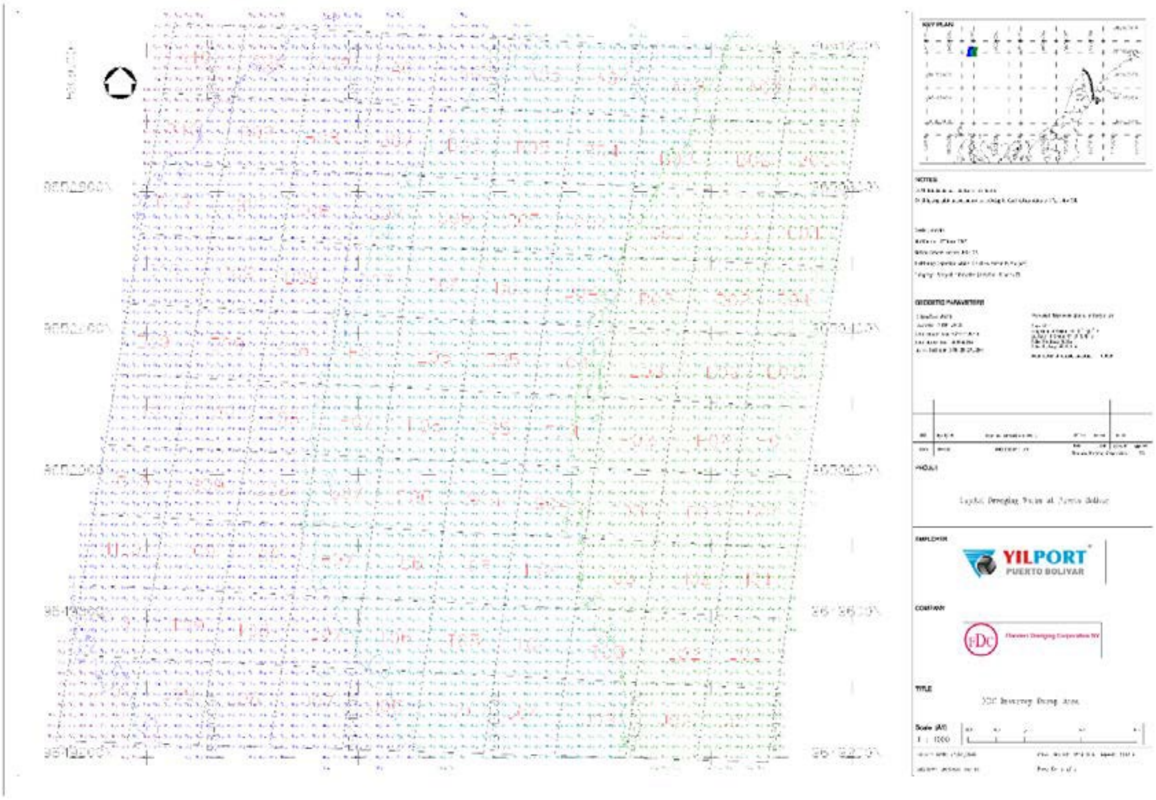
Currently, this area has been excluded from the dredging project by means of a Complementary Environmental Study that has been pre-approved by the MAAE, and is currently awaiting the assignment of the Social Facilitator by the MAAE.

In the last week of August 2020, an organized group of citizens carried out a massive invasion in the area of the sediment pools north of the port terminal, who, alleging a lack of housing options, took over the site, settling in with precarious constructions of wood and plastic and other waste materials. To date, neither the owners of the property (Armada del Ecuador), nor the municipal government, within its competencies, have initiated actions in the area.

1.2.7 Offshore dumping area

The offshore sediment dumping area is 4 km2 (2 km per side), located 13.75 miles from the sea buoy (25 km), and with depths in excess of -30m MLWS (and up to -40m MLWS). To ensure a homogeneous disposal of the dredged sediments, the basin is subdivided into 100 areas of 4 ha each (200 m x 200 m on each side), each sub-area being assigned according to bathymetry, and used as a deposition area for each of the trips made by the dredge vessels involved in the dredging.

Figure 2 Offshore division map of the dumping area.



Prepared by: FLANDERS DREDGING CORPORATION
Date: march 2018

1.3 New services

From February 2020 to October 2020, stockpiling and shipment of approximately 60,000 tons of mineral concentrate (20-30% copper) began. This material was collected in warehouses 1,2,3,4,5 and 6, and in yards 8 and 3.

Table 1. Hydrocarbon storage sites and other facilities

Area	Denomination of the tank	Stored input	Capacity (gal)	Year of construction	Tests performed (year)	Tank (dimensions)	Location (Coordinates 17S UTM)	Observations
Cell 1	Reservoir tank	Diesel	3,500	2003	--	--	(611479, 9639350)	Metallic, Foil with HHAA
	Feeding Tanks	Diesel	3 x 310	2003	--	7,5x8,4x0.2 m	(611479, 9639350)	Metallic
	Substation	Dielectric oil	--	2003	--	--	(611477, 9639341)	2 2000 KVA transformers
DP Collection Center	Tank for waste oils	Waste oils	550	--	--	2,9x1,5x0.2 m	(611493, 9639350)	Concrete under roof
Cell 2	Substation	Dielectric oil	--	2003	--	--	(611074, 9639429)	2 50 KVA transformers
Fuel Area	Tank No.1	Diesel	11,000	2012	--	8,4x11,75x0.65 m	(611517, 9639799)	Metallic
	Tank No.2 (ARETINA)	Diesel	6,069	1985	--	6,9x8,9x0,4 m	(611499, 9639799)	Metallic
	Tank No.3 (OROESTIBAS)	Diesel	1,200		--	3x7,5x0.2 m	(611484, 9639799)	Metallic
Electrical Substation	69 KV network	Dielectric oil	--	2012	--	6,3x8,3x0.32 m	(611463, 9639840)	2 transformers of 10 MV, each with a tank

Area	Denomination of the tank	Stored input	Capacity (gal)	Year of construction	Tests performed (year)	Tank (dimensions)	Location (Coordinates 17S UTM)	Observations
	Generators output	Dielectric oil	--	2012	--	--	(611485, 9639799)	4 2000 KVA transformers
Generators room	Cell Room 1	Diesel	3 x 310	2012	--	10x1,8x0.5 m	(611514, 9639855)	2 x XXX HP Generators
Wastewater Treatment Plant	PTAR	Sewage and gray water	XX m3	2009	--	--	(611450, 9639799)	Reinforced concrete
Well No. 1	Well No. 1	Untreated water	120 m	1998	--	--	(611065, 9639458)	Cased
Reservoir tank No. 1	Reservoir tank No. 1	Untreated water	120 m3	2008	--	--	--	Reinforced concrete
Well No. 2	Well No. 2	Untreated water	152 m	2010	--	--	(611302, 9639321)	Cased
Reservoir tank No. 2	Reservoir tank No. 2	Untreated water	100 m3	2008	--	--	--	Reinforced concrete
Anti-spill equipment warehouse	Tank N/N	Diesel	55	--	--	--	(611086, 9639425)	Metallic
Sediment pool	Pools 1, 2 and 3	--	--	--	SURCONSUL 2017	13 ha	(612098, 9640211)	Occupied by informal settlers

Source: Interviews Dpt. YILPORT Technician, APPB Technicians, field survey, carried out between October 22 and November 5, 2020.
Prepared by: Ecosambito, 2020

1.4 Description of geological and hydrogeological conditions

1.4.1 Geological Component

The study area is located in the southwest of Ecuadorian territory, in the western or coastal region, which occupies 25% of the land; the wet season prevails from January to June, with a rainfall of approximately 80%, and the dry season in the remaining months of the year. The plain is covered by detrital sediments (sands, sandstones, conglomerates) with a strong volcanic contribution from the Sierra. This feature allowed the development of important aquifers of large extent, with generally high variable permeability and with good yields. (INAMHI, 2015)

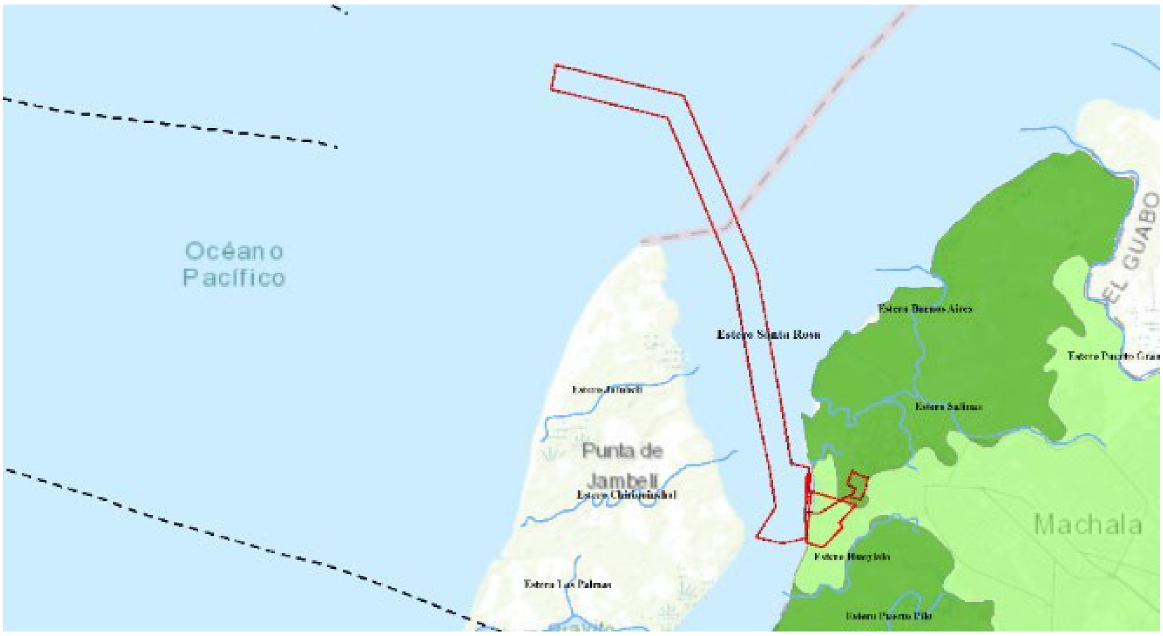
Three physiographic domains can be differentiated in the township of Machala:

1. **Low floodplain of the coast.** It is found over the entire eastern half and part of the north-western part of the township, at low altitudes, mostly at sea level. It is formed by a single morphological context, the *recent alluvial plain*. (Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2015)

2. **Coastal alluvial medium.** It consists of the water bodies of the rivers Jubones, Buenavista and the Santa Rosa estuary, where Puerto Bolivar is located. (Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2015)

3. **Mid-coastline.** It is completely occupied by the context *of fluvio-marine forms and deposits* (Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2015).

Figure 3 Physiographic domains of the project's area of influence



Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

The area where Puerto Bolívar is located is a coastal alluvial environment, located in the extreme west, formed mainly by the Santa Rosa estuary, where several estuaries flow into, as shown in the geological map of the area, mainly the following estuaries: Guayabal, Caza Camarón and Puerto Pillo, this environment is made up of a fluvial genetic group. The area has frequent flooding, resulting in alluvial soils, as well as slight plateau plains, the product of alluvial-colluvial soils.

The study area includes both current and non-functional fluvio-marine forms and deposits generated at different times of the Quaternary (Holocene, mainly, and Pleistocene). The map shows alluvial deposits of estuaries and mangroves, sands and alluvial estuarine deposits, consisting of clays, silts and sands. In addition, it is a sub-zone of mangroves that comes from Tumbes and continues through the Santa Rosa Estuary, the mangrove forests develop in marshy areas, which are plains near the sea where the water is brackish.

1.4.2 Stratigraphy

1.4.2.1 Machala Unit

The area is distinguished by low areas of soft relief, consisting of fine-grained sediments, which from the tectonic point of view are areas of subsidence and subsidence, with a surface formed by recent sediments.

- **Marine Terraces Q_{Tm1}**

More recent marine deposits are considered to occur south of Puná Island around Cape Salinas and also extend along the Jambelí archipelago; in the zone of direct influence to the Pacific Ocean. These deposits are formed by salt flats, marshes, estuaries, mangroves and beach ridges. Most beach deposits are found isolating mangroves and marshes with tidal channels at different stages of development. These deposits are found overlying Pleistocene sediments of the "Miembro Lechuza". No dating is available; however, they are considered to be more recent deposits of Holocene. (INSTITUTE OF GEOLOGICAL AND ENERGY RESEARCH, 2018)

Restricted to the zone of direct influence of the current ocean and its level variations (tides). The huge contributions of silt and clay dragged by rivers, will be deposited directly in the ocean pit. The area shows sands with cross stratification, with superposition of levels of acceptably classified granulometry, but poorly distributed spatially, since the lenticular strata reflect the bathymetric variations of the ocean or the magnitude of the river floods at the time of debris deposition. (INSTITUTE OF GEOLOGICAL AND ENERGY RESEARCH, 2017)

The Jubones parish is made up of two types of soils:

- ✔ Entisol: these are young soils that do not show any defined development of profiles, their composition is similar to the rocky material that gave rise to them.
- ✔ Inceptisol: soils derived from both fluvionic and residual deposits, formed by lithic materials of volcanic and sedimentary nature.

- **Alluvial Plains (Q_{La})**

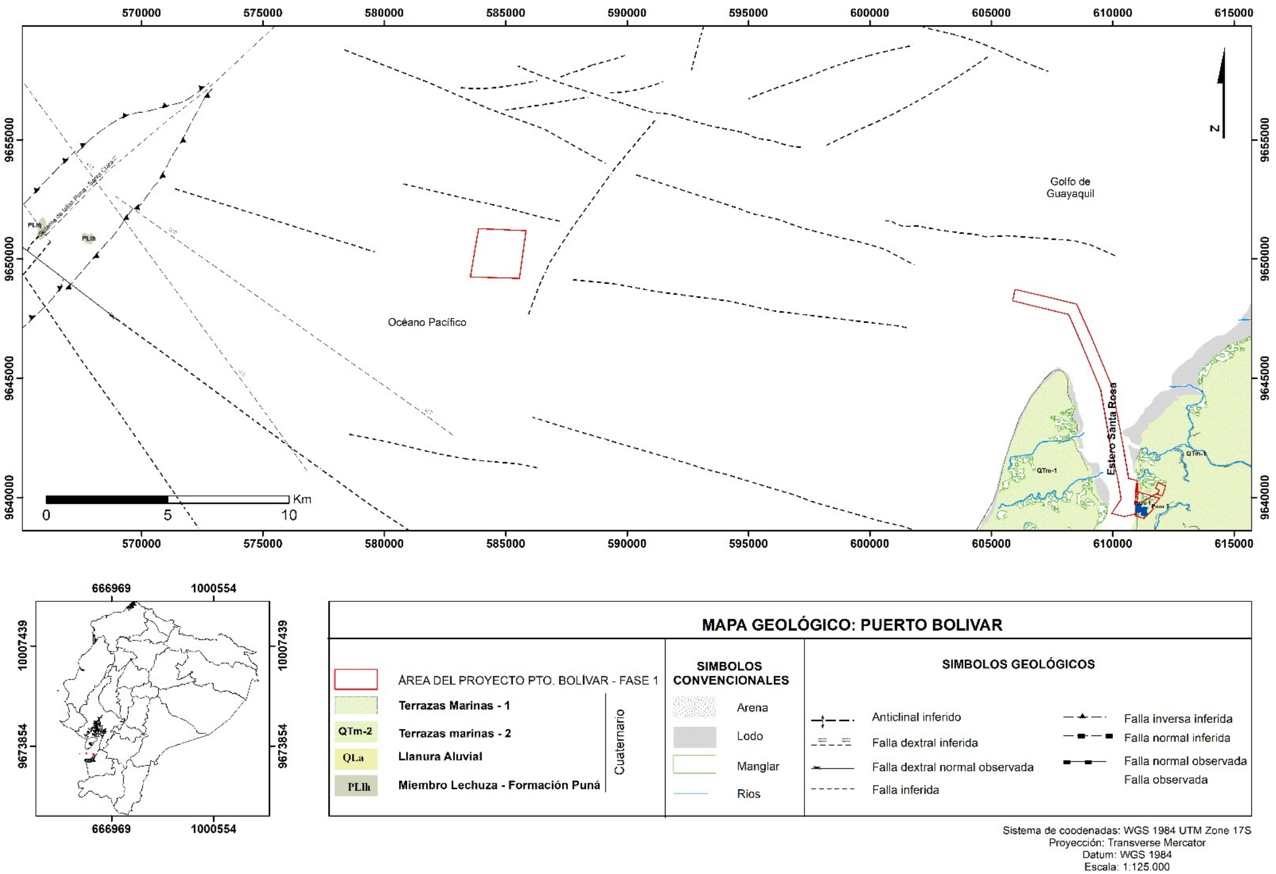
They extend in the slope changes of the boundaries of the mountain range to the coast, below the foothills deposits and covering the geological base of the coastal plain. The terraces, made up of blocks, gravels, silts and sands, are poorly developed. The power of these deposits can reach hundreds of meters, depending on the topography of the substrate. (INSTITUTE OF GEOLOGICAL AND ENERGY RESEARCH, 2017).

- **Formation Fortuna (Msf)**

They present tuffs of rhyolitic composition, containing disseminated crystals of plagioclase, biotite and quartz. It discordantly overlies the dacitic tuff bodies. Geochemically and petrographically, it is similar to the tuffs of the Jubones Formation, the difference being that the La Fortuna matrix has a greater amount of fine elements with a vitroclastic texture.

Radiometric dating by fission traces determines an age of 23.2 ±0.8Ma, late Oligocene-early Miocene. (INSTITUTE OF GEOLOGICAL AND ENERGY RESEARCH, 2017).

Figure 4 Geological map of the project's area of influence



Geological map: Puerto Bolivar		
Puerto Bolivar Project Area - Phase 1	**Conventional symbols**	**Geological Symbols**
Marine Terraces - 1	Sand	Inferred anticline
Marine Terraces - 2	Mud	Inferred dextral fault
Alluvial Plain	Mangrove	Observed normal dextral fault
Lechuza Member - Puná Formation	Rivers	Inferred fault
Quaternary		Inferred reverse fault
		Inferred normal fault
		Observed normal failure Failure observed

Coordinate system: WGS 1984 UTM Zone 17S
Projection: Transverse Mercator
Datum: WGS 1984
Scale: 1: 125.000

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.4.3 Hydrogeological Component

The fluvial network of the province is of great importance, born in the high Andean peaks and descends in such a way that it irrigates the lands of the green province, making them fertile and finally flows into the Pacific Ocean. The Santa Rosa Estuary is fed by rivers that flow down from the western slopes of the Dumari, Chilla and Sambotambo mountain ranges. (Vargas, 2002).

The Machala Hydrogeological Unit is composed of a main basin, the Jubones river basin and 6 sub-basins: Balao, Gala, Tenguel, Siete, Pagua, Santa Rosa and Motuche estuary, corresponding to a flat to gentle terrain. Regionally, the climate is influenced by Intertropical Convergence Zones (ITCZ) and the cold Humboldt Current. (Manzano Herrera & Naranjo Calero, 2012).

The water resource for drinking water supply comes from a series of shallow and deep wells. The entire territory of the parish is subject to flooding and surges. (JAMBELÍ PARISH Decentralized Autonomous Governments (GAD, by its acronym in Spanish), 2015)

Two deep wells have been drilled within the facilities of the Port Authority of Puerto Bolivar that belong to the aquifer or recharge area of the Motuche River. The wells are 3 to 200 m deep, NE from 2 to 10 m deep, flow rates between 3 to 28 l/s, pH 6.9, EC between 293 to 1904 μS/cm, and are used for human consumption and irrigation, and may have contamination of agricultural origin. (ESPOL, 2014).

Table 2. Motuche River Basin

Area	309 km^2
Perimeter	103.5 km
Axial length	39.8 km
Width	7.8 km
Basin shape	Oval oblong to rectangular oblong
Topography	Very weak

(Manzano Herrera & Naranjo Calero, 2012)

Well No. 1 of WGS-84 coordinates (611065, 9639458), with a depth of 120 m, 8 inches casing diameter, discharge at 2 inches; the resource is sucked and deposited in a 120 m^3 reservoir, tank then to an elevated tank of 100m^3 and then distributed to the points of use, washing and maintenance of the containers.

Well No. 2 of WGS-84 coordinates (611302, 9639321), with a depth of 152 m, 8-inch casing diameter, 2-inch discharge; the resource is suctioned and deposited in a 100 m^3 reservoir tank, then into an elevated tank of 150 m^3 and used for the consumption of personnel working in the administrative area.

In order to complement the information, hydrogeological data on drilled and excavated wells were collected from Senagua's archives. This also made it possible to describe the aquifer structure of the area, which is linked to alluvial deposits made up of gravels and sands. Its extension is 311.60 Km^2; these units are considered to have primary porosity, intergranular porosity and very high permeability.

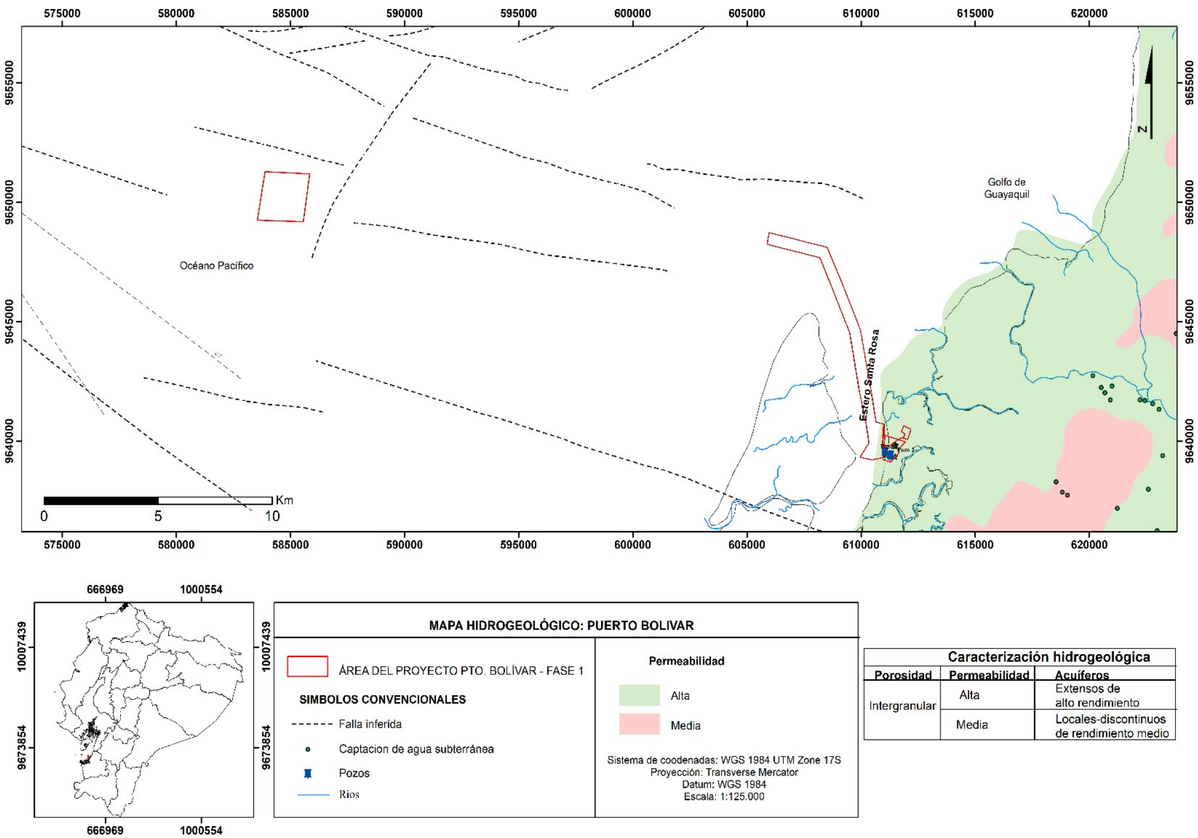
According to INAMHI (2015):

- Aquifers associated with unconsolidated clastic rocks of Quaternary age, with generally high permeability, with relative hydrogeological importance; of local extension, with good water chemical quality; with the possibility of exploitation through shallow wells; and,
- Aquifers in unconsolidated clastic sediments of the undifferentiated Quaternary, which predominantly outcrop in the basins of the Guayas, Taura, Balao, Jubones, San Miguel, Putumayo, Aguarico and Morona rivers; and in the inter-Andean valleys. The extension of these aquifers is regional, although in some places they are limited, free and/or confined, generally of medium to high permeability, with water of good chemical quality in most cases.

Exploitation is carried out through variable depth drilled wells and dug wells.

The conglomerates, sands and gravels that make up the area have high and medium permeability and reach notable thicknesses. A large colluvial deposit is located in the central eastern part, north of the Jubones River. The detrital materials that make it up are sub-rounded blocks and pebbles of volcanic agglomerates to silts and clays decomposed by the weathering of the bedrock in which it rests (F. Macuchi), as a consequence of slope instability as base erosion progresses in weakly tectonic zones. Like the previous ones, alluvial deposits are Quaternary deposits located along rivers where the natural slope decreases. Considerable outcrops are found north of Pasaje and south of Ponce Enriquez. These are unconsolidated deposits of boulders (on riverbanks and riverbeds) covered by sands and silts towards the exposed parts. (Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2015).

Figure 5 Hydrogeological map of the area of influence of the project.



Hydrogeological map: Puerto Bolivar	
Puerto Bolivar Project Area: Phase 1	Permeability
Conventional symbols	High
Inferred failure	Medium
Groundwater withdrawal	Coordinate System: WGS 1984 UTM Zone 17S Projection: Transverse Mercator Datum: WGS 1984 Scale: 1:125.00
Wells	
Rivers	

Hydrogeological characterization		
Porosity	Permeability	Aquifers
Intergranular	High	High-performance extensions
	Medium	Local-discontinuous medium-performance

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

1.5 Risk factors

The flow of cargo transports and/or heavy machinery are factors that could affect the existing civil structures in a given area, such as streets and avenues, gutters and sewage and rainwater wells; and, through these affectations, the infiltration of substances into the subsoil. In addition to rainfall, and because the area studied is located within a high flood risk zone, the degree of transport of these substances is greater. Another factor is the geodynamics of the area where the project is located, which is controlled by the subduction of the Nazca plates under the South American plate, and the movement of the fault system, which terminate to the south in the Gulf of Guayaquil.

The slope factor also influences the study area, considering that the Machala Hydrogeological Unit is a flat to gentle terrain, with a percentage range that varies between 0 and 7% slope. In addition, rainfall facilitates the transport of substances and hydrocarbons to the lower part of the basin. This data can be very useful for determining the amount of soil entrainment by surface streams, aquifer recharge averages and/or soil moisture content. A high annual precipitation rate at a site contaminated with a highly water-soluble compound would cause significant migration. Between Machala - Huaquillas and Santa Isabel - Saraguro, there is evidence of a range that varies between 200 and 900 mm of annual rainfall.

On the other hand, the infiltration rate of a substance spilled on the soil depends on the soil texture, considering impermeable conditions with low and high plasticity silts.

The mechanisms of contaminant transport to aquifers are based on the interaction between the three media: air, water and soil. Contamination of one of the media usually results in subsequent contamination of the others. The behavior of contaminants in a medium is a function of their physicochemical characteristics, mainly: density, solubility, and viscosity; in addition to the characteristics of the surrounding medium such as: soil type, adsorption, permeability, particle size, moisture and organic matter content, suction, water level depth, among others. Climatological factors such as temperature and rainfall also play a role. That is, all physicochemical phenomena define the size and distribution of the contamination plume in an area (Varela, 2007).

Contaminants can reach groundwater in dissolved form, by direct infiltration of surface water and dissolution/leaching, or as a separate liquid, if they are in this state. When they reach the groundwater, contaminants that can dissolve in it will move with it. A combination of a moving groundwater body and a continuous source of contamination can therefore contaminate large volumes of groundwater. Some plumes from long-contaminated spaces can be several kilometers long. Permeability and porosity are important soil factors that help to conclude the migration and retention behavior of a rock medium in the presence of a fluid. Usually, sandy soils have fast infiltration regimes. When soils are sandy, silty or a combination of these, oil spills can reach existing aquifers directly (Varela, 2007).

On the other hand, some hazardous substances dissolve very slowly in water, as is the case with many organic compounds, including heavy hydrocarbons. When these substances infiltrate the soil into the groundwater, faster than they can dissolve, a portion will remain in liquid form. If the liquid is less dense than water, it will float on the surface of the water table, like oil on water. If the liquid is denser than water, it infiltrates and accumulates at the bottom of the aquifer. The flat slope facilitates the settling process of the fixed or heavy hydrocarbon fraction, allowing its accumulation in the sediments, the smaller diameter of the silt particles (less than 0.05 mm) and clay (less than 0.002 mm) offer a larger contact area to retain the fixed hydrocarbon fraction in its matrix (Varela, 2007).

Table 3. Substance transport velocity in low plasticity silts

Sustancia Derramada	Velocidad de Humedecimiento (Vh) [cm/min]	Velocidad de Saturación (Vs). [cm/min]	Velocidad de Transporte (Vt). [cm/min]
Gasolina	4.287	1.35	0.532
Agua Potable	2.8	0.874	0.408
Diesel	0.905	0.309	0.127
Ácido Sulfúrico	0.731	0.193	0.084

Source: (Varela, 2007)

Table 4. Substance transport velocity in high plasticity silts

Sustancia Derramada	Velocidad de Humedecimiento (Vh) [cm/min]	Velocidad de Saturación (Vs). [cm/min]	Velocidad de Transporte (Vt). [cm/min]
Gasolina	5.356	2.534	1.3
Agua Potable	2.121	0.878	0.524
Diesel	2.165	0.773	0.361
Ácido Sulfúrico	0.772	0.186	0.058

Source: (Varela, 2007)

Spilled Substance	Wetting rate (Vh) [cm/min].	Saturation rate (Vs) [cm/min].	Transport rate (Vt) [cm/min].
Fuel			
Drinking water			
Diesel			
Sulfuric Acid			

1.5.1 Sources of risk

In this section we identify the activities and infrastructures existing in the studied area (internal and external) that can generate contamination plumes in the soil and even groundwater, such as agriculture, ports, refinery, service stations, storage tanks, among others.

1.5.1.1 Sources of risk within the project

In the Puerto Bolívar area, marine terraces predominate, which are characterized by sands, silts, clays and some conglomerates, material from weathering. These have intergranular porosity, which allows fluid migration and a high permeability that helps fluid retention, lithology that is not very consolidated because it is from the Quaternary.

According to the studies carried out by CAMINOS Y CANALES C. LTDA (CAMINOSCA C. LTDA., 2006), the plasticity of the materials is medium to high, in a well up to 2.20 m deep (performed in the area of the current Wastewater Treatment Plant PTAR and Fuel Area), so that, according to the seepage velocities, it is relatively higher compared to soils of low plasticity.

This is explained in the following table:

Illustration 1. Composition of the improved surface layer of soil in the port terminal

Prof. (m)	Estratigrafía	Descripción del suelo
De 0,00 0,80		Material de mejoramiento, limos con plasticidad, presencia de agregados pétreos, compactos, y color habano.
De 0,80 2,20		Arcillas, de alta plasticidad, y de elevada humedad, con contenido orgánico, consistencia muy blanda a mediana, color café verdoso, (CH).

Source: (CAMINOSCA C. LTDA., 2006)

Depth (m)	Stratigraphy	Soil description
From 0.00 0.80		Improvement material, silts with plasticity, presence of pale, compact, tan colored aggregates.
From 0.80 2.20		Clays, of high plasticity and high humidity, with organic content, very soft to medium consistency, greenish brown color, (CH).

Illustration 2. Soil stratigraphy in the sample studied.

Estrato I	De 0.00 a 2,00 m Espesor: 2,00 m Descripción: Relleno de lastre
Estrato II	De 2,00 a 4,50 m Espesor: 1,50 m Descripción: arcilla verdosa con residuos de materia orgánica, consistencia de blanda a muy blanda, alta plasticidad. Clasificación SUCS: CH y OH Su de 0.9 a 0,30 t/m^2
Estrato III	De 4,50 a 5,50 m Espesor: 1,00 m Descripción: limo gris verdoso con estratos de arena fina consistencia media Clasificación SUCS: ML
Estrato IV	De 5,50-6,50 m (fin de perforación) Espesor medido hasta fin de perforación: 1,00 m Descripción: arena fina limosa gris verdosa medianamente compacta Clasificación SUCS: SM N (SPT) varía de 10 a 13 golpes

Source: (CAMINOSCA C. LTDA., 2006)

Stratum 1	From 0.00 to 2.00 m Thickness: 2.00 m Description: Ballast backfill
Stratum 2	From 02.00 to 4.50 m Thickness: 1.50 m Description: Greenish clay with organic matter residues, very soft consistency, high plasticity. SUCS Classification: CH and OH Su from 0.9 to 0.30 t/m2
Stratum 3	From 4.50 to 5.50 m Thickness: 1.00 m Description: greenish-gray silt with strata of fine sand of medium consistency. SUCS Classification: ML
Stratum 4	From 5.50 to 6.50 m (end of drilling) Average thickness until the end of drilling: 1.00 m Description: medium compacted greenish gray silty fine sand SUCS classification: SM N (SPT) varies from 10 to 13 impacts

From a depth of approximately 5 m, the presence of sands is observed, which have a higher hydrocarbon infiltration rate, allowing for a greater depth of the contamination plume.

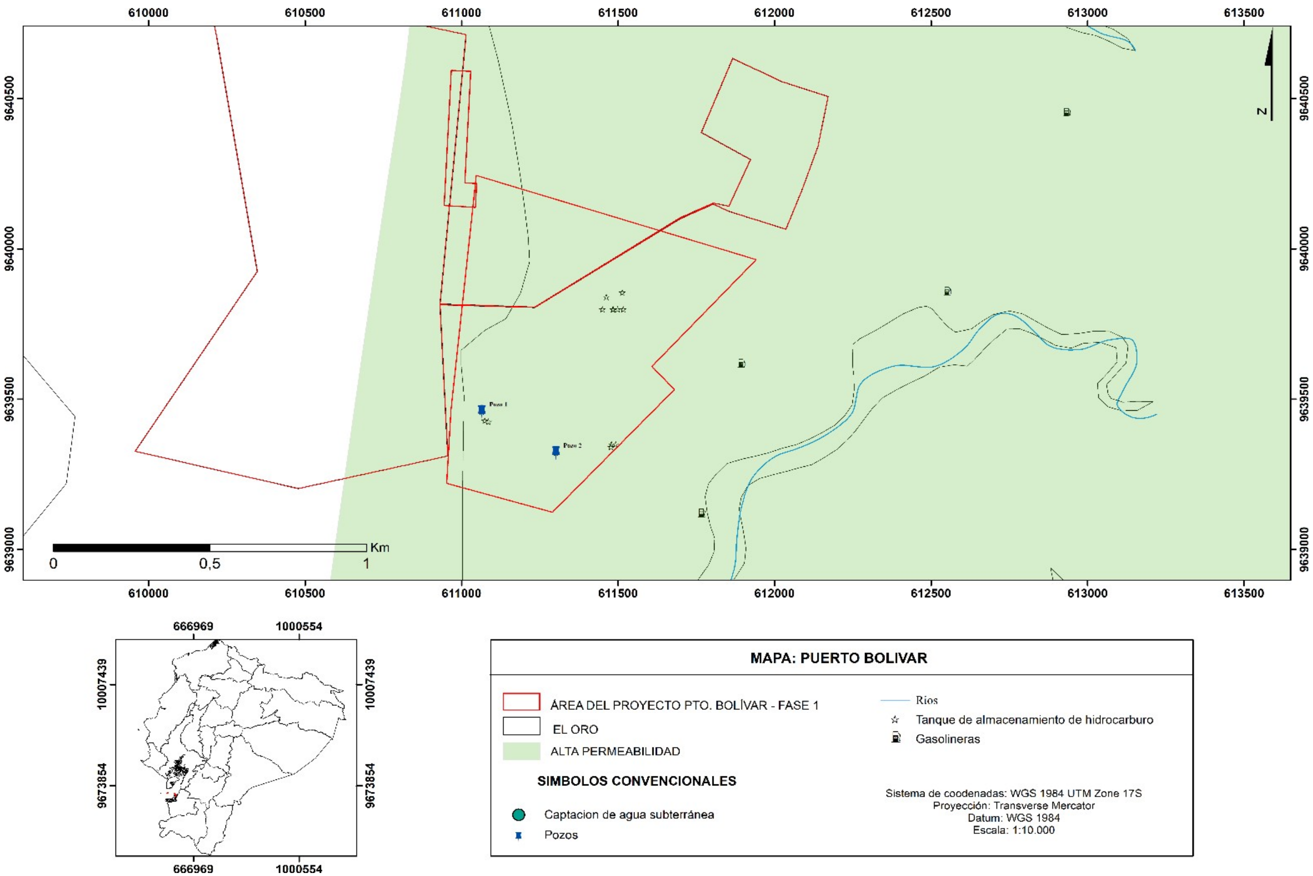
1.5.1.2 Sources of risk outside the project

Block 6 of Amistad field, located in the Gulf of Guayaquil, is the only source of free natural gas, and is processed in the natural gas dehydration plant located approximately 30 kilometers north of Puerto Bolivar, at the Bajo Alto site of Tendales parish, in El Guabo township, in the province of El Oro. This plant has identified a potential risk of affecting the soil resource due to condensate spillage from the Filter Separator, since the equipment does not have a cement platform to avoid direct contact with the soil in the event of a spill (Flores Sandoval & Siñalin Sevilla, 2013).

Other potential sources of contamination risk to the aquifer are the fuel storage facilities inside BINJAM and SUBSUR, and the fuel stations located in the Puerto Bolívar parish, both on land and on the body of water (Huaylá estuary).

The location of the identified potential sources of risk - both inside and outside the project site area - are shown in the Figure 5.

Figure 6 Risk infrastructures in the project's area of influence



Source: Yilportecu S.A.

Map: Puerto Bolivar	
Puerto Bolivar Project Area - Phase 1	Rivers
El Oro	Hydrocarbon storage tank
High Permeability	Gas stations
Conventional symbols	Coordinate system: WGS 1984 UTM Zone 17S Projection: Transverse Mercator Datum: WGS 1984 Scale: 1:10.000
Groundwater capture	
Wells	

Prepared by: Ecosambito, 2020

2. Environmental Studies

The records obtained, according to the principle of 'reasonably verifiable sources'[5], are:

- Environmental information
  - Environmental License No. MAE-RA-2017-309603 for the Project "CONSTRUCTION AND OPERATION OF THE PORT TERMINAL OF PUERTO BOLÍVAR, OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A.", issued by Resolution No. GADPEO-2018-009363-SUIA, of 03 April 2018, of the Provincial Government of El Oro.
  - Environmental License No. MAE-RA-2017-297974 for the Project "DREDGING OF PIERS 1, 2, 3, 4, 5 AND 6, MANEOUVERING AREA AND ACCESS CHANNEL OF PUERTO BOLÍVAR", issued by Resolution No. MAE-DPAEO-2017-009, December 19, 2017, of the Provincial Directorate of Environment of El Oro.
  - Environmental Registry No. 239660 for the project "CONSTRUCTION, OPERATION AND ABANDONMENT OF PIER # 6 OF THE PORT TERMINAL OF PUERTO BOLÍVAR", issued on December 16, 2019 by the Undersecretariat of Environmental Quality of the Ministry of Environment.
  - Hazardous Waste Generator Records, in force for each of the projects with environmental regularization detailed in the preceding numerals:
    - SUIA-10-2018-MAE-DPAE0-00440;
    - SUIA-11-2018-MAE-DPAEO-00446;
    - SUIA-03-2020-MAE-DPAEO-00699;

    and the respective Annual Declarations on Hazardous Waste Management for the years 2018 and 2019.
  - Waste Minimization Plans in force for each of the projects with environmental regularization detailed in the preceding numerals, and their respective Compliance Reports.
  - Environmental Compliance Audit, period December 2017-2018, of the Project "DREDGING OF PIERS 1, 2, 3, 4, 5 AND 6, MANEOUVERING AREA AND ACCESS CHANNEL OF PUERTO BOLÍVAR", submitted by official letter YPTO-GG-0103-19 of 10 May 2019, and approved by official letter MAE-

[5] Record information that is reasonably ascertainable means (1) information that is publicly available, (2) information that can be obtained from its source within reasonable limits of time and cost, and (3) information that is practically reviewable. Translated from the original in English.

DPAEO-2020-0482-O of 27 February 2020 by the Provincial Directorate of El Oro of the Ministry of the Environment.

  - Environmental Compliance Audit, period April 2018-2019, of the Project "CONSTRUCTION AND OPERATION OF THE PORT TERMINAL OF PUERTO BOLÍVAR, OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A.", submitted by official filed letter YPTO-GG-0136-19 of June 24, 2019, and approved by official filed letter GADPEO-SGA-2020-0252-OF of January 03, 2020 by the Secretary of Environmental Management of the Provincial Government of El Oro.
  - Miscellaneous routine records and investigation reports of accidents involving the discharge of chemicals into soil and/or bodies of water.
  - Monitoring reports delivered monthly to MAAE and biannually to GADP El Oro, between December 2018 and September 2020.
  - Report on the stability and risk conditions of the walls of pool no. 2, conducted by SURCONSUL in October 2017.
  - Plans of implementation of port infrastructure.
- Historical usage information
  - Property Titles
  - Certificate of Ownership and Lien History
  - Permits and fees for local, regional, and national public entities.
- Other sources
  - Standard historical sources such as Ortho-photography, and relevant layers (.shp files) available in the National Information System Geoportal (SNI)[6], ministries, INEC and other public entities.
  - Interviews and surveys conducted with technical and administrative staff of YILPORTECU, APPB, Machala Fire Department, Parish Council of Puerto Bolivar, among others.

The analysis of the records obtained is carried out with considerations of accuracy and integrity of the information.

The purpose of the review of information provided by YILPORT is to obtain and review records that will help identify recognized environmental conditions in relation to the property.

[6] Available at https://sni.gob.ec/inicio

3. Identification of environmental liabilities

3.1 Introduction

For the identification of environmental liabilities, a Site Environmental Assessment (EAS, by its acronym in Spanish) has been carried out, which is an exhaustive review and investigation, aimed at knowing the environmental conditions that a site, property or terrain keeps, regarding its degree of pollution as a result of activities or operations carried out in it, through its history.

The EAS is the process of determining whether a particular property (including real estate and improvements) is subject to recognized environmental conditions, and is generally applicable to activities involving the storage of hazardous chemicals and subway storage/transportation of petroleum products.

This practice is intended to be used voluntarily by parties wishing to assess the environmental status of commercial real estate taking into account commonly known and *reasonably verifiable information* . The aim of this study is, through duly designed research, to identify recognized environmental conditions in relation to a property.

3.2 Methodology

This document constitutes the Environmental Assessment of the Site Phase 1 (EAS-F1) of the Puerto Bolivar Project - Phase 1 area, based on the *ASTM International Designation Technical Standard: E1527-13 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process"* [7], adapted to the specificities of the area to be evaluated.

The minimum search distance will be that which covers the properties with Environmental Regularization in force in the name of YILPORT TERMINAL OPERATIONS.

3.3 Historical information about the site

3.3.1 Port activity

Puerto Bolívar was born as a port enclave at the end of the 19th century, Puerto Pilo was its first settlement -later called Puerto Machala- (between 1783 and 1860). Subsequently, due to the cocoa boom and the sedimentation of the Pilo estuary during the 19th century, the administration decided to create the Port of Huaylá́ (1861) in front of the island of Jambelí́, and in 1879 the pier was built and functioned until 1883. In this year Puerto Bolivar was inaugurated together with the railway - for the transport of wagons by animal traction - that would connect it with Machala; and in 1887 the construction of an iron pier with railway terminal and mobile crane was contracted. However, the site was already a logistic enclave

[7] Available at http://bennett-ea.com/wp-content/uploads/2014/01/E1527-13-Phase-I.pdf

among the former inhabitants who moved between the present territories of Guayaquil and Puná, productive and commercial enclaves, dedicated to barge construction and salt extraction. In the 20th century, in 1902, the operation of the Municipal Cabotage Pier (Muelle Municipal de Cabotaje) began which, together with the railway, became the first intermodal transport link between the provinces of El Oro and Guayas. In 1970, the Port Authority of Puerto Bolivar -APPB- was created, in charge of the administration of the international seaport, and from this point on, countless expansions and adjustments were made to increase berthing capacity (Tapia, 2017).

The area of the current Puerto Bolívar parish is a zone that has been highly intervened by human activities, mainly those related to port activities and logistics in general, shrimp farming, human settlements and fishing, all creating constant expansive pressure on land use, leaving only small areas of mangrove forests, to the detriment of coastal biodiversity.

In general, within the territories of Puerto Bolívar (Machala) and Jambelí (Santa Rosa), the coastal edge until the mid 1950's was still covered by thick mangrove forest vegetation with heights of up to 10 m that only gave way to estuaries, canals and savannahs. It was, until then, a site of abundant harvesting of shells, crabs, "jaibas" (crab pastry), mussels and oysters, as well as a nesting site for many seabirds (Coastal Resources Management Program, 1993).

The large amount of natural resources available in the estuary-mangrove system, as well as the strong demand for labor due to the production of monocultures -first cocoa, then bananas, and finally shrimp- has originated immigration phenomena throughout its history, resulting in the informal occupation of the banks of the Huaylá estuary and its flood zones (formerly the rural parish of Puerto Bolívar) until the entire available area was taken over and a single urban mass was consolidated with Machala (the urban parish), mainly from 1979, the year in which the hydraulic filling of the area was carried out (Gonzalez & Ochoa, 1993).

In 2016 by Administrative Resolution No. 31 -2016, delegated management of the Port Terminal is granted to YILPORT TERMINAL OPERATIONS. However, the property of Puerto Bolivar Port Terminal remains APPB, and YILPORTECU becomes the operator and administrator of the Port Terminal.

3.3.2 Evolution of land use

From the interviews conducted, and the review of historical information, publications, and photographic archive of APPB, a Timeline is established with the main activities carried out within the Port Terminal, in relation to the objective of this study.

Table 5 Timeline of the main milestones of the development of the Port Terminal

Year	Activity executed
1963	Construction of the breakwater Pier (No. 1 and No. 2)
1980	Construction of the marginal pier (No. 4 and No. 5)
1995	Construction of Cell 1
2000	Construction of the Yard No. 8
2008	Construction of Reservoir Tank 2 and elevated tank no. 2
2009	Construction of the Wastewater Treatment Plant (IMHOF Well)
2009	Separation networks AASS and AALL
2010	Paving of the Yard No. 9
2010	Construction of Well No. 2
2012	Construction of Well No. 5
2012	Construction of the electrical substation, fuel area and generators
2012	Paving of the Yard No. 8
2014	Construction of the Yard No. 10
2016	Administrative Resolution No. 31 -2016 - Delegated management to YILPORT TERMINAL OPERATIONS
2017	Rehabilitation of Buildings
2019	Rehabilitation of Warehouses
2019 - 2020	- Construction of the Cell Room and Electrical Wiring (from the main substation to the cell room and to pier 5) - Change of Rails in Pier 5
2020	• Construction of an effluent collector and grease trap in Yard No. 2 OROESTIBAS • Rehabilitation of the main roads, settlement areas, yards, pier 1 and access roads to the piers with asphalt within the Port Terminal. • Rehabilitation of Buildings

Source: Interviews with APPB and YILPORT staff
Prepared by: Ecosambito, 2020

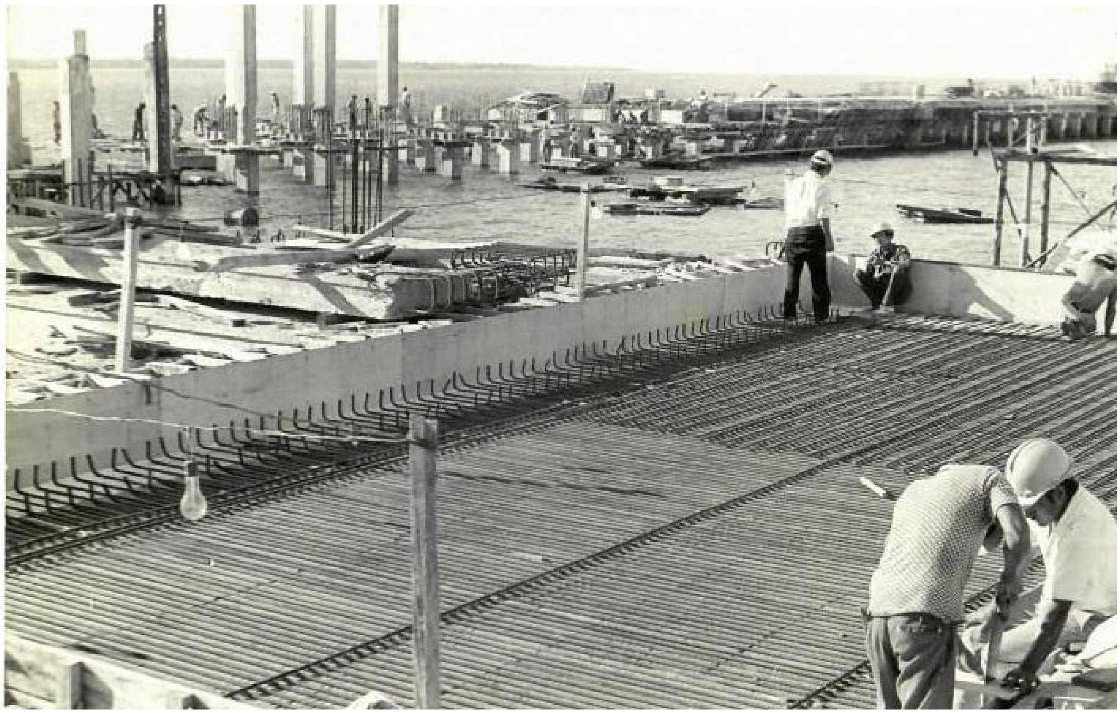
Moreover, the dredging that have been executed, are shown in the 6.

6 Dredging and Deposit Site History Table

Period	Dredged Volume (m^3)	Dredged Area	Deposit Area
July to October 1992	263,000.0	X	APPB Reservation Area
January-February 1996	182,000.0	X	APPB Reservation Area
November 1998 to February 1999	157,500.0	X	APPB Reservation Area
September to December 2000	121,000.0	X	APPB Reservation Area
February to July 2004	172,415.0	X	APPB Reservation Area
September 2008 to May 2009	284,263.0	X	APPB Reservation Area
March to May 2018	7,268,526.9	Access channel and maneuvering area	Offshore storage tank
April to May 2019	2,564,102.25	Access channel and maneuvering area	Offshore storage tank

Source: Yilportecu S.A.
Prepared by: Ecosambito, 2020

Photographic Record 1 APPB Photo Archive



Construction of the breakwater pier, year 1962

Construction of the marginal pier, year 1962

Construction of road work Av. 2nd Transversal, between current Yards No. 5 and No. 8, around the year 2000

Work for the consolidation of the current Yard area No. 10, year 2012.

Dumping of sediments dredged from the piers in the sediment ponds, between 2004 and 2009.

Source: APPB Photo Archive
Prepared by: Ecosambito, 2020

Photographic record 2. Infrastructure built in the last decade (2010-2020)

Electrical substation, built in 2012

Fuel area, built in 2012

Emergency generator room, built in 2012

Well No. 2, built in 2012

Source: Port terminal inspection of October 26, 2020.
Prepared by: Ecosambito, 2020

Photographic record 3.

Source: ECOSFERA 2017

3.3.3 Surrounding developments

Along with the port development, the parish was consolidating as a population and logistical center for the shrimp and artisanal and semi-industrial fishing sector, with more than 3,000 boat authorizations and 328 pier operating licenses in 2017 (100% occupation of the north bank of the Huaylá estuary). During this period, warehouses were also developed for the storage of various supplies for the aquaculture industry (food and chemical agents), ice factory, fuel and lubricant distributors, in addition to the shipment of machinery and construction materials -mainly by means of the barge that operates from the Yacht Club- and the transportation of personnel; as well as warehouses for the storage of bananas until their shipment for export. Tourist activities - mainly to the islands of Jambelí, del Amor and Santa Clara - and passenger transport to and from communities in the archipelago such as Costa Rica, Las Casitas, Las Huacas, Pongallillo, and others on the mainland coast such as Puerto Jelí and Puerto Pitahaya, are carried out from the cabotage dock of Puerto Bolívar, adjacent to the Port Terminal (Tapia, 2017, 25-34).

According to the chronicles of the time and the testimony of members of the Parish Council, until the end of the 1980s, there existed in Puerto Bolívar the CEPE[8] storage tanks on Olmedo Street (entrance to the 4 de Abril neighborhood, 600 m from the port terminal), which was supplied by means of an overhead pipe that ran along Av. Olmedo to the Santa Rosa estuary, fueling tankers that in turn supplied the fishing industry. CEPE had acquired an entire city block to strategically establish several tanks that contained: the largest containing 150,000 gallons of gasoline, a second holding 98,000 gallons of kerex, and a third large reservoir containing 150,000 gallons of diesel; in addition to other small tanks that stored *Fuel Oil*. This transportation of fuels by means of superimposed piping continually generated small leaks and spills, both on public roads (at the time, dirt roads) and in the Santa Rosa estuary, the site where the tankers were supplied. In 1987, a fire occurred in these tanks, which according to the testimony of a firefighter from the present time[9] during the incident, was started by accident when children in the sector played with fire near a puddle with discharges of stored hydrocarbons. The flames reached up to 60 m in height, and the surrounding population had to evacuate immediately, some even jumping into the waters of the Huaylá estuary. Finally, through an Act of Commitment between representatives of CEPE and residents of Puerto Bolivar, the definitive closure of CEPE's operations in the sector was agreed upon. However, there is no reliable record of the site's operations and closure conditions, since CEPE ceased to exist as a legal entity in 1989, and subsequently became Petroecuador.

Between February and March 1995, given the upsurge of shares in Upper Cenepa (yellow alert declaration), the Jambelí Naval Station (ESNAJA) was created in a small property delivered by APPB (former commissariat), where it operated until March 1996, when it moved to its new facilities (location and #243; n current), and it is in 2008 when he is designated as Marine Corps Battalion No. 22 “Jambelí” (BIMJAM), (Vargas Molina, 2014). The complex was built on the western margin of the Jambelí Naval Lyceum, between east and the coastline, on a high ground land surrounded by mangroves and shrimp pools.

In 2003, a 12.5-inch diameter pipeline was installed to transport natural gas offshore, linking the platform at Campo Amistad with Petroamazonas EP's facilities in the community of Bajo Alto (approximately 30 km north of the port terminal), to increase natural gas production by approximately ten (10) million cubic feet per day, with the incorporation of production from the AMSB-10 well, drilled by Petroamazonas EP.

North of BIMJAM, on the Puerto Cobre S.A. property (part of ECSA's mining project, and which will allow the shipment of the mineral concentrate extracted from the Mirador project in the province of Zamora Chinchipe to the Chinese market), a breakwater wall was erected

[8] Ecuadorian State Oil Corporation.

[9] Source: https://www.facebook.com/NoticiasElMachaleno/posts/3394247847266321/ consulted on 10/11/2020 at 16h00.

in 2015 to reinforce the existing structure (shrimp pool wall). Although the project has been licensed since 2007, no new intervention has been carried out on the site.

3.3.4 Previous environmental research

From the review of the archives detailed in section 2, and other publications, the following evidence was found related to research, study and/or analysis of infrastructure, operating conditions and environmental impacts:

- In the Ex-post Environmental Impact Assessment for obtaining the Environmental License for the project "CONSTRUCTION AND OPERATION OF THE PORT TERMINAL OF PUERTO BOLÍVAR, OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A." (ECOSFERA CIA.LTDA., 2017), the baseline of the project, the identification and assessment of environmental aspects and impacts, as well as the Environmental Management Plan are established. In this, the initiatives carried out by YILPORT to mitigate the environmental impacts generated by its operations are established among others. This document does not recognize any existing Environmental Liabilities or Environmental Condition.
- In the Environmental Impact Assessment for obtaining its Environmental License for the project "DREDGING OF THE PIERS 1, 2, 3, 4, 5 AND 6, MANEOUVERING AREA AND ACCESS CHANNEL OF PUERTO BOLÍVAR" - elaborated by (ECOSFERA CIA.LTDA., 2017), the baseline of the project, the identification and evaluation of environmental aspects and impacts, as well as the Environmental Management Plan are established.
- The Environmental Audit of Compliance with the Environmental License for the project "CONSTRUCTION AND OPERATION OF THE PORT TERMINAL OF PUERTO BOLÍVAR, OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A." (ECOSAMBITO C.LTDA., 2019), where an average level of compliance with the evaluated criteria is established of 97.6%. This document sets out an action plan that includes the commitment to improve the order and management of hazardous wastes and effluents generated in the operations carried out in Yards No. 2 (OROESTIBAS) and No. 9 (ARETIN). To date, corrective action has been implemented in Yard No. 2, the action is pending in Yard No. 9.
- The Environmental Compliance Audit of the Environmental License for the project "DREDGING OF PIERS 1, 2, 3, 4, 5 AND 6, MANEOUVERING AREA AND ACCESS CHANNEL OF PUERTO BOLÍVAR" (ECOSAMBITO C.LTDA., 2019), where an average compliance level of 95.5% of the evaluated criteria is established; and where the established non-conformities are mainly linked to a change made in the dredging methodology, regarding the non-use of sediment ponds on land.
- And the Environmental Registry?

- Existing bibliography of heavy metal monitoring in sediments and biological species in the Santa Rosa estuary, among these: "Quantification of heavy metals in Anadara tuberculosa (*Mollusca: Bivalvia*) from the Huaylá estuary of Puerto Bolívar, by atomic absorption spectrophotometry" (Collaguazo, Ayala, & Machuca, 2017); "Evaluation of the distribution of total and bioavailable content of heavy metals: Cu, Cd, Pb and Hg in surface sediments of the Santa Rosa estuary, province of El Oro, Ecuador" (Senior, Valarezo, Yaguachi, & Marquez, 2015).

3.3.5 Administrative Processes

To date, the Ministry of the Environment has conducted 02 (two) administrative processes to Environmental License No. MAE-RA-2017-297974 for the Project “DREDGING OF PIERS 1, 2, 3, 4, 5 AND 6, MANEOUVERING AREA AND ACCESS CHANNEL OF PUERTO BOLÍVAR”.

1) Through Administrative Process No. 007-2018C.A., on September 19, 2018, the Provincial Directorate of the Environment of El Oro provides as a provisional preventive measure the order for the temporary suspension of activities in the execution of the dredging project; due to established breaches, associated with the use of 02 (two) TSHD dredgers instead of 01 (a), and partial submission of monitoring reports and non-compliance with some of the water and sediment quality parameters set out in the reference standards.
   By Filed document No. YPTO-GG-0309-18 dated October 1, 2018, YILPORT sends the disclaimer to Administrative Process No. 007-2018C.A.

   At a hearing held in Machala on 5 February 2019, the Administrative Procedure Sanctioning No. 007-2018C.A., in accordance with what is determined by Art. 213 and 244 of the Administrative Organic Code, rendering ineffective all actions within the administrative process No. 007- 2018C.A. and, the Temporary Suspension of Activities ordered in the execution of the Project “Dredging of Piers 1,2,3,4,5 and 6 of the Port Bolivar Maneuvering Area and Access Channel” was declared extinguished.

2) By Citation Ballot issued on February 18, 2019, the Provincial Directorate of the Environment of El Oro notifies Administrative Process No. 002-2019CA, for alleged breaches of the Environmental Management Plan and obligations established in the Environmental License.
   By Filed document No. YPTO-GG-0055-19 dated February 25, 2019, YILPORT sends the disclaimer to Administrative Process No. 002-2019C.A.
   At a hearing held in Machala, on March 19, 2019, everything acted on the basis of the initial order with which the administrative sanctioning procedure was initiated No. 002-2019C.A.

3.4 Environmental Monitoring

This section will analyze the historical results of the monitoring carried out between 2018 and 2020 of the respective Environmental Management Plans in force. See Annex 5 which includes Plan and Coordinates of Monitoring Points and Historical Monitoring Results.

3.4.1 Soil quality (seabed sediments)

Based on the results obtained in two years of soil quality monitoring of seafloor sediments carried out according to the Monitoring and Follow-up Plan (PMS) of the updated Environmental Management Plan in effect for the dredging project, the existence or absence of heavy metals (arsenic, cadmium, copper, total chromium, iron, mercury, lead), total petroleum hydrocarbons (TPH), and pesticides (organochlorine, organophosphorus, organonitrogen, and carbamates) is analyzed graphically. For pesticides, the result of highest value per type of pesticide or the total value by category is collected, depending on their availability (see Figure 7)

Analysis of results

From the historical results measured in the area of influence of the project, we have:

The Total Petroleum Hydrocarbons (TPH) parameter remains consistently below the MPL, with the exception of the baseline monitoring (conducted in May 2017) where all monitored points are well above the MPL, and in the monitoring conducted in May 2020 at point 7 (sediment pool on land) where a high value of the parameter associated with waste dumping by informal dwellers of the sector was detected.

The Arsenic parameter shows recurrently at all monitored points, values above Canadian regulations at all points (from P1 to P7), and above national regulations in points 1 and 2, however this behavior occurs interchangeably to whether or not dredging activities are carried out. In this regard, it should not be forgotten that arsenic can be found in groundwater inputs linked to natural geochemical processes, as a constant element in marine and estuarine waters, where contributions from continental waters and local variations in salinity and redox and temperature gradients can control the entry of arsenic from the mainland to the sea, and in drainage and leachates from mining activities (Lillo, 2005); is a component in arsenical pesticides (Reigart & Roberts, 1999); and that there is evidence of its accumulation in the seabed of the Santa Rosa estuary, as evidenced by the presence of arsenic by bioaccumulation in the "concha prieta" (Anadara tuberculosa) in the Huaylá estuary, which exceeds the limits established for consumption by Australian and New Zealand legislation (Collaguazo, Ayala, & Machuca, 2017).

A similar situation, although to a greater extent, occurs with the Copper parameter, where values above the Canadian and Ecuadorian standards are recurrently reported at all points, with large variations between the maximum and minimum values reported throughout the year, although it is observed that this behavior occurs regardless of whether or not dredging activities are carried out. In this regard, studies conducted on Evaluation of the distribution of total and bioavailable content of heavy metals, including copper, found that in the Santa Rosa estuary the concentration of copper ranged from 5.42 mg/kg to 39.17 mg/kg, with an average value of 21.85 mg/kg, of which bioavailable copper is on average 9.5% of total copper (Senior, Valarezo, Yaguachi, & Marquez, 2015).

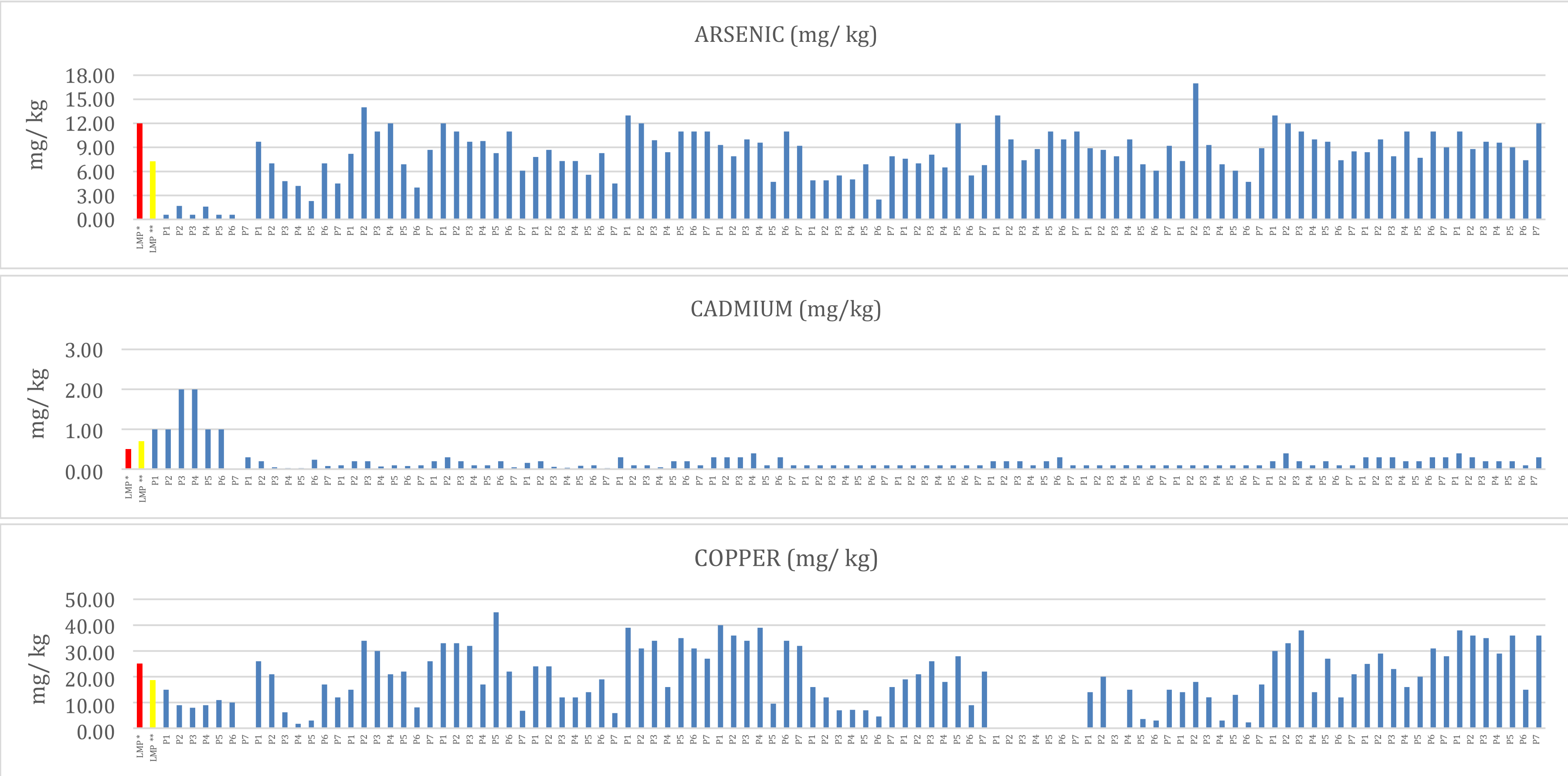
In the case of the Mercury parameter, the results of the analyses show accredited quantification limit values (< 0.1) coinciding with the MPL of the local regulations, so it is considered that it complies with the standard since, being a quantification limit value, we know that its exact concentration is below the value shown.

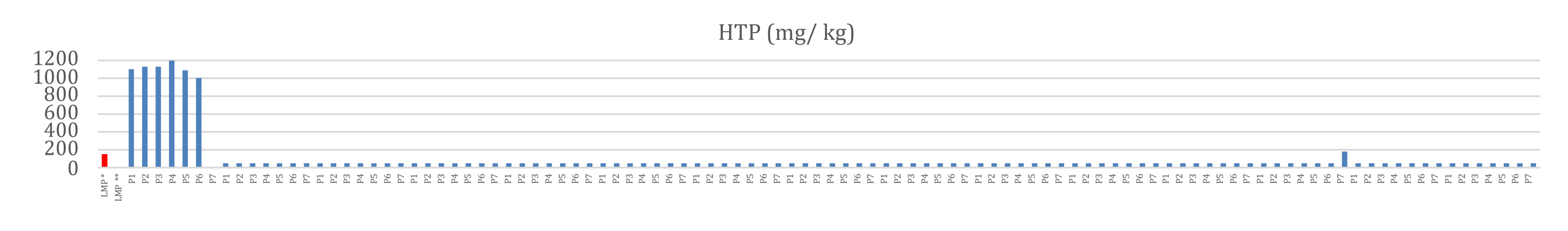
The parameters Cadmium, total Chromium, Lead, and Iron show a marked stability and in general remain below the MPLs of the standards evaluated - except for iron, which has no established MPL.

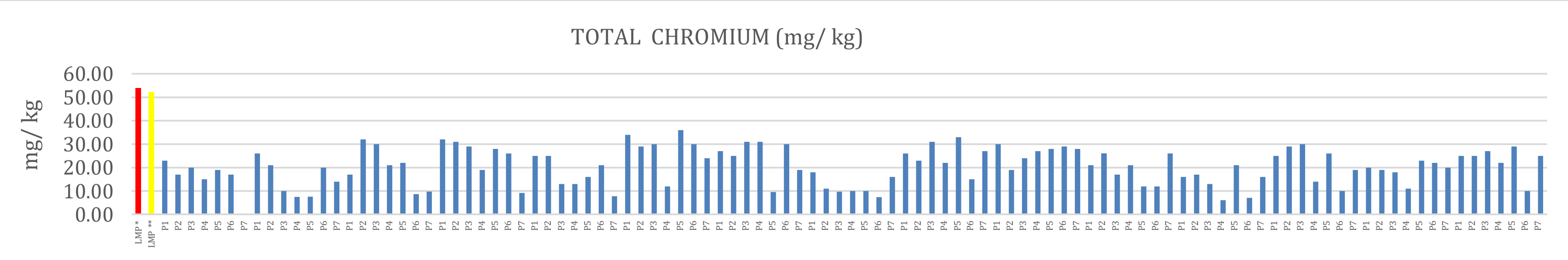
On the content of pesticides (organophosphates, organonitrogenates and carbamates, and all pesticides within these groups), their results appear as a constant value that corresponds to the accredited limit of quantification; and that do not exceed the MPL values when they exist.

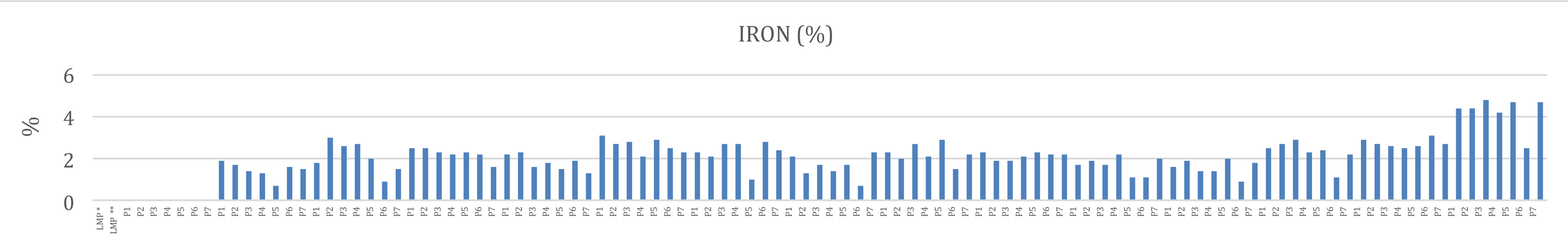
What was observed allows establishing that these results may be related to anthropogenic activities unrelated to dredging, given that the first dredging period was executed at the end of March 2018; among them aggregate and metallic mining, and which has an already reported impact on the sediment quality of the Santa Rosa estuary.

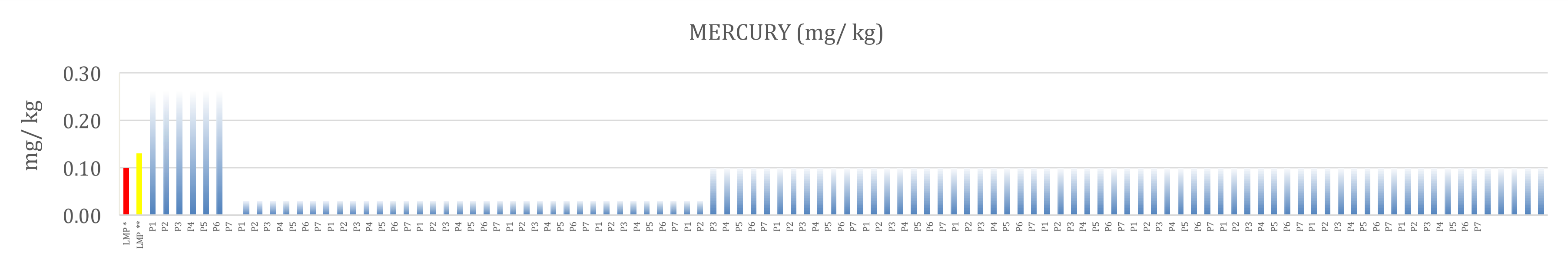
Figure 7 Historical results of soil quality parameters

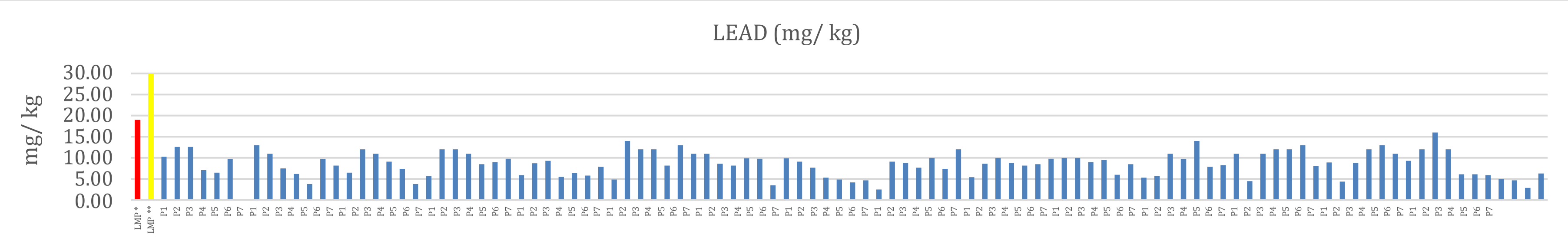


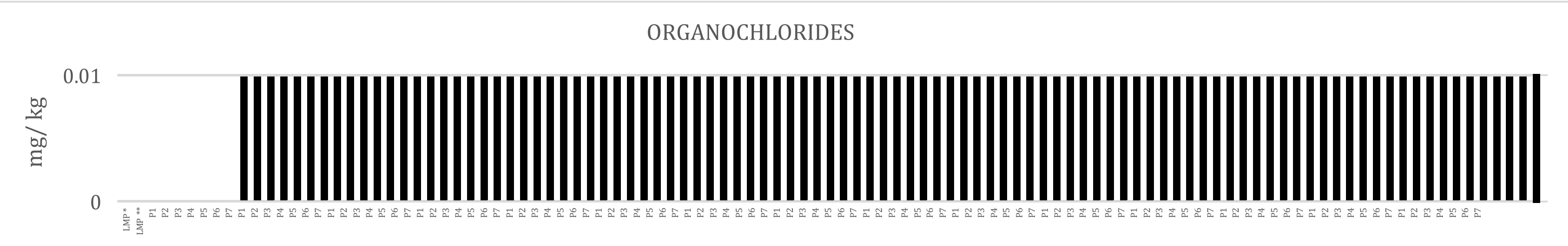

HTP (mg/ kg)
0
200
400
600
800
1000
1200
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7

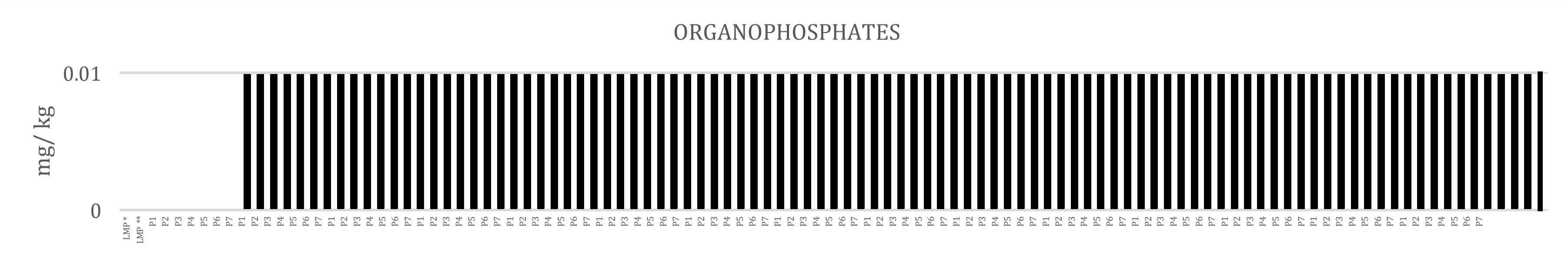

TOTAL CHROMIUM (mg/ kg)
mg/ kg
0.00
10.00
20.00
30.00
40.00
50.00
60.00
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7

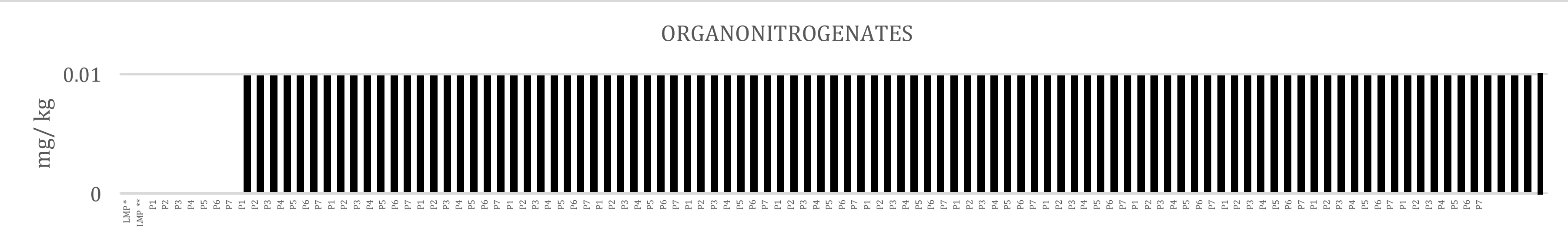

IRON (%)
%
0
2
4
6
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7

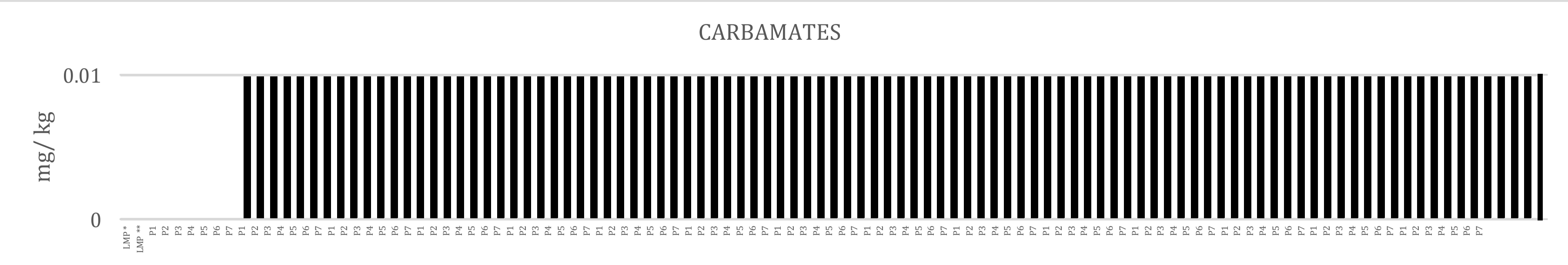

MERCURY (mg/ kg)
mg/ kg
0.30
0.20
0.10
0.00
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7


LEAD (mg/ kg)
mg/ kg
30.00
25.00
20.00
15.00
10.00
5.00
0.00
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7


ORGANOCHLORIDES
mg/ kg
0.01
0
LMP *
LMP **
P1
P2
P3
P4
P5
P6
P7







** AM 097-A, Annex 2, Table 1: Soil Quality Criteria.*
*** Canadian Environmental Quality Guide Values for Water Bodies.*

ENVIRONMENTAL BASELINE_V2.

3.4.2 Dumping area

The richness and biological diversity of the marine flora and fauna of the dumping area has been monitored since 2018, with quarterly sampling of water, plankton and benthos, standardized fishing, and reports of sightings of marine mammals; establishing that the benthic community is the one that receives the greatest impacts when dredged sediments are deposited on top of it - burying the existing community - its recovery is achieved in about two months after dredging, so the level of diversity indicators H' of Shannon and Margalef did not decrease significantly, and fluctuations that would occur naturally within the bottoms of the dumping area are observed (Rebolledo Monsalve, 2020).

Water quality was assessed at baseline in April 2017, and water and sediment quality monitoring was conducted in December 2020 that included parameters Aliphatic non-chlorinated, Aliphatic chlorinated, BTEX (Benzene, Ethylbenzene, m+p Xylene, O-xylene, and Toluene) and Organotin Compounds (TBT).

Regarding water quality at the site, the results show that all parameters that have a defined maximum permissible limit comply with current regulations (Ministerial Agreement 097A, Annex 1: Environmental Quality Standard and Effluent Discharge to Water Resources, Table 2: Admissible Quality Criteria for the preservation of aquatic life and wildlife in fresh, marine and estuarine waters). Although in the case of the metals Copper, Iron, Mercury, and Lead (from the group of Total Metals), although the results obtained correspond to the "limit value of quantification" accredited by the laboratory, so we know that the real value is below this, it could not be established with certainty whether or not it complies with the regulations.
Regarding the quality of the sediments, the samples analyzed correspond to soils with an alkaline tendency (pH>7), and an organic matter content higher than 10%, in addition:

- Total Petroleum Hydrocarbons, metals Arsenic, Cadmium, Copper, Total Chromium, Tin, Mercury, Zinc and Lead are below the established maximum permissible limit; and Iron in normal concentrations for this environment.
- In the group of parameters of non-chlorinated aliphatics, BTEX, and aliphatic chlorinates, the results obtained are below the established maximum permissible limit.
- The content of the organochlorine pesticides Dieldrin, Endrin, Heptachlor, pp'DDE, pp'DDD, and pp'DDT, organophosphorus pesticides, organonitrogen pesticides and carbamates (and all pesticides within these groups), their results appear as a constant value that corresponds to the limit of quantification accredited by the laboratory.
- Tributyltin (TriButylTin) is reported as a value below the detection limit of 0.2 mg/kg. In the absence of a local standard setting MPL for TBT, and taking as reference values those proposed by the Dutch National Institute for Coastal and Marine Management (RIKZ) in their sediment quality guidelines, it is established that the TBT contained in the samples obtained far exceeds the reference maximum permissible limit. This excess indicates that the sediments in this area were highly contaminated by TBT, although at a much lower level than other monitored sites worldwide.
- The results obtained could be associated with dredging and sediment transport from the aprons of docks and maneuvering area of Puerto Bolivar, considering that in this port cleaning and painting of hulls have been carried out in a semi-artisanal way since the eighties of the last century and until 2017, when this activity was banned inside the Port Terminal.

3.4.3 Groundwater quality

Based on the results obtained in two years of monitoring water quality from Well No. 2 carried out by YILPORT's internal management, the existence or not of heavy metals (arsenic, cadmium, copper, total chromium, iron, mercury, lead), total petroleum hydrocarbons (TPH), and pesticides (organochlorine, organophosphorus, organonitrogen, and carbamates) is analyzed graphically. In the case of pesticides, the result of the highest value per type of pesticide or the total value per category, according to their availability, is shown (see Figure 8).

For the analysis of results, it should be considered that the regulations evaluated correspond to Ministerial Agreement 097A, Annex 1: Environmental Quality Standard and Discharge of Effluents to the Water Resource, Table 1: Quality Criteria of water sources for human and domestic consumption, i.e., it does not represent environmental quality parameters for groundwater.

Analysis of results

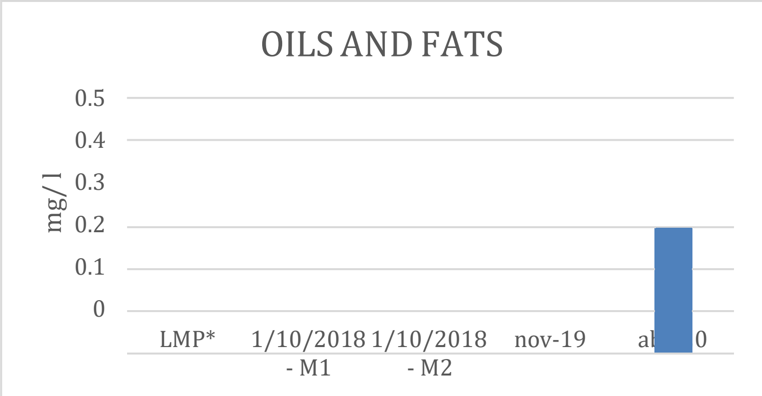
From the historical results measured in Well No. 2, we have:

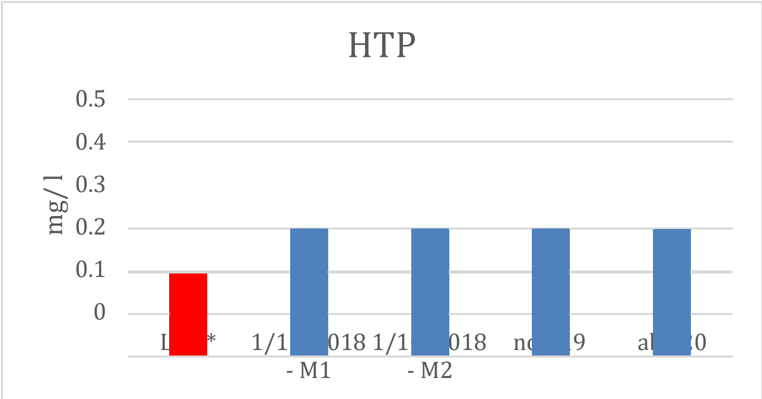
The Total Petroleum Hydrocarbons (TPH) parameter remains consistently above the maximum permissible limit, however, as these results are "accredited quantification limit values", it is considered that the actual value will be lower. In this case, the existence of petroleum hydrocarbon content of unknown origin in the aquifer is established, which, in general, may be the result of the following:

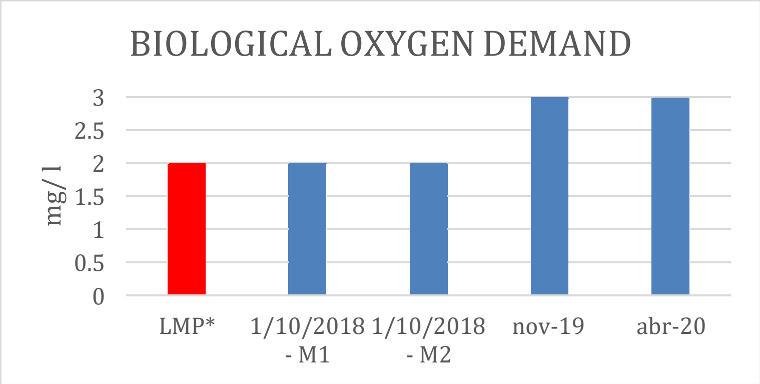
- Spills or leaks of toxic substances on the surface or in warehouses that subsequently infiltrate (oils and greases, wastewater, residues, chemicals, etc.).
- Hydrocarbons from leaking subway storage tanks or accidental spills.
- Inadequate maintenance of well extraction systems.

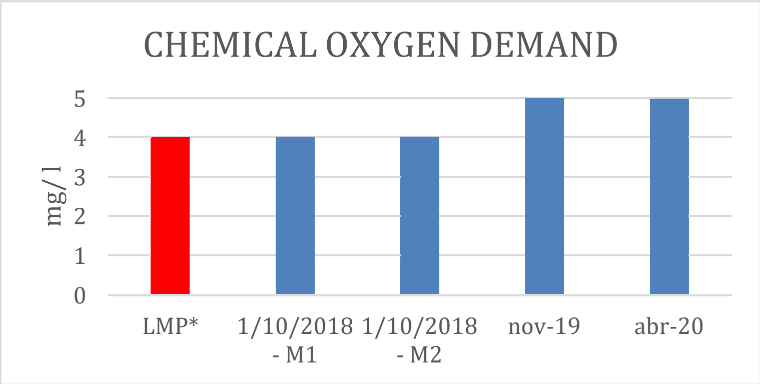
The BOD and COD parameters also oscillate between the maximum permissible limit and higher values, althoughagain they correspond to "accredited quantification limit values", so it is also considered thatthe real value will be lower.

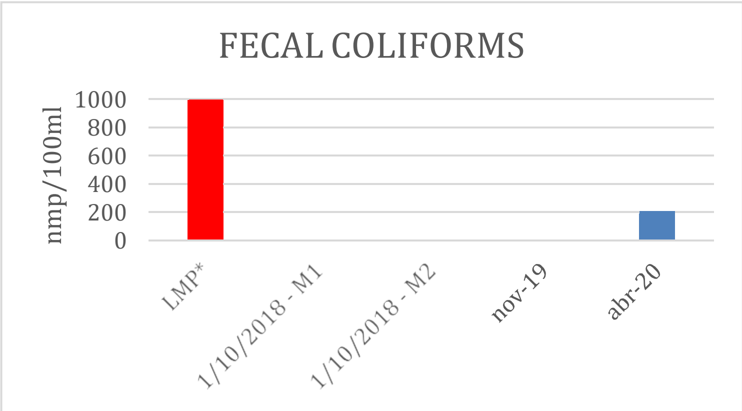
Figure 8 Historical results of water quality parameters for Well No. 2

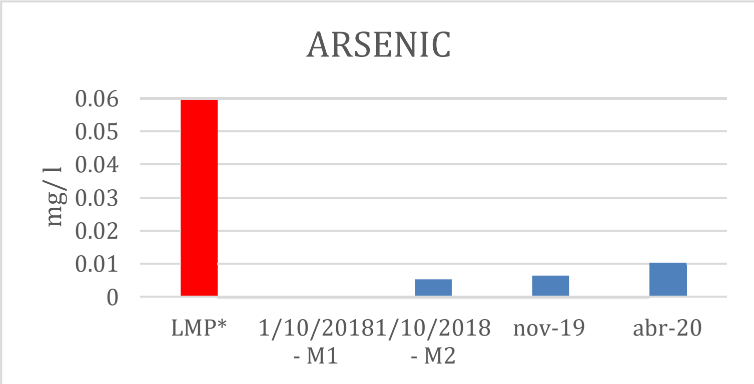


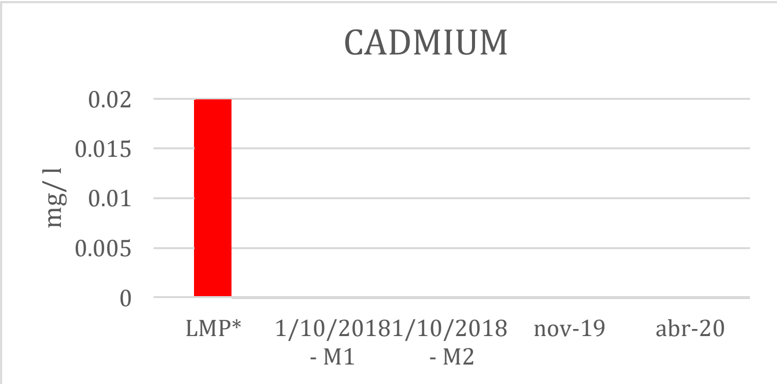


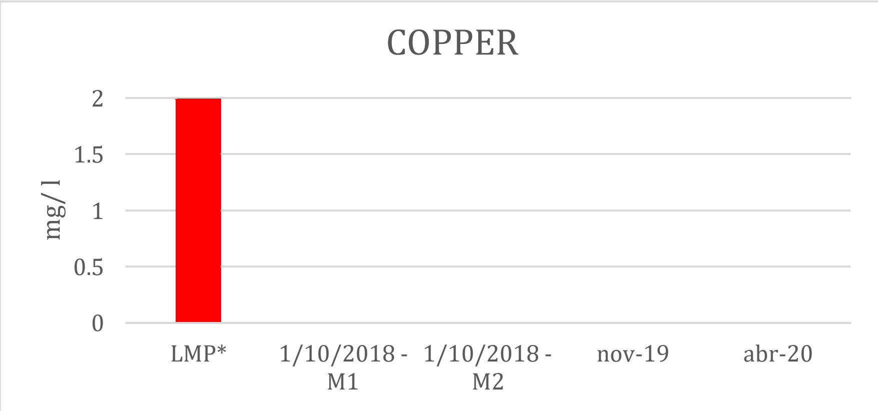

BIOLOGICAL OXYGEN DEMAND
mg/l
3
2.5
2
1.5
1
0.5
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

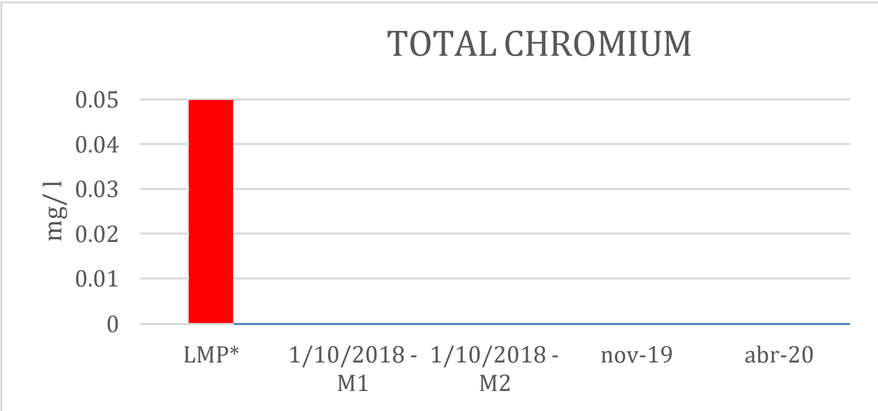

CHEMICAL OXYGEN DEMAND
mg/l
5
4
3
2
1
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

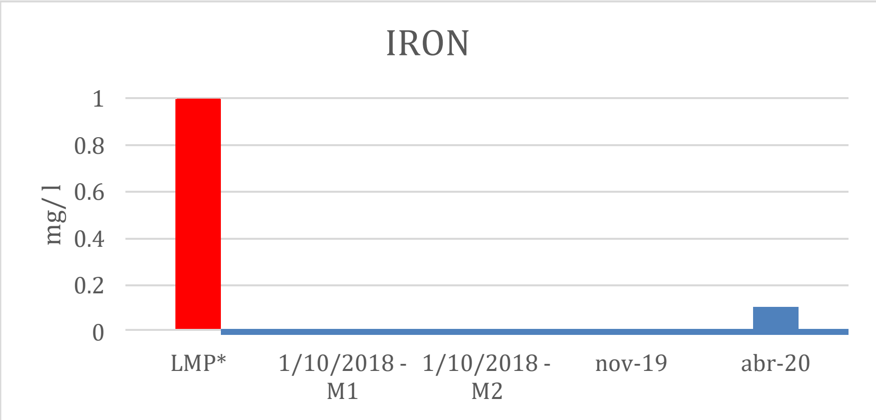

FECAL COLIFORMS
nmp/100ml
1000
800
600
400
200
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

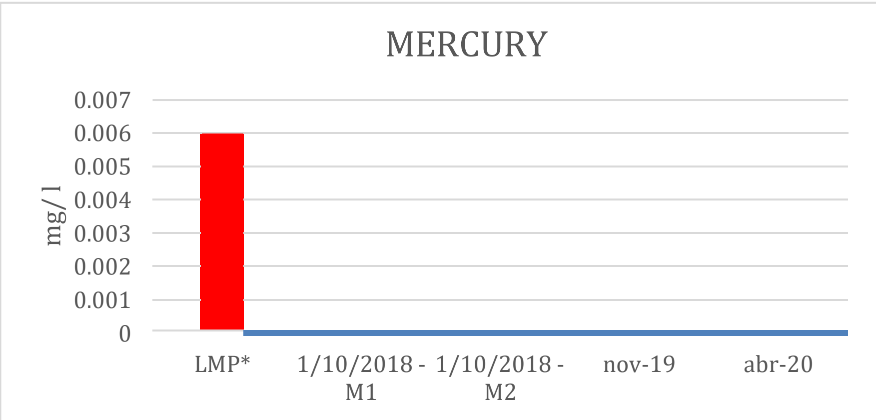

ARSENIC
mg/ l
0.06
0.05
0.04
0.03
0.02
0.01
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

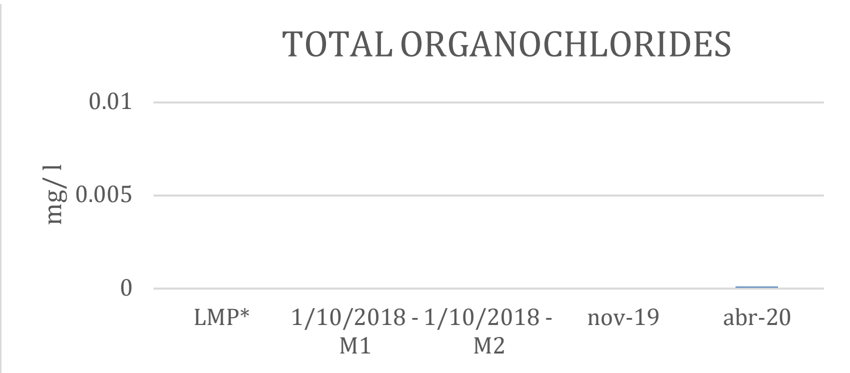

CADMIUM
mg/ l
0.02
0.015
0.01
0.005
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

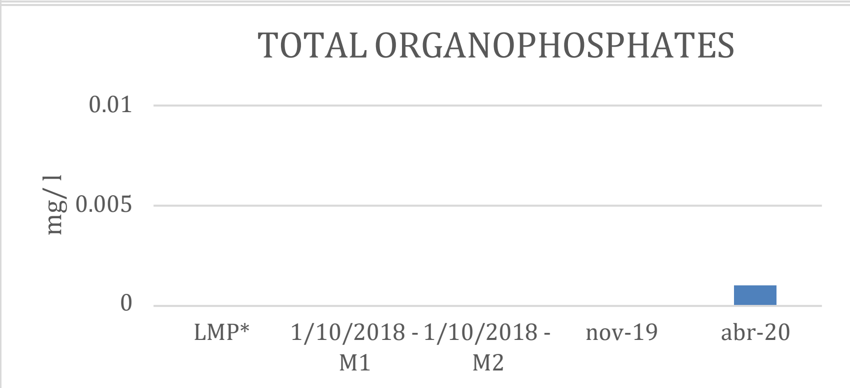

COPPER
mg/l
2
1.5
1
0.5
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20

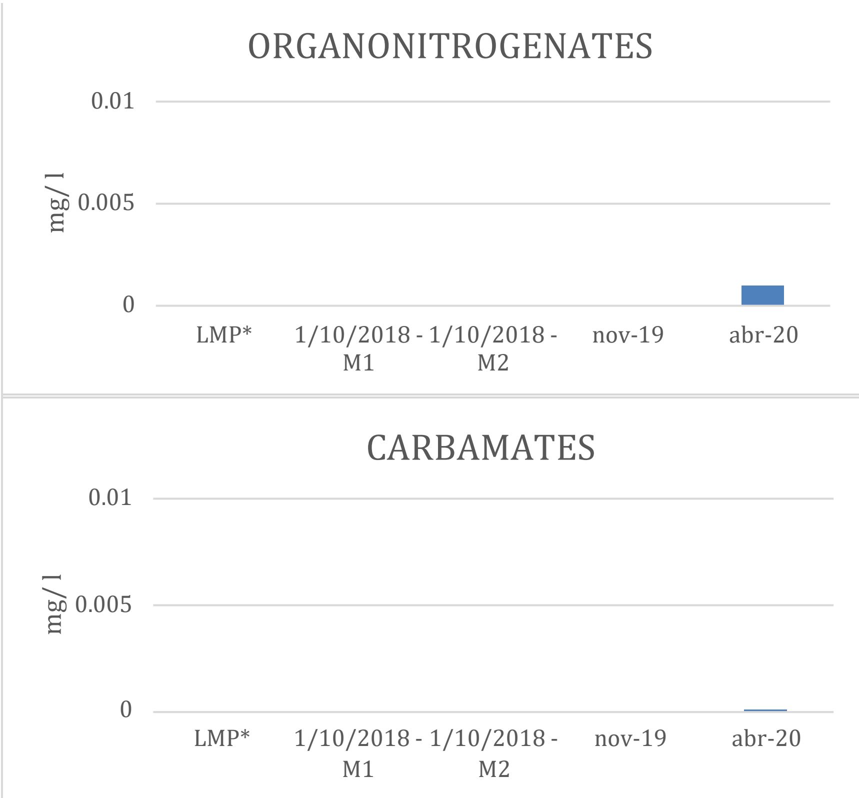

TOTAL CHROMIUM
mg/l
0.05
0.04
0.03
0.02
0.01
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20


IRON
mg/l
1
0.8
0.6
0.4
0.2
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20


MERCURY
mg/l
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20


TOTAL ORGANOCHLORIDES
mg/l
0.01
0.005
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20


TOTAL ORGANOPHOSPHATES
mg/l
0.01
0.005
0
LMP*
1/10/2018 - M1
1/10/2018 - M2
nov-19
abr-20



** AM 097-A, Annex 1 Table 1: Quality Criteria for Water Sources for Human and Domestic Consumption*

Source: Yilportecu S.A.

Prepared by: Ecosambito, 2020

3.4.4 Air quality and noise

Air and noise quality in the project implementation area has been monitored for two years on a quarterly basis by Ecuadorian Accreditation Service (SAE, by its acronym in Spanish)-accredited laboratories, in accordance with the provisions of the Environmental Management Plans.

The air quality parameters measured are: Carbon Monoxide (CO), Nitrogen Oxides (NOx), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Ozone (O_3), Particulate Material $PM_{10}$and $PM_{2.5}$.

The air quality monitoring point is located at the APPB piers (610951, 9639819).

During this period of time, all measured parameters are below the Maximum Permissible Limits (Section 4.1.2 of Annex 4 of Book VI of the A.M. 097-A, that is, COMPLY with environmental regulations)

Ambient noise monitoring in the area of direct influence of the Project has been carried out with the same frequency as ambient air quality monitoring. The monitoring points are: Point 1. Pier #1 (610941, 9639369). Point 2. Administrative Area APPB (611136, 9639401) Point 3. Pier #5 (611014, 9640135) Point 4. Cabotage Pier Puerto Bolivar (610892, 9639050).

The results show that there are some points that exceed the permissible limits for land use (Ministerial Agreement 097-A, Annex 5: Maximum Noise Emission Levels and Measurement Methodology for Stationary and Mobile Sources, Table 1: Maximum E Levels).

Details of the monitoring results can be seen in detail in Annex V.

3.4.5 Biotic monitoring

An integral part of the Environmental Management Plan of the dredging project consists of the following monitoring:

PMS-06 MONITORING PROGRAM FOR PHYTOPLANKTON AND ZOOPLANKTON SPECIES

Phytoplankton and zooplankton quantities in the area of marine influence are monitored by taking samples. This resource is evaluated periodically, preferably on a quarterly basis. Measurement records will be kept and compared with the values obtained in the environmental baseline of the project. The monitoring frequency is quarterly.

PMS-07 MONITORING PROGRAM FOR BIOAQUATIC SPECIES

Monitoring of mollusks and crustaceans in mangrove zones located within the project's area of influence: - Vikingos del Mar Artisanal Fishing Production Cooperative - Estero Porteño Artisan Women's Association - La Playita Community Organization for Tourist Services. The monitoring frequency is quarterly.

PMS-08 FLORA AND FAUNA MONITORING PROGRAM

Monitoring of planktonic and benthic Flora and Fauna, sighting reports of marine mammals and ichthyofauna in the offshore deposition area, including a monitoring point at the Santa Clara Island Marine Reserve boundary. The monitoring frequency is quarterly.

Based on the results obtained in one year of monitoring (February 2019 — 2020), a Results Report was delivered to the Ministry of Environment (Annual Report - IC N° 002-2019-IC-FORAFAUNA-DPAEO-MAE)

Analysis of results

In terms of sestonic resources, it is observed that the pulses of zooplankton abundance in fractions greater than 300 and 500 microns — without a clearly defined pattern being observed — in the case of the fraction greater than 500 microns a greater winter abundance is observed, with a decrease corresponding to the development of dredging maneuvers, and a new peak of abundance after two months in the vicinity of Santa Clara Island as well as in the Santa Rosa estuary. This decrease cannot be attributed to dredging maneuvers, but rather, as these are resources that increase significantly in certain periods, they also show considerable decreases, with the lowest sestonic biomasses (mainly associated with zooplankton and ichthyoplankton) occurring during August and October 2019. The lowest zooplankton and ichthyofauna abundances occurred during the months of August and October 2019, corresponding to the summer period of the Ecuadorian coast.

Regarding benthic resources, it is observed that there is a greater richness of these in the Santa Clara station (offshore), which has mixed bottoms providing more habitats that allow the establishment of a greater number of species, while the stations within the dredge deposit tank (offshore) are of silt, mud and fine sands, being logical to have fewer differentiated forms of life in a much more homogeneous habitat. It is observed that, although the dredging maneuvers decreased the population and richness of benthic species, the Shannon's and Margalef's diversity index H' did not decrease significantly, showing fluctuations that would occur naturally within the bottoms of the tank.

Regarding the pedestrian extraction resources (bivalves and crustaceans), monitored in mangrove conservation areas within the Santa Rosa estuary, and adjacent to the Puerto Bolivar project implementation area, it is concluded that the extraction levels of bivalves in the Playita and Vikingos del Mar sectors are quite stable with respect to the fluctuations described in Isla del Amor. In the first two, it has been observed that in the samples taken during dredging maneuvers, more abundant collections have been achieved than in other samples, which is evidence that there is no effect in terms of bivalve abundance attributable to dredging activities. This non-affectation is corroborated by the size indicator (mean valvar diameter) of the exploited resources, which in the event of affectation, there should be - in subsequent sampling after dredging activities - smaller mean sizes, a situation that did not occur in any of the monitored areas.

3.4.6 Conclusions to the analysis of monitoring results

According to these results, it is established:

- The existence of heavy metals in the seabed of the Santa Rosa estuary, presumably from metal and aggregate mining activities upstream in the interior of the province, mainly in the townships of Machala, Santa Rosa, Zaruma and Portovelo;
- The existence of hydrocarbons in the pumping system of Well No. 2 or directly into the aquifer at 146 m deep. In this case, the existence of an infiltration of some type of hydrocarbon from the surface of the studied property cannot be ruled out, however, as seen in section 1.5 Risk Factors, there are a variety of possible sources of contamination (past and present) in the sector.
- ● The presence of TBT on the seafloor of the offshore sediment dumping area.
- There is no impact on the biodiversity surrounding the area where the project will be implemented.

3.5 Environmental permits or authorizations

The existing environmental authorizations correspond to those identified in Section 2. Information provided by YILPORT from this study.

In addition to the obligations to comply with the provisions of the applicable legal regulations and the conditions of the environmental licenses, as applicable, and the management plans in force, the EMP for the dredging project establishes that no sediment may be deposited in the offshore tank during the whale season (June 1 to October 31 of each year), this being the only specific restriction contained in the environmental authorizations in force.

3.6 Interviews

Interviews with stakeholders related to YILPORT and APPB management, industrial and environmental safety, public institutions and related social actors, is to obtain information or indications on the possible existence of recognized environmental conditions and/or environmental liabilities on the project sites.

In order to carry out this evaluation, an analysis of the main social stakeholders and institutions linked to the project, as well as YILPORT and APPB staff, was carried out in order to establish a list of relevant stakeholders according to their roles and the objectives of this evaluation, to whom they are conducted interviews, and are detailed in the Table 7.

Table 7. Interviews conducted

Name	Institution	Position	Date of interview
Tulio Jaramillo	MAAE	Environmental Quality Technician	5/11/2020
Alfonso Marín	MAAE	Environmental Quality Technician	5/11/2020
Freddy Aguilar	UPMA	First Sergeant	6/11/2020
Aída García	APPB	Chief Administrative Officer	22/10/2020
Vicente Arcentales	APPB	PIB MANAGER	22/10/2020
Henry Arévalo	APPB	Engineering Dept.	22/10/2020
Glenda Penaloza	APPB	Inventory of assets	22/10/2020
Héctor Vizueta	CPPB	Chairman	6/11/2020
Zoila Arias	CPPB	Secretary	6/11/2020

Belfo Alvarado		Inhabitant of Puerto Bolivar	6/11/2020
Hugo Ruilova	CBM	Chief (Commander)	17/11/2020
Antonio Coello	CBM	Second-in-command (Major)	17/11/2020
Santiago Aguilar	YILPORT	Project Manager	23/11/2020

MAAE, Ministry of Environment and Water
UPMA, Environmental Protection Unit - National Police
APPB, Port Authority of Puerto Bolivar
CPPB, Parish Council of Puerto Bolivar
CBM, Machala Fire Department
YILPORT, Yilport Terminal Operations

3.6.1 Conclusions of the interviews

From the interviews conducted, we obtained that:

- There have been no environmental incidents related to the spill of hydrocarbons within the assessed area (100% of responses), but only minor spills due to the loading and unloading of diesel into tanks and machinery.
- There have been no environmental incidents related to the burial of hazardous substances in soil (content or not) within the area evaluated (100% of responses).
- There have been no environmental incidents related to underground pipelines within the evaluated area (100% of responses).
- There have been no environmental incidents related to the deterioration of flora and/or fauna in the area of influence of the project (100% of the responses). This is, in addition to the construction of the Port Terminal and its consequent expansions, on previously populated territories of mangroves, "salitres", and associated fauna).

From these same interviews it is clear that, within the history of population and use of Puerto Bolivar (the parish), there have been some environmental incidents related to hydrocarbons, either due to the sinking of passenger transport vessels, minor spills during fuel loading in the Santa Rosa estuary and a large fire due to poor storage of hydrocarbons by CEPE (see section 5. 3 Surrounding Developments); and others such as the burial of a dead whale on the BINJAM beach (northeast neighbor of the port terminal) around the year 2000.

3.7 Site recognition

The purpose of site recognition is to obtain information indicating the likelihood of identifying recognized environmental conditions in relation to the property. Once the relevant zones within the area of interest have been established, through the review of aerial photography and site plans, a walking tour pattern is established to carry out a visual inspection of these sites, a photographic and geo-referenced record of the existing conditions - for this the best possible angle will be sought so as to record possible stains not visible at ground level, if possible from above or overhead (aerial) -, and an evaluation of the conditions found.

3.7.1 Relevant outdoor areas

The areas to be inspected outdoors are:

- Onshore sediment pools
- Access channel and Maneuvering Area in the Santa Rosa estuary
- Offshore sediment storage tank

Inspections of the Access channel and Maneuvering area in the Santa Rosa estuary were carried out between October 28 and November 8, 2020 by the ECOSAMBITO biological survey team.

The sediment pool was visited on November 9 at 11:50 am together with the sediment sampling team of GRUENTEC Laboratories.

The offshore sediment deposition tank could not be visited within the scope of this study, however the existing photographic record of biotic species monitoring conducted during 2019 and 2020 was reviewed, as well as the respective monitoring reports, with emphasis on bottom sediment sampling[10]. It should be noted that this site corresponds to a square of 2 km on one side at sea, where the seabed is located at a depth between 25 and 40 m.

3.7.2 Relevant indoor areas

The areas to be inspected indoors are:

- Fuel area
- Electrical Substation and Cell Room 1
- Yard 9 ARETINA
- Yard 2 OROESTIBAS
- Hydrocarbon storage tank area, Warehouse 12
- Hazardous Waste Collection Centre
- Cell 1
- Crane maintenance area, Pier 5
- Location area of *power-packs*, Pier 5
- Warehouses 1-6

3.7.3 Findings

The inspections were carried out during the tour of the specified sites, on October 26 and November 04, 2020, in the company of Industrial Safety and Maintenance technicians.

The specifications of the inspected facilities are shown in Table 1the, Photographic Record 1, Photographic record 2, Photographic record 4.

During the recognition of the property, the following elements were sought, which could indicate the potential presence of recognized environmental conditions in it:

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[10] Carried out with a Van Been type dredge of 10 kg empty weight, 4 liters of sample capacity and 0.08 m^2 of impact surface with open mouth, during 10 sampling campaigns.

- **Hazardous substances and petroleum products in relation to identified uses:** Hazardous waste generation is largely used oils and adsorbent material impregnated with hydrocarbons, which in 2019 accounted for 71.23 per cent and 10.27% of the total generated respectively (ECOSAMBITO C.LTDA., 2020). Although the main hazardous wastes have been properly managed, there are still accumulations of special wastes (tires and rubber *fenders*, scrap metal) in areas of unsealed soils, as well as accumulations of common wastes on the coastline, which have arrived from the urban centers due to the effect of the tides.
- **Offensive odors:** In the sectors adjacent to the copper concentrate storage (30%), i.e. Warehouses 1 to 6, Yards 3 and 8, there is a strong and penetrating odor; however, this varies according to weather conditions (mainly in hours of intense sunlight or drizzle). Other odors perceived correspond to emissions of combustion gases from vehicles and loading machinery.
- **Liquid pools:** No pools containing liquids that may be hazardous substances or petroleum products were found.
- **Drums and hazardous substances, petroleum products and unidentified substances:** In the maintenance area (Warehouse 12) and the yards assigned to OROESTIBAS and ARETINA (2 and 9, respectively), there is storage of lubricating and hydraulic oils and greases in 55-gallon metal tanks, 20-liter buckets and 5-gallon drums, as well as used oils and greases (hazardous waste) in the respective storage tanks in each area described above. These areas also store - albeit in smaller quantities - refrigerant gas tanks and paints. In Cell 1 Collection Center, there are 55-gallon metal tanks with waste oils, adsorbent material impregnated with hydrocarbons, and used filters. Tanks containing liquid waste are located inside the existing concrete tank.
- **Heating and cooling source:** The air conditioning is made using air conditioner units (*compressor+split* unit) of a variety of sizes depending on the office, and a central unit in the training room. There is no heating system.
- **Interior stains or corrosion:** There are stains of moisture in various parts of the buildings, mainly those that have no use, since those that are occupied have been remodeled since 2018.
- **Drains and sinks:** Along the road axes are the collection wells of the wastewater system and leading to the PTAR; and in the corners next to the sidewalks, the sinks of the rainy water collection system.
- **Wells, ponds or lagoons:** Sediment pools constitute large empty ponds, which have not been used for sediment discharge since 2012. According to the structural analysis performed in 2017, it is concluded that "all the walls of pool No 2 are structurally stable" however, the use of the pools for the deposit of dredged material entails a series of risks, such as pipe breakage, water outflow force, stability of the surrounding walls, wall failure, inadequate or insufficient emptying and/or flooding, as well as the risk that exists due to the exposure of people adjacent to the project; which is why the pools are not used as a dumping area.

It is important to mention that to date no sediment disposal has been carried out in the area of the pools. In addition, the Complementary Environmental Study proceeds to the elimination of this area and the planned activity.
At present, the interior of pools 1, 2 and 3 are populated by an informal settlement that began at the end of August 2020.

- **Stained floors and pavements:** Hydrocarbon stains from dripping from machinery and vehicles operating inside the terminal are very common on the floors of the traffic lanes. The north sidewalk of Yard No. 9 is stained with traces of paints and hydrocarbons, effluents generated by ARETINA's operations.
- **Stressed Vegetation:** Although the port terminal is surrounded by areas with anthropogenic interventions, no areas of stressed vegetation were observed or reported on or adjacent to the property.
- **Solid waste:** The reserve areas and/or unpaved yards (Yards 7 and 14) are currently used for the disposal of debris, mainly from road repairs, although in small quantities in relation to the total area. It should be noted that these areas (Yards 7, 8, 9, 14, 14A) have been filled over the years up to 2012, with sediments from the dredging of the pier aprons (see 6 Dredging and Deposit Site History Table6).
- **Effluent:** The effluent collected by the sewage system is taken to the treatment plant, where it receives primary treatment by decanting and filtration with gravel, before being chlorinated and discharged into the breakwater area of the Santa Rosa estuary, at the height of Pier 4. The discharge complies with the MPLs established in Ministerial Agreement 097A, Annex 1: Environmental Quality Standard and Effluent Discharge to Water Resources, Table 10. Discharge limits to a marine water body, A) Discharge in a breaker zone. In Yard No. 2 There is a grease trap with a sand trap to pre-treat the effluent generated before it is discharged into the wastewater system.
- **Well:** The terminal has two wells authorized by Senagua, although Well 1 is currently collapsed and only water is obtained from well 2 (Table 1).
- **Septic systems:** No tanks or septic tanks were observed during the inspection carried out.
- **Other environmental considerations (asbestos-containing materials):** From a preliminary evaluation conducted by the YILPORT technical department, it is known that there are buildings (mainly warehouses and smaller buildings) whose roof is made of asbestos-containing fiber cement boards. However, these have been systematically replaced since 2017 according to needs for maintenance and remodeling of buildings. In total, there are about 21,000 m^2 of asbestos cement covers in operation.

Photographic record 4. Visual inspection

Yard 12 (behind the north end of Pier 5)

West Boundary of Yard 12

Front access to Fuel Area

Front access to Yard 1

Hazardous Waste Collection Centre Tank (Cell 1)

3.7.4 Limiting conditions

During the inspections, **NO** limiting conditions were found for the free observation of the Relevant Areas.

3.8 Previous evaluations

There are no environmental assessments of the site prior to the present study.

3.9 Limitations of the study

Considering that no environmental assessment or investigation is infallible, there will always be some degree of uncertainty regarding the presence or absence of recognized potential environmental conditions on the property under study, regardless of the rigor of the investigation. Consequently, ECOSAMBITO does not guarantee that Recognized Environmental Conditions, other than those identified in this report, do not exist on the subject property, or may not exist there in the future.

The findings and opinions presented in this report are based in part on information obtained from a variety of sources over which ECOSAMBITO has no control, but believes to be reliable. However, ECOSAMBITO does not guarantee the authenticity or reliability of information from these sources.

ECOSAMBITO believes that it has rendered the services summarized in this report in a manner consistent with the level of care and skill normally exercised by environmental professionals practicing at the same time and under similar conditions in the project area.

Conclusions about the status of the site do not represent a guarantee. Should new evidence or additional information become available after the date of this report, ECOSAMBITO is under no obligation to revise the conclusions and recommendations made in this report.

3.10 Environmental Conditions

3.10.1 Recognized Environmental Conditions (ERC, by its acronym in Spanish)

During the site inspection and tour, **NO** Recognized Environmental Conditions were identified within the facilities associated with the Project's activities, or outside its perimeter.

3.10.2 Historical Recognized Environmental Conditions (HREC)

Based on interviews, background documentary research, and water and sediment quality monitoring, **NO** Historical Recognized Environmental Conditions associated with Project activities were identified. However, the detection of TBT in the sediments at the bottom of the offshore basin gives us clues to the possible existence of tributyltin (TBT) in the bottom sediments of the docks and the maneuvering area.

3.10.3 Controlled Recognized Environmental Condition (CREC)

During the on-site inspection and tour, and interviews conducted and documentary background investigation, **No** Controlled Environmental Conditions were identified within the facilities associated with the Project's activities, or outside its perimeter.

3.11 Results and conclusions

Although it is concluded that the existence of environmental liabilities of any kind has not been established within the Port Terminal premises, it has not been possible to demonstrate the suitability of the fuel storage facilities (tanks, floors, spill containment tanks), due to the non-existence - within the scope of this evaluation and with the sources consulted - of Technical Memorandums and/or Delivery-Reception Acts of the same, nor of periodic evaluations of the integrity of the overlying steel tanks or of the semi-buried tanks.

It has been established that throughout the history of use of the Puerto Bolivar parish and the Santa Rosa estuary, there have been activities and events that could lead to the existence of environmental liabilities in the area of influence of the Project, and even in the sediments of the seabed of the Santa Rosa estuary, such as heavy metals, hydrocarbons, and TBT.

3.12 Recommendations

Perform an Environmental Site Assessment - Phase II (as defined for Standard Practice ASTM E1903 - 19), which includes assessments of the integrity of fuel storage tanks based on applicable technical standards, such as API 653 (Inspection, repair, modification and reconstruction of tanks), and API 575 (Inspection of atmospheric and low pressure tanks); as well as monitoring and measurements to establish the existence or not of an environmental liability in the subsurface.

TBT monitoring should also be conducted in the sediments of the Santa Rosa estuary to establish its presence and/or concentration.

3.13 Missing documentation and data

From the interviews, consultations and requests for information made to the APPB and YILPORT, it has not been possible to obtain the documents listed below:

- Technical report on the construction (if any) of fuel storage areas, tanks, effluent channeling systems, treatment plants, and others.
- Certificate of liens on the premises of the Port Authority of Puerto Bolivar.

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5. Annexes

ANNEX 1. Legal ownership of the evaluated properties
ANNEX 2. Location map of the Puerto Bolívar Project — Phase 1
ANNEX 3. Geological Map of the Project Area
ANNEX 4. Hydrogeological Map of the Project Area
ANNEX 5. Plan of Monitoring Points and Monitoring Results
ANNEX 6. Employee Interview Model
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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– MARINE-COASTAL BIODIVERSITY BASELINE –

Prepared for:

YILPORT TERMINAL OPERATIONS S.A.

Prepared by:

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December 2020

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Executive Summary

The Puerto Bolívar project is mainly developed in the marine and coastal environment of the Tumbes Choco Magdalena ecoregion, one of the 34 global biodiversity hotspots–those sectors that concentrate more than 70% of the known life species in spaces that do not represent more than 1.4% of the world's surface.

The area of influence is an extensive estuarine and coastal marine system associated with the Guayas system, the largest watershed on the Pacific coast of South America that transports compounds of continental origin that fertilize this sector with depths not exceeding 90m to its mouth and receives an injection of oxygen supplied by the cold Humboldt current that comes from the south attached to the coast to this sector to deviate towards the Galapagos Islands. In terms of biological oceanography, these conditions constitute a favorable environment for multiple forms of life within which critical habitats are identified as remnants of mangrove forests that have mostly been transformed into shrimp ponds.

The richness of resources in the area of influence was estimated from secondary sources and the compilation of standardized samplings from the biological monitoring program defined in the document "Environmental Impact Study and Environmental Management Plan for the Dredging of Piers 1, 2, 3, 4, 5, 6 maneuvering zone and access channel of Puerto Bolivar", from which quantitative results of bimonthly monitoring between April 2018 and February 2020 were integrated.

When compiling the volume of sampling information, a disproportion between main sectors was observed, since of the 5 fixed analysis sites associated with dredging maneuvers; 4 were located offshore and included planktonic, benthic and captured or fished ichthyofauna analyses; while the sector closest to the dredging area, Estero Santa Rosa had only one sampling site next to Pier 1 of Puerto Bolivar Project and involved exclusively the planktonic community.

We chose to evaluate the infauna of soft-bottom beaches with samples from the interior of Estero Santa Rosa as well as the northern end of the area of influence and the southern end of the same plus Jambelí beach due to its practicality in collecting quantitative information that could be contrasted over time.

The integration of sampling yielded the presence of 191 phytoplankters, 59 zooplankters, 79 benthic beings of subtidal soft bottoms, 66 species of beach infauna and 81 fish captured within the area of influence, of which 8 ichthyofauna resources are considered vulnerable according to RedList and only one endangered species, the green turtle <u>Chelonia mydas</u>, was recorded.

1. Introduction

Biodiversity, a term coming from the words *"bios"* or life and "*diversitas"* or diversity, means the variability of living organisms from all sources, including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD, 1992)[1].

In simpler terms we can define biodiversity as the diversity of species that coexist in a given space and time and that represent an important environmental support and regulation service, since the functions performed by living beings integrate it in a given sector or site and its energy flows are generators of more forms of life and support other ecosystem services such as environmental regulation, also linking with resources that are exploited by man, constituting both as a provision of goods and cultural services.

Animal Biodiversity is higher in aquatic systems than in terrestrial ones. 34 of the 35 animal phyla known by science are aquatic and 50% of them are exclusively marine. Only one animal phylum is exclusively terrestrial. The estimated figures of different species are surprising; however, there is a practical way to classify all marine species based on their motility.

Animal biodiversity is higher in aquatic systems than in terrestrial systems: of the 35 animal phyllums known to science, 34 of them are aquatic, half of them exclusively marine, and only one animal phyllum is exclusive to terrestrial systems. The calculated numbers of different species are surprising, however, there is a practical way to classify all marine beings according to their motility and habitats in which they develop.

In this way we have the plankton or planktonic community, all those forms of life that float in the water column and with reduced capacity of movement with respect to the movement of the water, being dragged by the currents. Here we find two large groups: phytoplankton which corresponds to photosynthetic life forms and zooplankton which is the heterotrophic fraction (which requires consuming organic compounds to obtain energy), that is, they feed on other living beings. Size is not the best characteristic to discriminate these life forms, since they vary from microscopic beings to beings that exceed several meters in length.

In the opposite situation, the beings with the capacity for active movement that exceed the speed of water currents and that can move from one place to another in the water column are called nekton or nektonic community. Here its best known representatives are fish or ichthyofauna, however, other animal groups that are active swimmers include mollusks (octopuses and squid), crustaceans (shrimp, crabs) and higher vertebrates such as cetaceans, pinnipeds, reptiles and birds such as penguins, boobies and cormorants.

The third category is made up of animals that do not live in the water column, but are associated with bottoms, whether they are hard, such as rocks where they are cemented and can develop on submerged surfaces (biofouling) or are associated with soft bottoms, moving slowly over them or burying themselves in them (infauna). We call all these beings Benthos or benthic community.

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[1] Convention on Biological Diversity

An interesting aspect of aquatic beings is that most of them may have initial stages of planktonic life, being larvae or eggs that will be disseminated by marine currents and the surface drag effect of the wind to later develop into benthic or nektonic life forms; We will call these beings mere planktonic and include marine invertebrate larvae as well as fish eggs and larvae (ichthyoplankton), while the life forms that integrate the plankton throughout their life cycle are called holoplanktonic.

The classification of marine life is broad, the mode of classification just described is functional and is mainly used for rapid sampling with specific equipment for each major group. However, once the samples are collected and arrive at a laboratory to proceed to the taxonomic identification of marine resources or marine life, they will be grouped according to taxa defined in the systematics, grouping them into Phyllums, Superclasses, Classes, Orders, Families, Genera and Species.

Many marine organisms are difficult to identify and in practical terms would require considerable periods of identification down to the genus or species level, considering that in complex groups it is acceptable to go as far as the family category. Table 1 presents the main phyllums of marine animals to facilitate the understanding of this report.

Table 1. Main Marine Animal Phyla. (Branch, 2001)

Phylum	Example	Phylum	Example
Porifera	Sponges	Platyhelminthes	Flatworms, planarias
Cnidaria	Corals and jellyfishes	Nemertea	Ribbon worms
Ctenophora	Comb jellies	Nematoda	Nematoda
Sipunculida	Peanut worms	Annelida	Polychaetes
Arthropoda	Crustaceans	Bryozoa	Bryozoans
Brachiopoda	Lamp shells	Mollusca	Clams, octopus, chitons, snails
Echinodermata	Urchins, sea cucumber, starfish	Chordata	Urochordata, Pisces, Mammalia
Priapulid	Priapulus	Chaetognata	Arrow worms

Prepared by: Ecosambito, 2020

As for plant species, size is the main general classification factor. Thus, we have microalgae (already described as phytoplankton) and macroalgae, with three main classes: green algae or Chlorophyta, brown algae or Phaeophyta, and red algae or Rhodophyta.

It is important to mention that taxonomic studies to describe the marine diversity are scarce in Ecuador. There are main groups without any description, it being necessary to resort to reference texts from other locations.

2. Methodology

In order to describe the marine-coastal biodiversity of the Puerto Bolívar Project's area of influence, three main activities were carried out:

- Search for general and sectoral bibliographic background.
- Compilation of the information gathered from 5 fixed monitoring points during the monitoring activities established in the EIA 2017; and
- Samplings to complete information on sites lacking information or analysis of general communities not included in the EIA 2017.

The reference texts used to study the marine-coastal biodiversity in the area of influence are listed below:

2.1 Phytoplankton

- *Acta Oceanográfica del Pacífico* (Oceanic Record of the Pacific), Volume 19, N.1, 2014 ISSN N° 1390-129X, of the Naval Oceanographic Institute of Ecuador (INCOAR in Spanish), which contains descriptions of diatoms, silicoflagellates and coccolithophorids of the phytoplankton in the Gulf of Guayaquil, by Roberto Jiménez; dinoflagellates of the phytoplankton in the Gulf of Guayaquil, by Flor Pesantes, and tintinnids in the Gulf of Guayaquil, by Iván Zambrano
- Identifying Marine Diatoms and Dinoflagellates. Carmelo R. Tomas, Grethe R. Hasle, Karen A. Steidinger, Erick, E. Syvertsen, Karl Jangen, 1995. Academic Press, Inc.
- The "algaebase" digital database[2].
- Phytoplankton identification, Kudela Lab Biological Oceanography, University of California Santa Cruz. http://oceandatacenter.ucsc.edu

2.2 Zooplankton:

- Naval Oceanographic Institute of Ecuador (INCOAR in Spanish). Oceanic Record of the Pacific, Volume 2, N° 2, 1983:
- Tintinnids in the Gulf of Guayaquil, Iván Zambrano
- *Estudio taxonómico de los Quetognatos del Golfo de Ecuador* (Taxonomic Study of Chaetognatha in the Gulf of Ecuador), Dolores Bonilla A.
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[2] www.algaebase.org

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- Luzuriaga-Villarreal María, 2015. *Distribución del ictioplancton y su interrelación con parámetros bióticos y abióticos en aguas costeras ecuatorianas* (Ichthyoplankton Distribution and its Interrelationship with Biotic and Abiotic Parameters in Ecuadorian Coastal Waters). In: Oceanographic Record of the Pacific, Vol. 20, Nº 1, 2015. Naval Oceanographic Institute of Ecuador (INOCAR in Spanish).

2.3 Benthic Community:

- Brito Vera Maria José and Elba Mora Sánchez, 2017. *Moluscos marinos distribuidos en la primera milla de la costa ecuatoriana* (Marine Mollusks distributed in the First Mile of the Ecuadorian Coast). National Fishing Institute (INP in Spanish), Ministry of Aquaculture and Fisheries.
- Myra A. Keen, 1971. Sea tropical Shells of Western America. Stanford University Press.
- De León-González et al., 2009. *Poliquetos (Annelida: Polychaeta) de México y América Tropical* [Polychaeta (Annelida: Polychaeta) of Mexico and Tropical America].
- FAO Species Identification Guide for Fishery Purposes, Western Central Pacific, 1995. Volume 1. Marine Algae and Invertebrates.
- Oceanographic Record of the Pacific, Volume 19, N.1, 2014 ISSN N° 1390-129X, of the Naval Oceanographic Institute of Ecuador (INOCAR in Spanish), Bivalves of the Gulf of Guayaquil.
- The "World Register of Marine Species WoRMS[3]" digital database.
- The "Catalogue of Life[4]" digital base
- Ángel de León, 2017. *Estado del conocimiento de poliquetos en el Ecuador* (State of Knowledge of Polychaeta in Ecuador). In: Díaz-Díaz, O., D. Bone, C.T. Rodríguez & V.H. Delgado-Blas (Eds.) 2017. *Poliquetos de Sudamérica* (Polychaeta in South America). Special Volume of the Newsletter of the Oceanographic Institute of Venezuela. Cumaná, Venezuela, 149 pp.
- Francisco Villamar, 2013. *Estudio de los poliquetos (gusanos marinos) en la zona intermareal y submareal de la bahía de manta (ecuador), y su relación con algunos factores ambientales, durante marzo y agosto del 2011* [Study of Polychaeta (marine worms) in the intertidal and subtidal zone of Manta Bay (Ecuador) and their Interrelationship with some Environmental Factors, during March and August 2011]. Oceanographic Record of the Pacific, Vol. 18, Nº 1, 2013.

[3] http://www.marinespecies.org/

[4] http://www.catalogoflife.org/

2.4 Ichthyofauna

- FAO Species Identification Guide for Fishery Purposes, Western Central Pacific, 1995. Volumes 2 and 3. Marine Fish and Mammals.
- Herrera M., Saa I., Ferreyros S., Coello D., and Solís-Coello, P. 2017. *Peces del perfil costero ecuatoriano: primera milla náutica* (Fishes of the Ecuadorian Coastal Profile: First Nautical Mile). National Fishing Institute (INP in Spanish), 453 pp. Guayaquil-Ecuador.
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- The www.fishbase.org digital base[5].

2.5 Seabirds

- Robert S. Ridgely y Paul J. Greenfield. *Aves del Ecuador* (Ecuadorian Birds), Volume 1. Academy of Natural Sciences of Philadelphia and Jocotoco Conservation Foundation.
- Orihuela-Torres Adrián, Fausto Lopez-Rodriguez and Leonardo Ordoñez Delgado 2016. *50 aves comunes del archipiélago de Jambelí* (50 Common Birds in Jambelí Archipelago). Research Group on Governance, Biodiversity and Protected Areas. Universidad Técnica Particular de Loja.

2.6 Marine mammals and reptiles

- Fischer, W., Krupp F., Schneider W., Sommer C., Carpenter K.E., and V.H. Niem (1995). FAO Guide to the Identification of Species for Fisheries Purposes. Eastern Central Pacific. Volume III. Vertebrates Food and Agriculture Organization of the United Nations.
- The digital database of The whales and dolphins Conservation Society, https://uk.whales.org/whales-dolphins/species-guide/

Sampling information collected in monitoring carried out during the period 2018 - 200 is shown in Table 2, and that of the latest sampling carried out in Table 3.

[5] https://www.fishbase.se/search.php

Table 2. Samplings analyzed in the 2018-2020 Period

Main Biological Group	Analyzed Sites	Samples per Site	Total Samples	Sampling Method
Phytoplankton	5	14	840	Sample acquired at 3 depths per site with van Dorn Bottle, Utermohl analysis method
Zooplankton, fraction > 300 microns	5	1	60	Trawling with a 300-micron net for 3 minutes
Zooplankton, fraction > 500 microns	5	1	55	Trawling with a 300-micron net for 3 minutes
Benthic community	4	1	48	Sample acquired with a 10-kg Van Veen dredge and sieved through a 500-micron sieve
Fish	4	1	48	30-minute fishing with 3.5” nets and two cloths
Infauna	4	8	32	Manual collection at stations distributed along the intertidal elevation gradient with shovel support on reference beaches in the area of influence
Benthic community	9	1	9	Sample acquired with a 10-kg Van Veen dredge and sieved through a 500-micron sieve in the Santa Rosa estuary

Prepared by: Ecosambito, 2020

It is worth mentioning that in all the navigation trips made from Puerto Bolivar to Santa Clara Island during sampling, each crew member became an observer of protected marine life, when sightings occurred, the boat was slowly guided towards the protected species in question, geo-referencing the observation sites and describing the species observed, as well as its main activity.

Table 3. Samplings made in November 2020

Main Biological Group	Number of Analyzed Sites	Number of Samples Acquired per Site	Total Analyzed Samples	Sampling Method
Infauna	4	8	32	Manual collection from shovel-dug holes distributed along the vertical intertidal gradient of the beach analyzed
Benthic community	9	1	9	Sample acquired with a 10-kg Van Veen dredge and sieved through a 500-micron sieve in the Santa Rosa estuary
Fish	2	1	2	20-minute fishing with 8 2 ¾“ panels in the Santa Rosa Estuary, enclosure type “pens”

Prepared by: Ecosambito, 2020.

The description of seabirds was exclusively based on secondary sources, extracting information from previous projects executed in the intervention.

The descriptors selected to quantify the diversity obtained from records in the area are as follows:

1) Species richness
2) Abundance of individuals collected
3) Shannon H´ diversity index
4) Margalef diversity index

3. Results

3.1 Phytoplanktonic Community

The monitoring carried out from April 2018 to February 2020 recorded 197 different phytoplankters in the study area. Diatoms or Phyllum Bacillariophyta are the most abundant group with 123 species, followed by Phyllum Myozoa with 43 species, protozoa with 14 species, Cyanophyta with 10 species and Phyllum Charophyta with only one species. The abundance base of recorded species is attached as an annexed document and it should be noted that Phytoplanktonic beings are not categorized within RedList, being considered NA or Not assigned.

Despite this high richness of microalgae, 20 main species represented more than 80% of the total microalgae abundance, which are listed in Table 4. In this table, the Phyllum Cyanophyta species (cyanobacteria) are highlighted in light green and Dinoflagellates are highlighted in salmon. Figure 1 and Figure 2 show the total microalgae abundance, considering all monitoring and samples acquired and the evolution of abundance and sectoral distribution of microalgae for the same period.

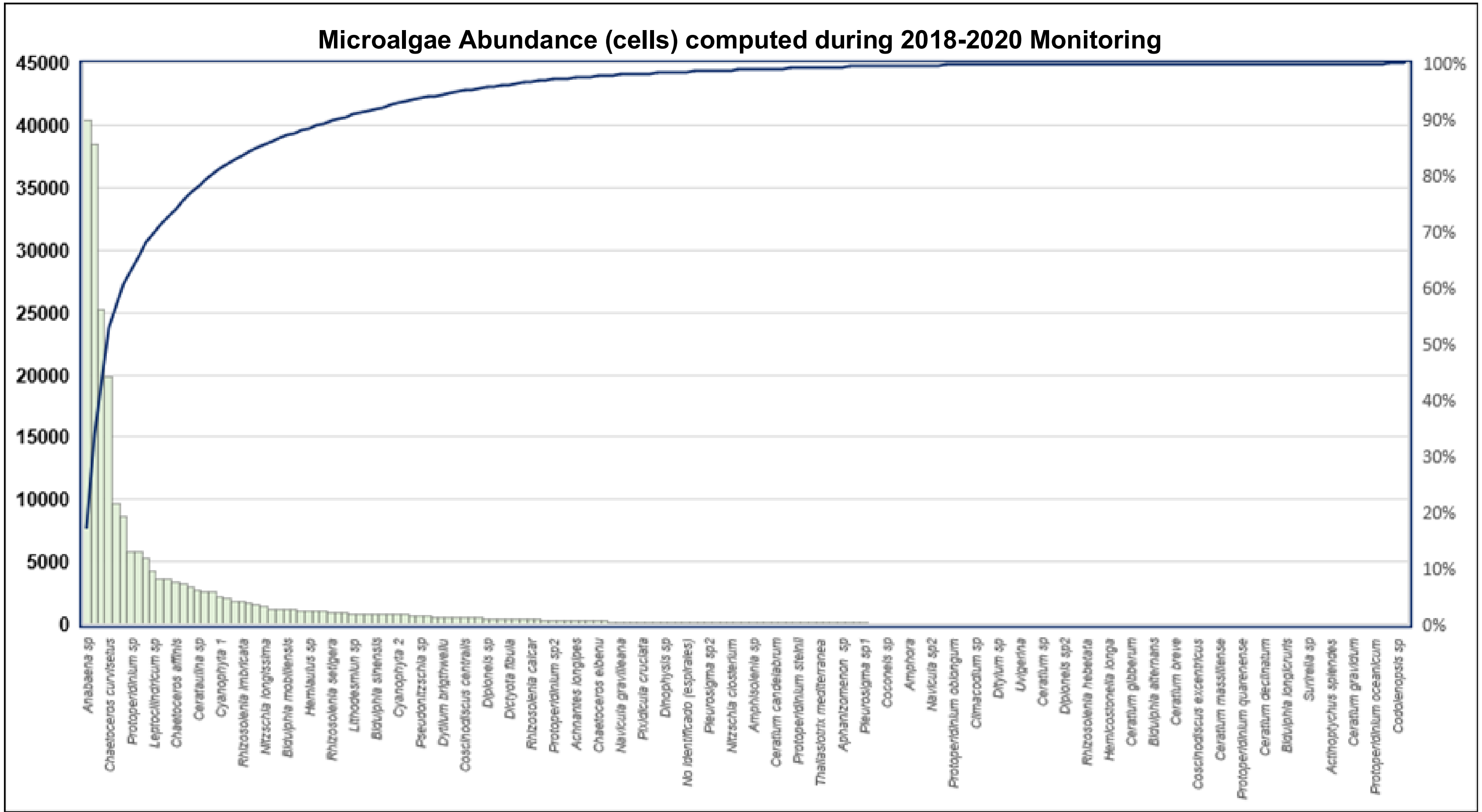
Table 4. Top 20 Phytoplankton Species for the 2018 – 2020 Period

Abundance Ranking	Genus/Species	Relative Abundance
1	*Anabaena sp*	17.27%
2	*Skeletonema costatum*	16.47%
3	*Thallasiosira subtilis*	10.77%
4	*Chaetoceros curvisetus*	8.47%
5	*Lauderia sp*	4.10%
6	*Nitzschia pungens*	3.68%
7	*Protoperidinium sp*	2.47%
8	*Bacteriastrum elegans*	2.45%
9	*Guinardia sp*	2.28%
10	*Leptocilindricum sp*	1.79%
11	*Bacteriastrum hyalinum*	1.53%
12	*Thallasionema nitzschoides*	1,52%
13	*Chaetoceros affinis*	1.44%
14	*Coscinodiscus granu*	1.39%
15	*Chaetoceros costatus*	1.27%
16	*Cerataulina sp*	1.15%
17	*Coscinosira polychorda*	1.12%
18	*Cyanophyta 1*	0.92%
19	*Coscinodiscus radiatus*	0.91%
20	*Coscinodiscus granii*	0.79%

Prepared by: Ecosambito, 2020

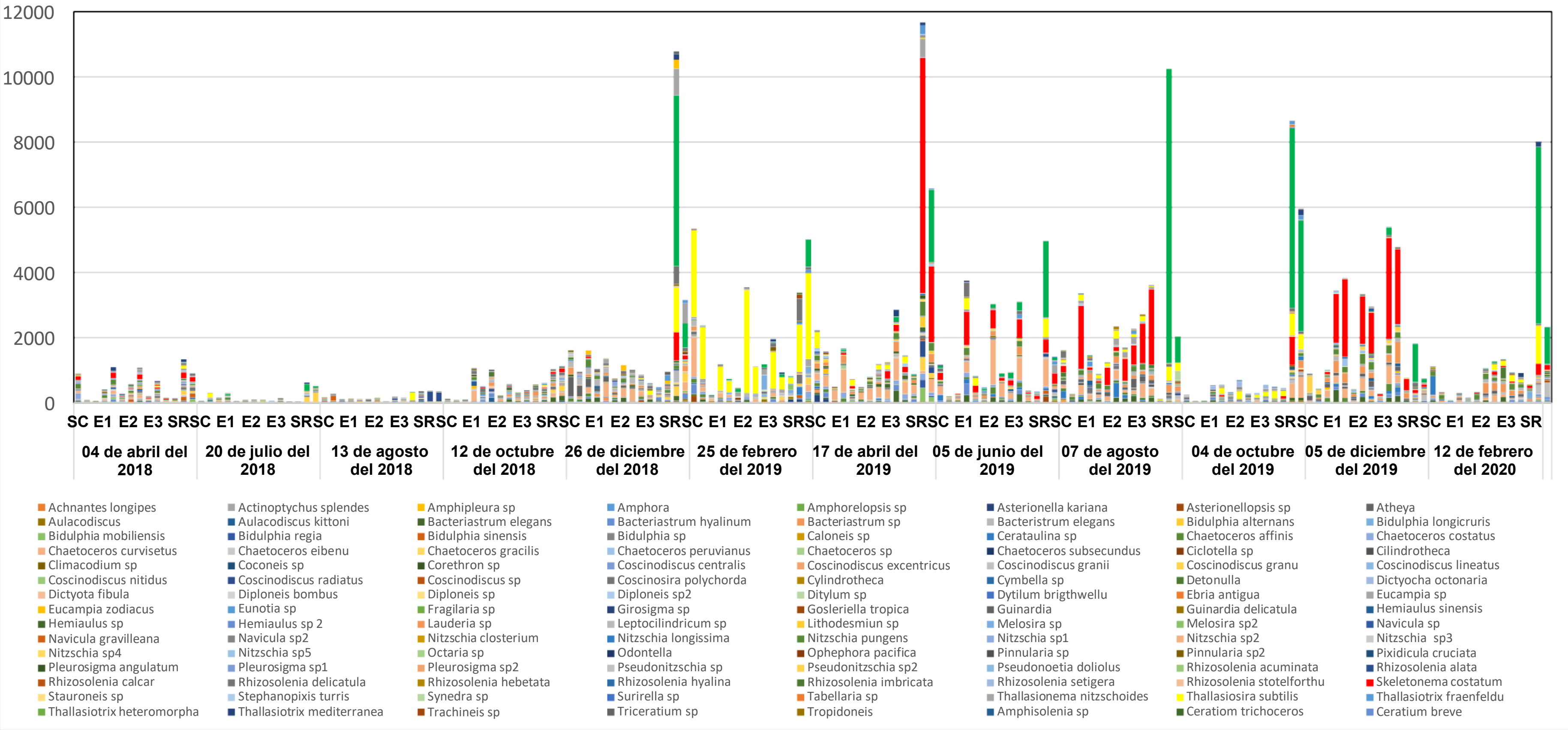
As can be seen in Figure 2, the greatest abundance of microalgae occurs precisely in the vicinity of Puerto Bolívar Project port complex, which is attributed to the higher temperature (Wohlers et al, 2009), the lower water movement and the shallower depth; however, the increases in abundance, which sometimes border the Harmful Algal Bloom (HABs) event levels, represent a decrease in diversity in periods of greater abundance.

Figure 1 Microalgae Abundance for the 2018 – 2020 Period



Prepared by: Ecosambito, 2020

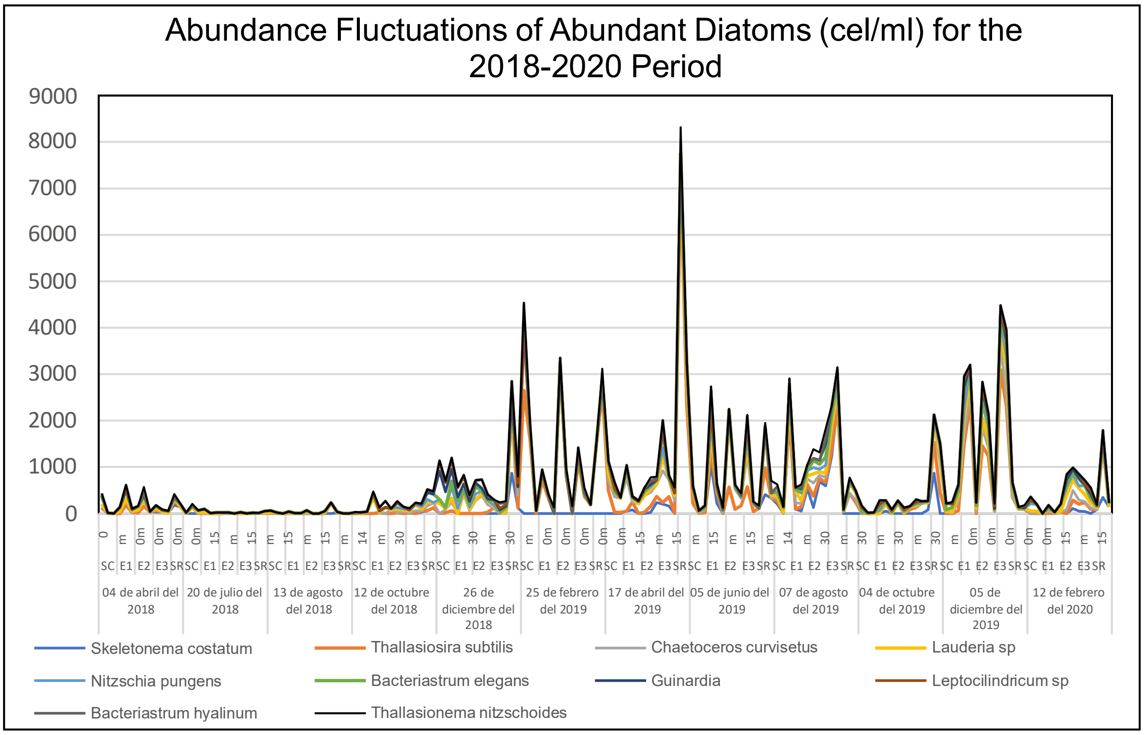
Figure 2 Microalgae Abundance and Distribution 2018-2020



Prepared by: Ecosambito, 2020

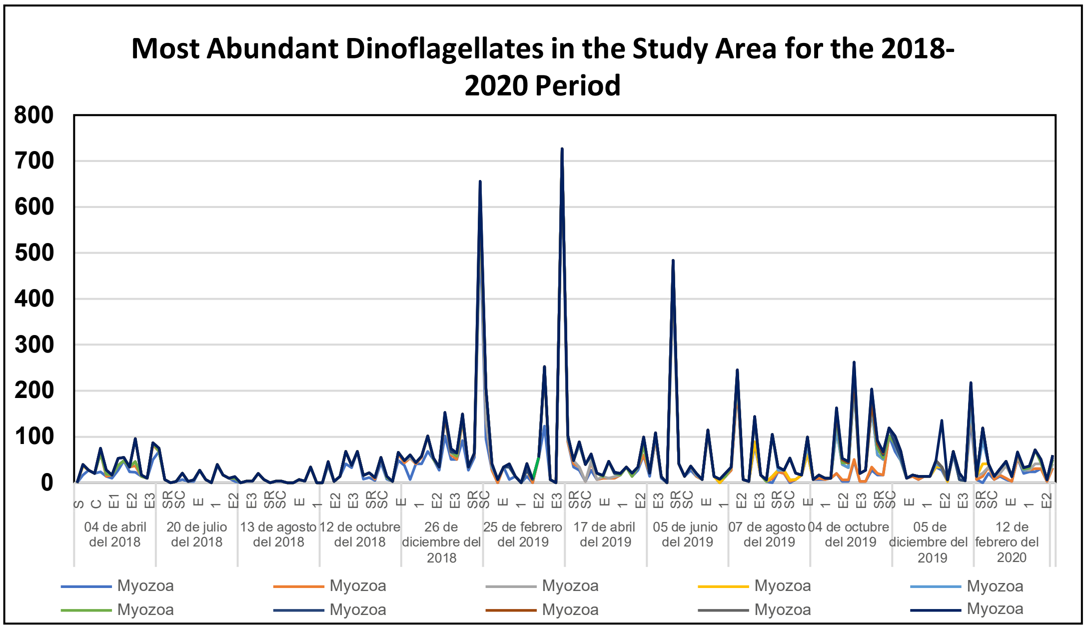
The 10 most abundant species accounted for 52% of the estimated total microalgae present in the study area. Figures 3 to 7 show the fluctuation of abundant species during the 2018-2020 period. As regards diatoms, the highest proliferation of algae was observed in the Santa Rosa estuary by April 2019; in general, there was a low abundance of diatoms in 2019 as compared to 2019.

Figure 3. Fluctuations of Most Abundant Diatoms



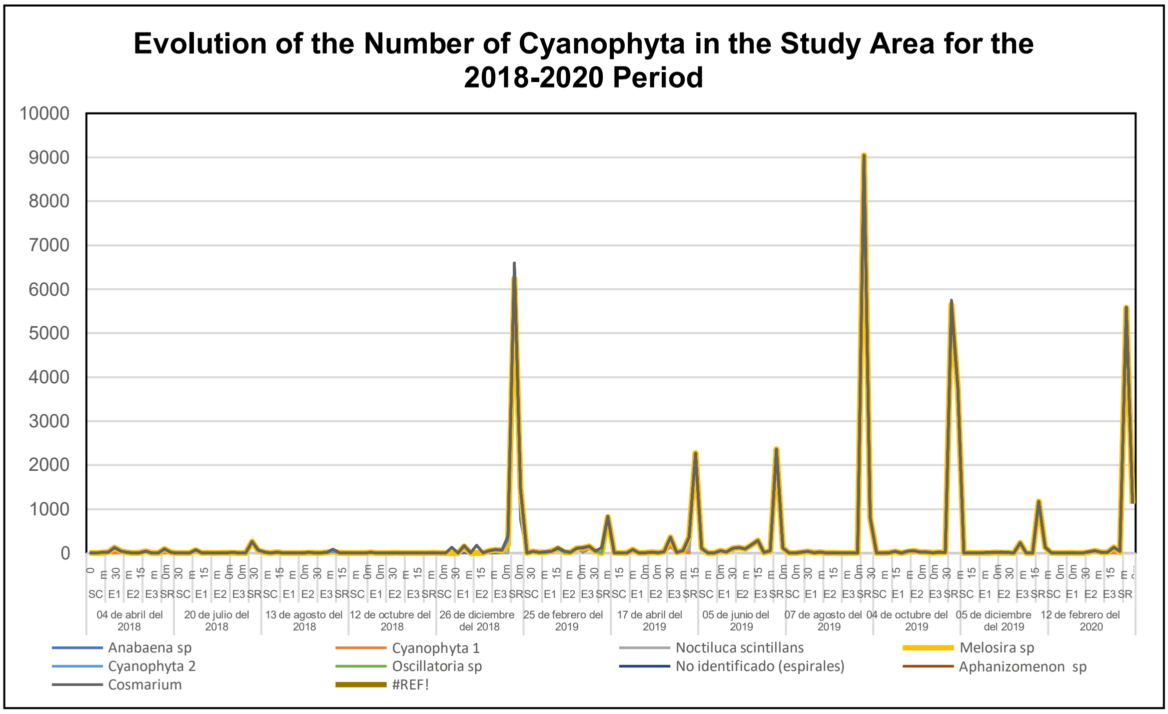
Prepared by: Ecosambito, 2020

Figure 4. Fluctuations of Dinoflagellates in the Study Area



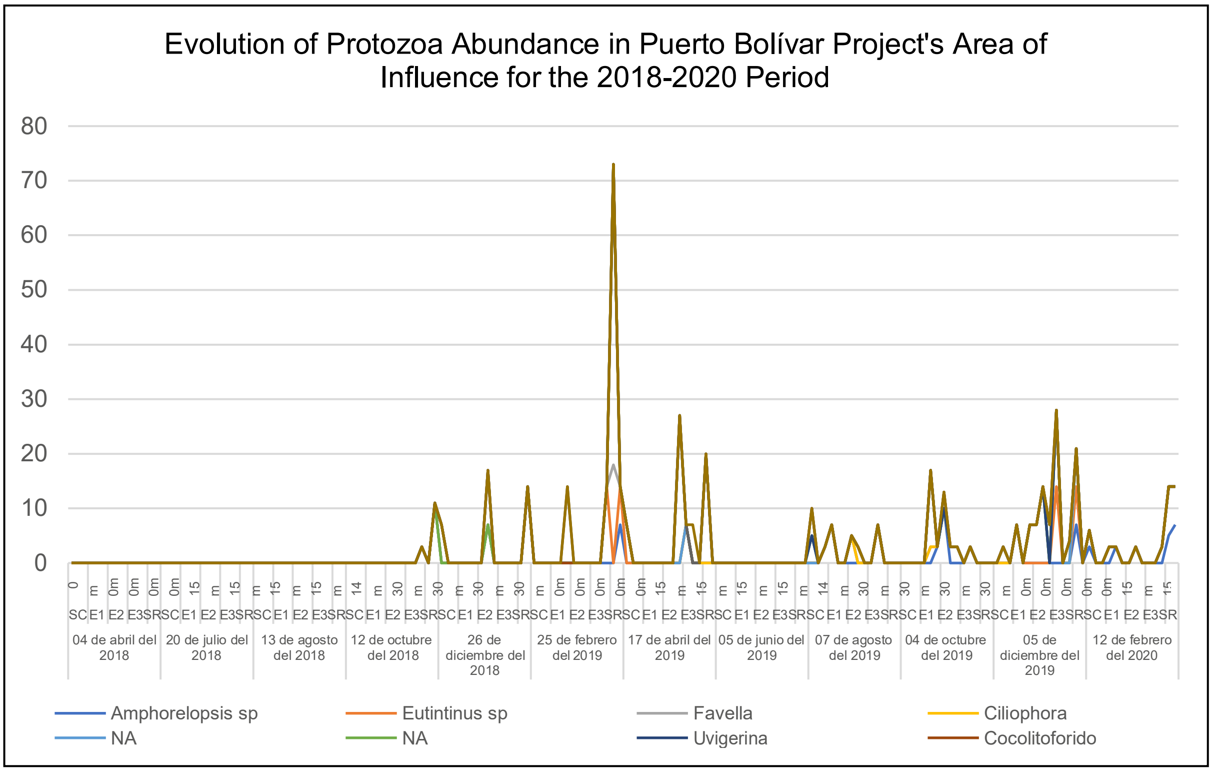
Prepared by: Ecosambito, 2020

Figure 5 Evolution of Cyanophyta Abundance



Prepared by: Ecosambito, 2020

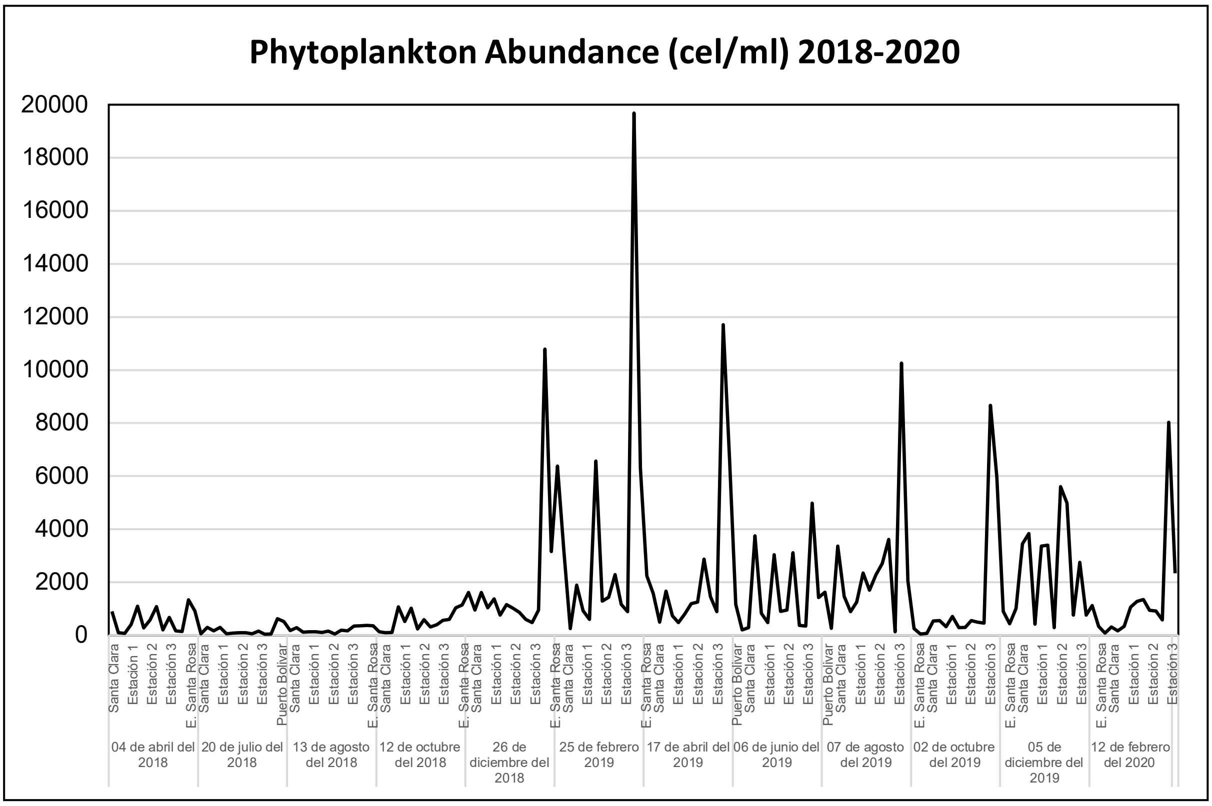
Figure 6. Evolution of Protozoa Abundance in Puerto Bolívar Project's Area of Influence



Prepared by: Ecosambito, 2020

eanic and estuarine, while cyanobacteria are abundant mainly in the Santa Rosa estuary and protozoa increased in abundance from 2019, a trend observed in all groups analyzed, with considerable interannual variations in primary productivity reflected in the total abundance of phytoplankters (Figure 7).

Figure 7. Evolution of Phytoplankton Abundance in Puerto Bolívar Project's Area of Influence

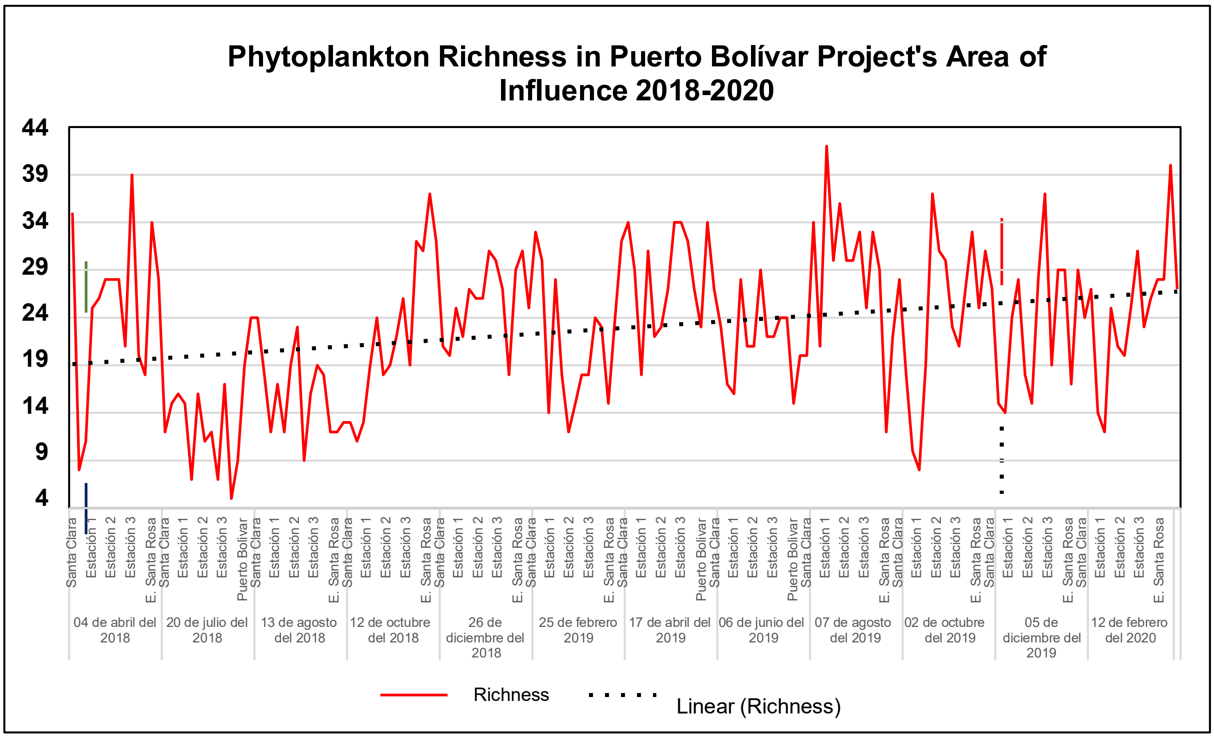


Prepared by: Ecosambito, 2020

Consistent with Figures 3 to 6, phytoplankton abundance has significantly increased since the end of 2018, recording peak values above 10,000 cel/ml in Santa Rosa estuary. The oceanic phytoplankton community can be considered abundant when it exceeds 2,000 cel/ml, which occurred in April, June, August and December 2019. Mean phytoplankton abundance in the area is considered high, with a mean of 1,549 ± 2,482 cel/ml.

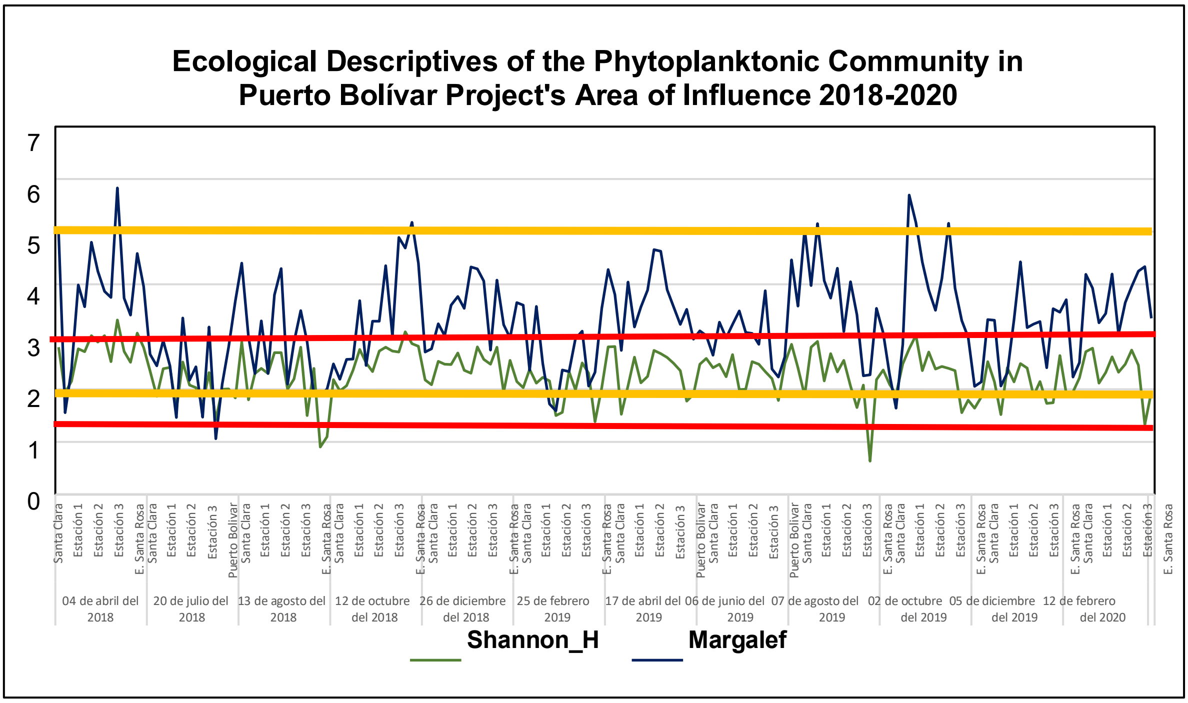
Figure 8 depicts the evolution of the phytoplankton species richness registered using 1-liter samples collected at surface (15 and 30 m). Even though the linear trend shows an increase in species, it cannot be stated that this trend is real, but it could be attributed to the greater knowledge acquired by the evaluation team, which is identifying more and more species with increased expertise. The mean phytoplankton richness per sample analyzed, integrating all depth strata and sampling sites and dates, was 22.9 ± 7.71 genera / species.

Figure 8. Evolution of Phytoplankton Species Richness



Prepared by: Ecosambito, 2020

Figure 9. Phytoplankton Diversity Descriptors

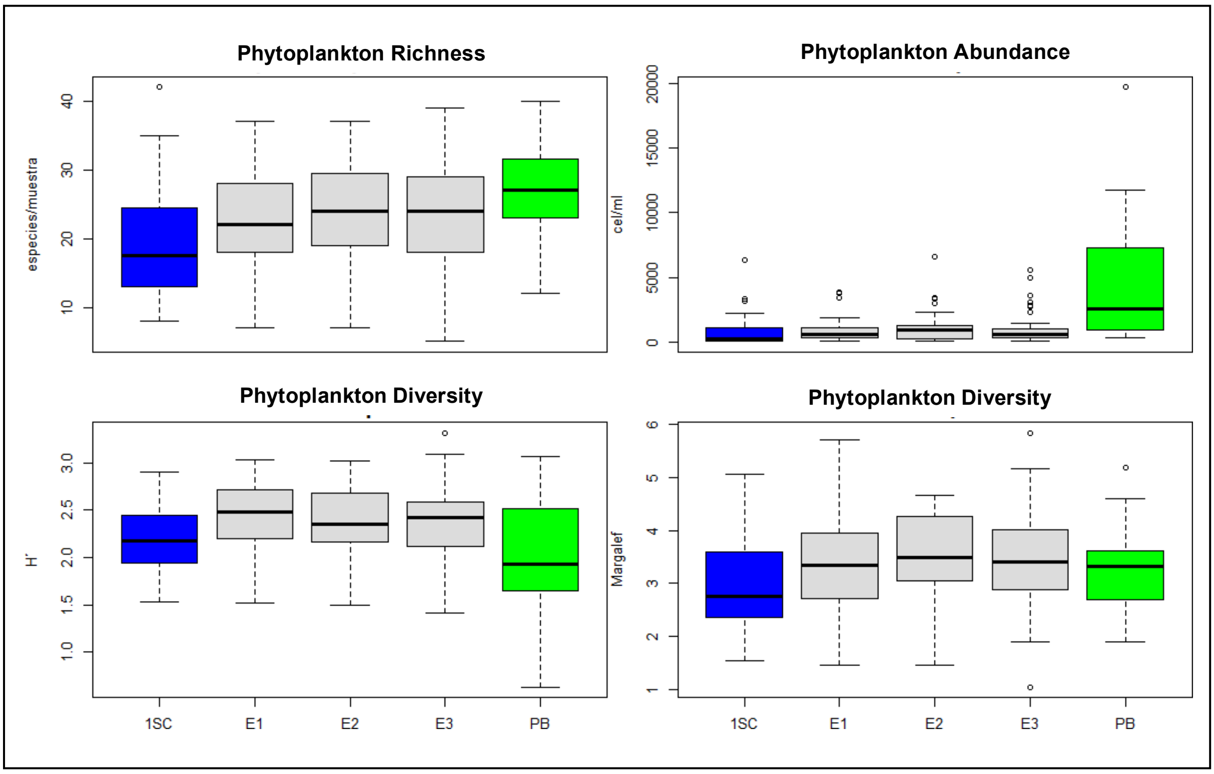


Prepared by: Ecosambito, 2020

Figure 9 shows the plankton diversity levels in Puerto Bolívar Project's area of influence. In general terms, the phytoplanktonic community of the area of influence is interpreted as a sector of intermediate diversity, which is considered to be an area with slight disturbances. The reference ranges of intermediate diversity fluctuate between 1.5 and 3 bits in Shannon H´ index. An index of more than 3 bits is interpreted as a high-diversity sector, typical of an environment with few disturbances or of good environmental quality. The Margalef index, which values species richness more than Shannon's combination of richness and abundance, establishes intermediate diversity values for the area, since it is in a range of 2 to 5. The mean diversity values in Shannon index were 2.299 ± 0.439 bits, which more closely approximates to a high-diversity sector, and they were 3.307 ± 0.90 in the Margalef index, which is considered to be intermediate diversity.

In order to better understand how the ecological variables of this community behave, Figure 10 shows the species richness, phytoplankton abundance and diversity indicators, grouping the data according to the sampling sites. The most oceanic or most offshore station is highlighted in blue (Santa Clara Island); the light colors refer to samples obtained in the deposit basin for dredged material and the green color refers to samples obtained less than 100 m away from Dock 1 in Santa Rosa estuary.

Figure 10. Sectoral Comparison of Ecological Descriptors of the Phytoplanktonic Community.

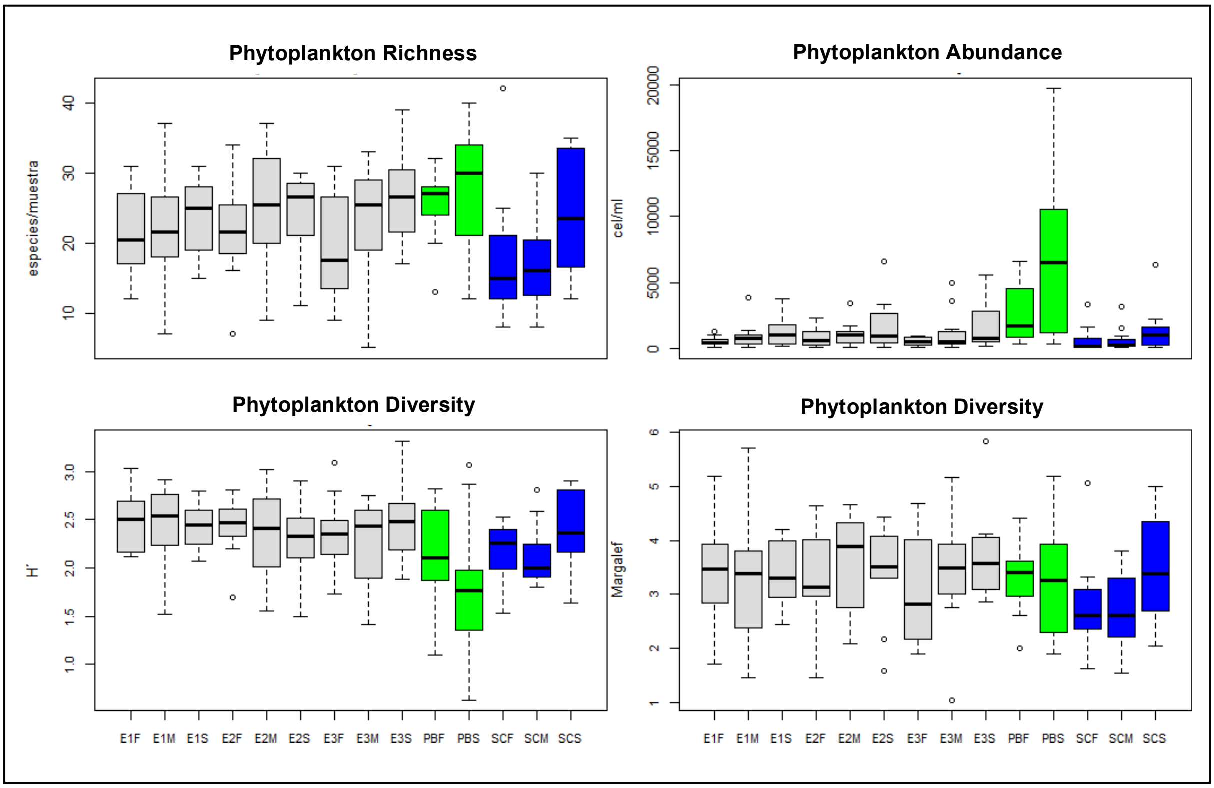


Prepared by: Ecosambito, 2020

In Figure 10, we can see a trend for increase in species as the distance from the coastal edge decreases and an evident greater abundance in inland waters of Santa Rosa estuary. The highest diversity values are found in mixing waters, that is, in the samples collected from the deposit basin for dredged material.

With a clear understanding of the existence of differences between sampling sites, the graph contained in Figure 11 was obtained by introducing the variable depth at which the sample was acquired.

Figure 11. Ecological Descriptors of Phytoplankton grouped by Site and Depth



Prepared by: Ecosambito, 2020

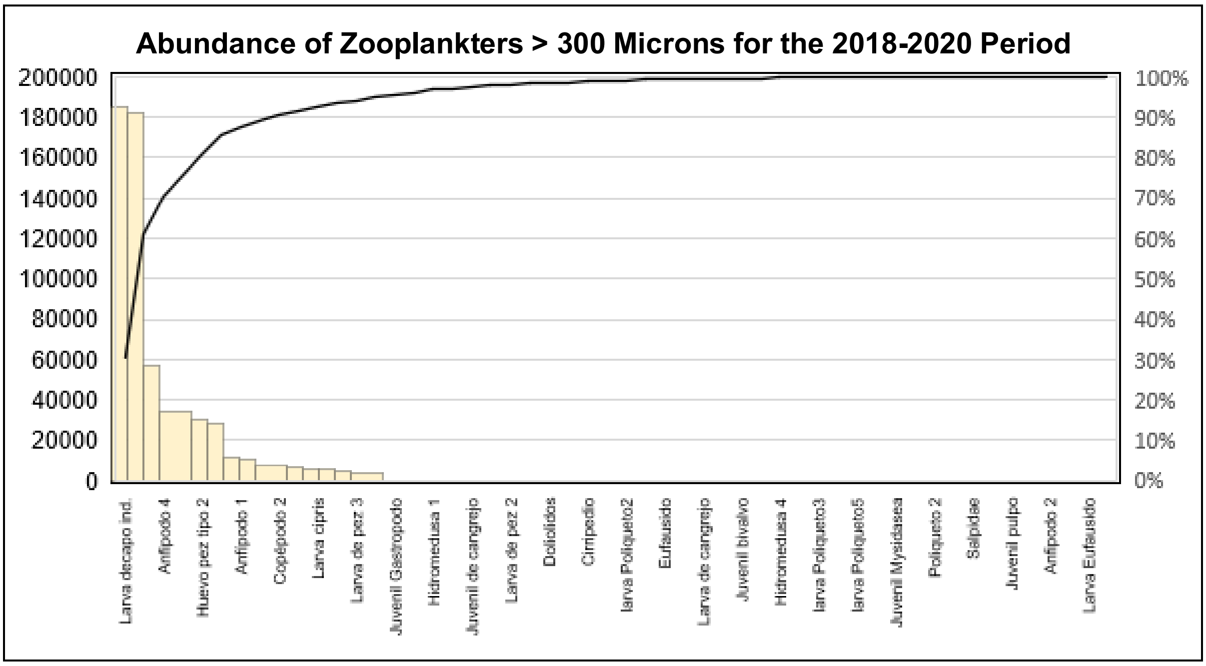
When grouping the ecological descriptors by sites and depths, we can observe a considerable difference in the abundance of algae present in the vicinity of Dock 1 of Puerto Bolivar. Here there are almost 4 times more abundance of phytoplankton species than on the surface of the other monitoring sites, as evidenced by the mean values described below.

```
tapply(Abundancia,`Profundidad (m)`,mean)
      E1F       E1M       E1S       E2F       E2M       E2S       E3F
 513.2500  924.5500 1336.5833  790.8167 1073.7833 1676.5417  513.6250
      E3M       E3S       PBF       PBS       SCF       SCM       SCS
1217.2000 1673.9667 2623.9692 6686.4567  635.2750  647.6183 1380.4500
> tapply(Abundancia,`Profundidad (m)`,sd)
      E1F       E1M       E1S       E2F       E2M       E2S       E3F
 349.1718  999.3217 1203.9470  683.4216  894.9811 1896.2788  317.5826
      E3M       E3S       PBF       PBS       SCF       SCM       SCS
1522.6662 1666.4045 2347.0068 5914.3812  978.0253  909.8523 1716.1857
```

3.2 Zooplankton > 300 microns

The samplings made in the 2018-2020 period revealed a richness of no less than 54 different zooplankters > 300 microns: 22 crustaceans, 3 chaetognaths, 7 polychaetes, 1 larvacean, 4 urochordates, 5 cnidarians, 3 mollusks, 1 echinoderm and 8 fish eggs and larvae. The database of zooplanktonic samples of the fraction larger than 300 microns is not included in the IUCN Redlist. The abundance of zooplankters of this fraction is shown in Figure 12 and Figure 13 shows their distribution and abundance, showing the occurrence of pulses of zooplanktonic increases linked to massive reproductive events linked to samples taken on dates close to the seasonal changes.

Figure 12. Cumulative Abundance of Zooplankters after two Years of Monitoring using 300-Micron 3-Minute Trawls



Prepared by: Ecosambito, 2020

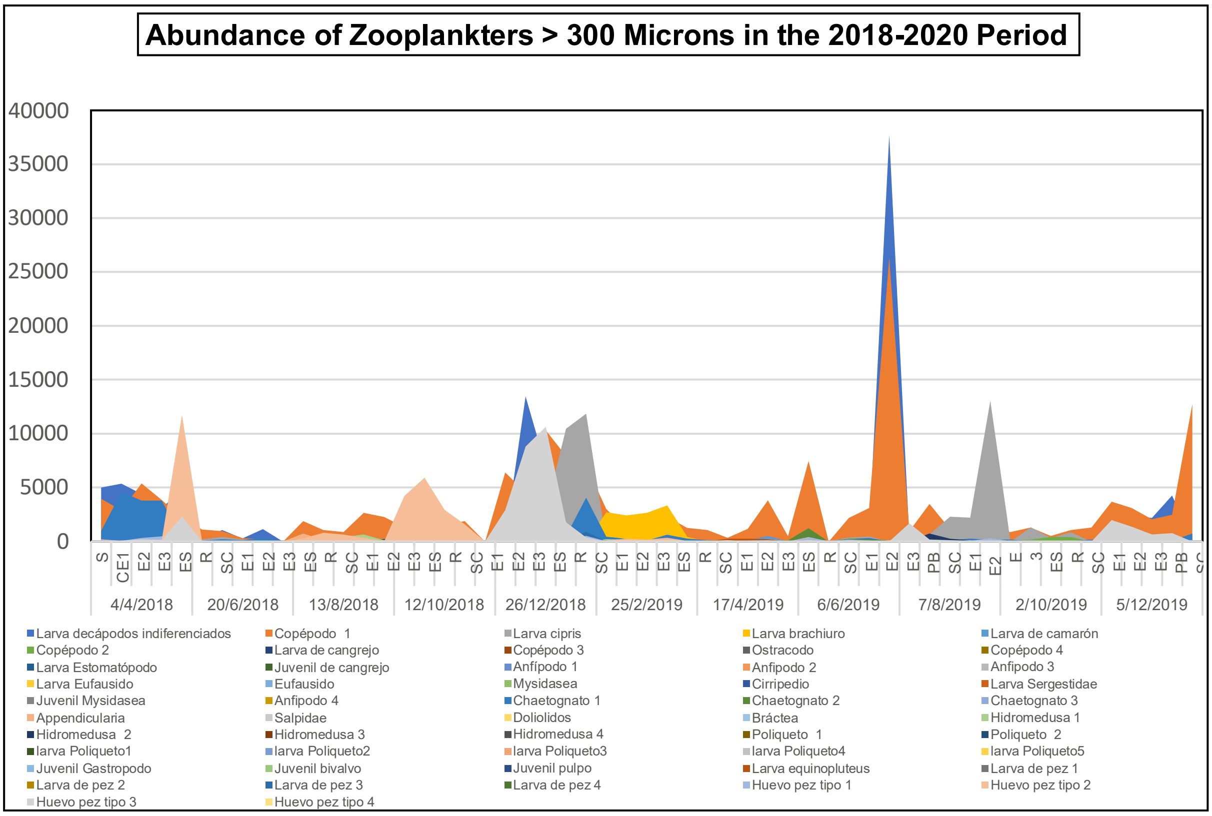
As will be discussed below, zooplankton diversity is not high due to its relationship with reproductive pulses corresponding to those moments at which the presence of specific larvae increases excessively. Of the 57 zooplankters identified, the 10 most abundant ones account for 91% of the estimated total individuals, which are shown in Table 5.

Table 5. Most Abundant Zooplankters > 300 Microns in the Project's Area of Influence

	Type of Zooplankter	Relative Abundance %
1	Larva decapod ind.	30%
2	Copepod 1	30%
3	Amphipod 4	9%
4	Fish egg type 3	6%
5	Fish egg type 2	5%
6	Chaetognaths 1	5%
7	Amphipod 1	2%
8	Egg fish type 1	2%
9	Copepod 2	1%
10	Chaetognaths 2	1%

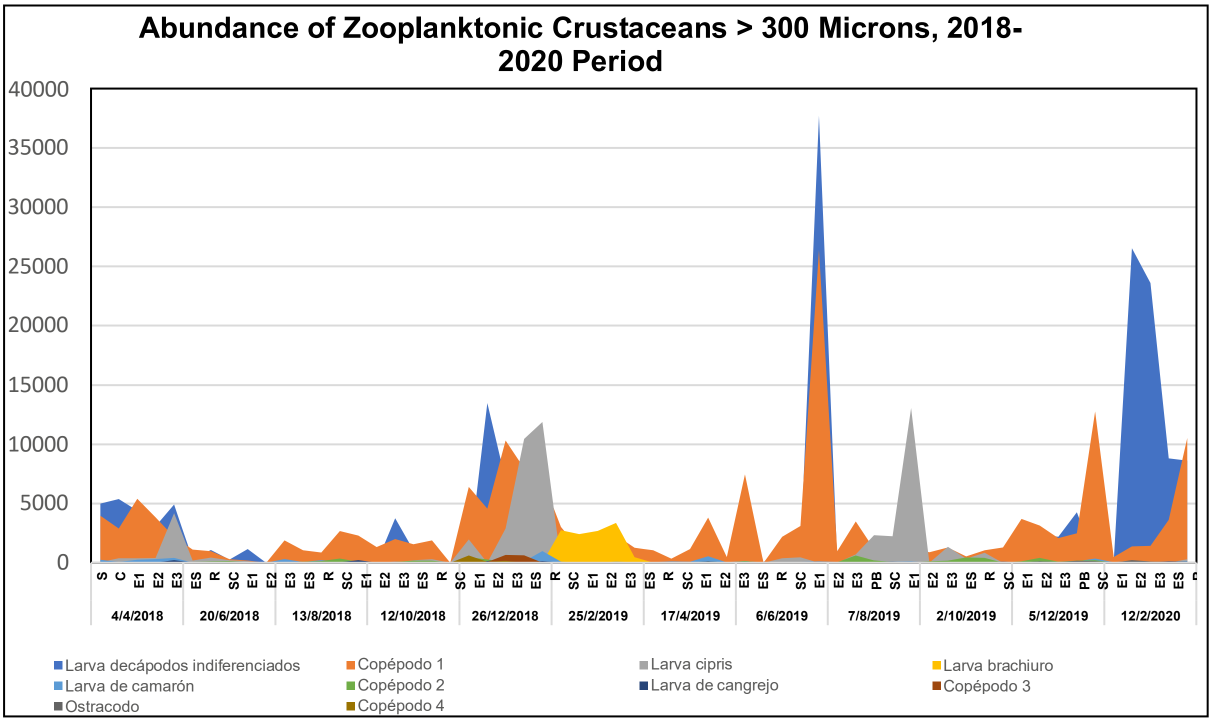
Prepared by: Ecosambito, 2020

Figure 13. Zooplankton Abundance "Pulses" associated with Seasonal Changes



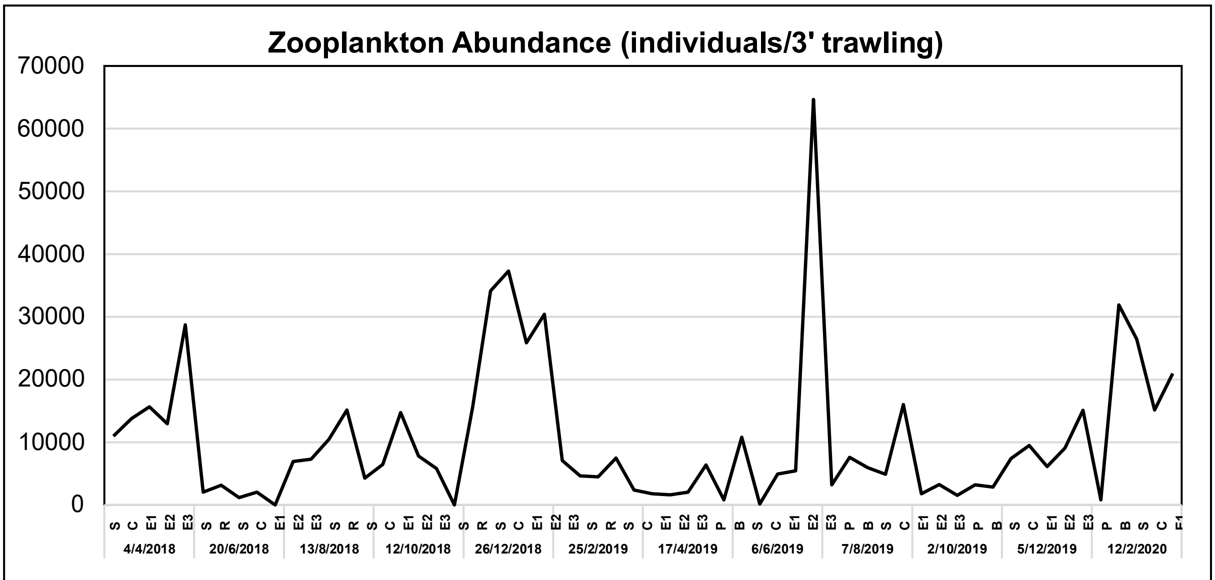
Prepared by: Ecosambito, 2020

Figure 14. Evolution of Abundance of Zooplanktonic Crustaceans > 300 Microns



Prepared by: Ecosambito, 2020

Figure 15. Abundance of Zooplankters > 300 Microns



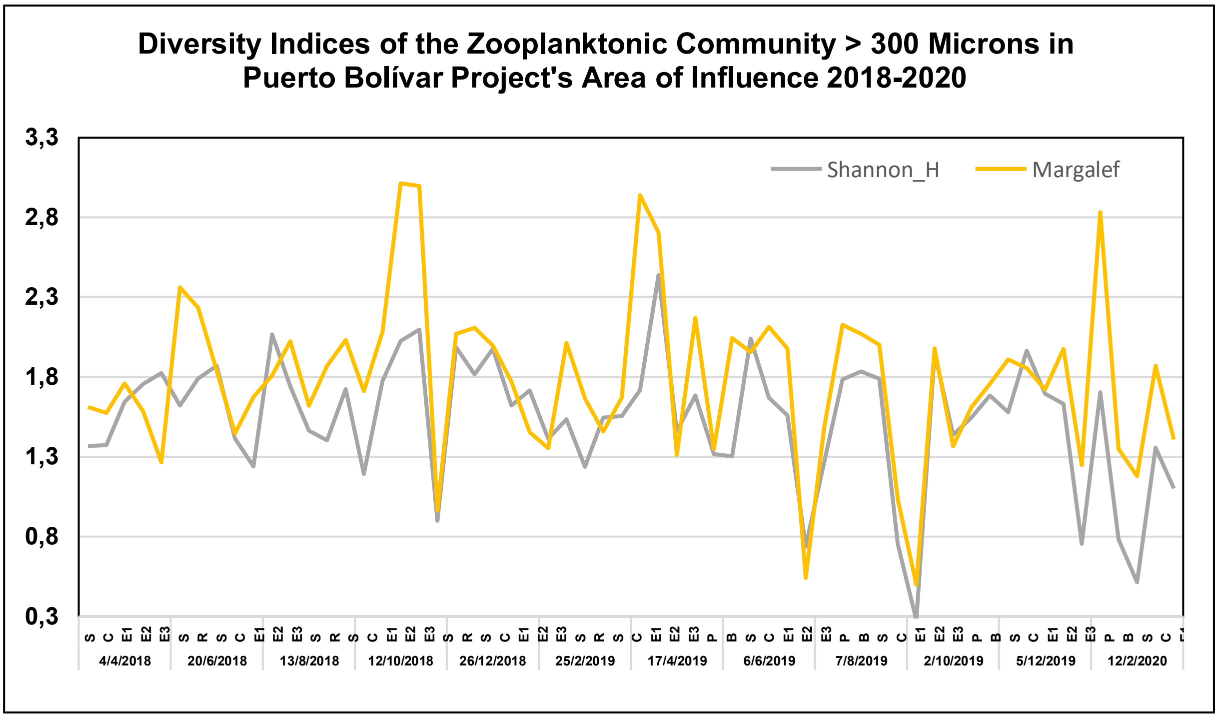
Prepared by: Ecosambito, 2020

In Figure 11 and Figure 12, it can be seen that most zooplankters > 300 microns are crustaceans, the average total abundance of zooplankters > 300 microns was 10,506 ± 11,651 individuals collected using a 300-micron net with a 38-cm diameter mouth that was trawled for 3 minutes.

The richness of zooplankters was variable. However, considering all trawls without discriminating among sectors and dates, there was an average of 15.53 ± 4.62 different types of zooplankters per trawl. The zooplankton diversity of the fraction > 300 microns was 1.534 ± 0.409 bits in the Shannon H' index and 1.790 ± 0.506 in the Margalef index, with this community being interpreted as a low-diversity one, which is not considered as poor condition but rather as a response to massive bloom-like reproductions or larval pulses where the abundance of a few species that dominate the water column increases significantly.

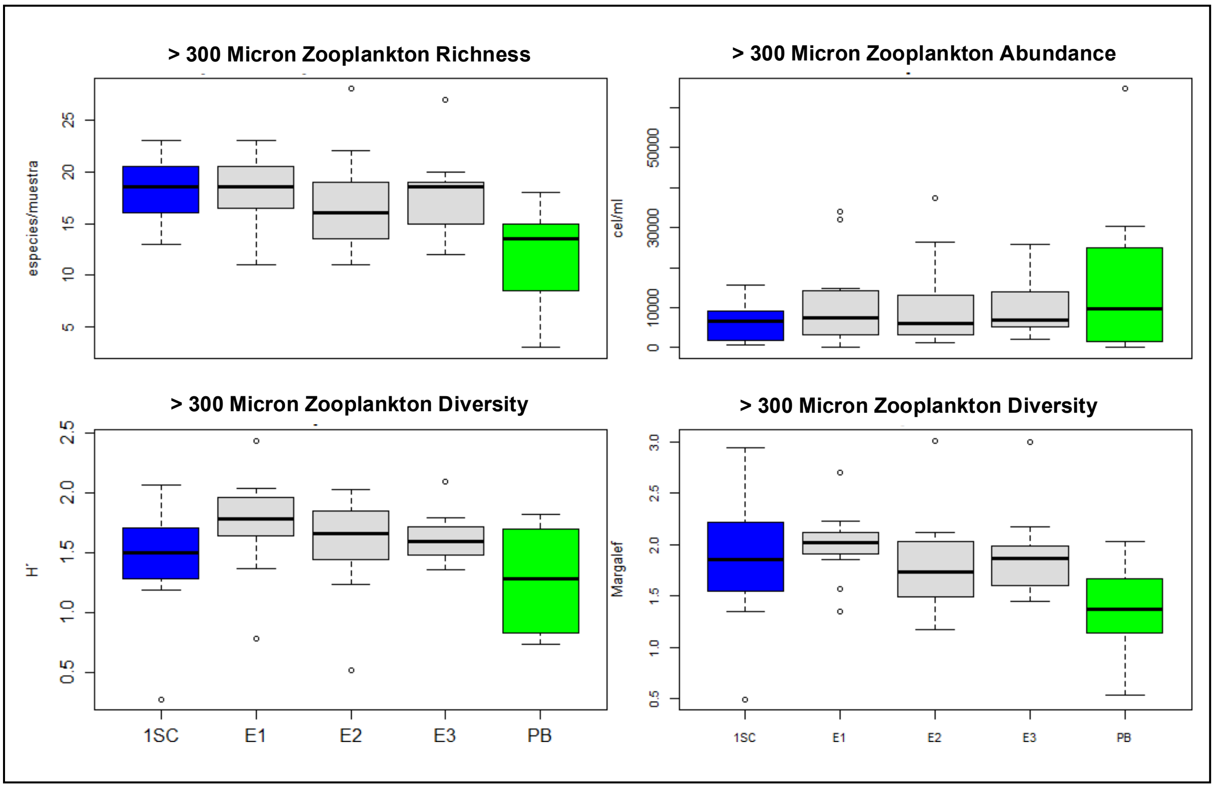
With regard to the sectoral variables of the zooplanktonic community > 300 microns, their general descriptors are presented in Figure 16. Such figure shows a greater zooplankton abundance in terms of the number of animals collected in a 3-minute trawl in the sector near Puerto Bolívar facilities, which is in turn the least diverse site, a situation that indicates the dynamics of larval pulses near the coastal edge, which will later integrate into the coastal benthic communities as they develop.

Figure 16. Diversity Variations in the Zooplankton Fraction > 300 Microns



Prepared by: Ecosambito, 2020

Figure 17. Sectoral Comparison of Ecological Descriptors of the Zooplankton Fraction > 300 Microns without considering the Time Variable



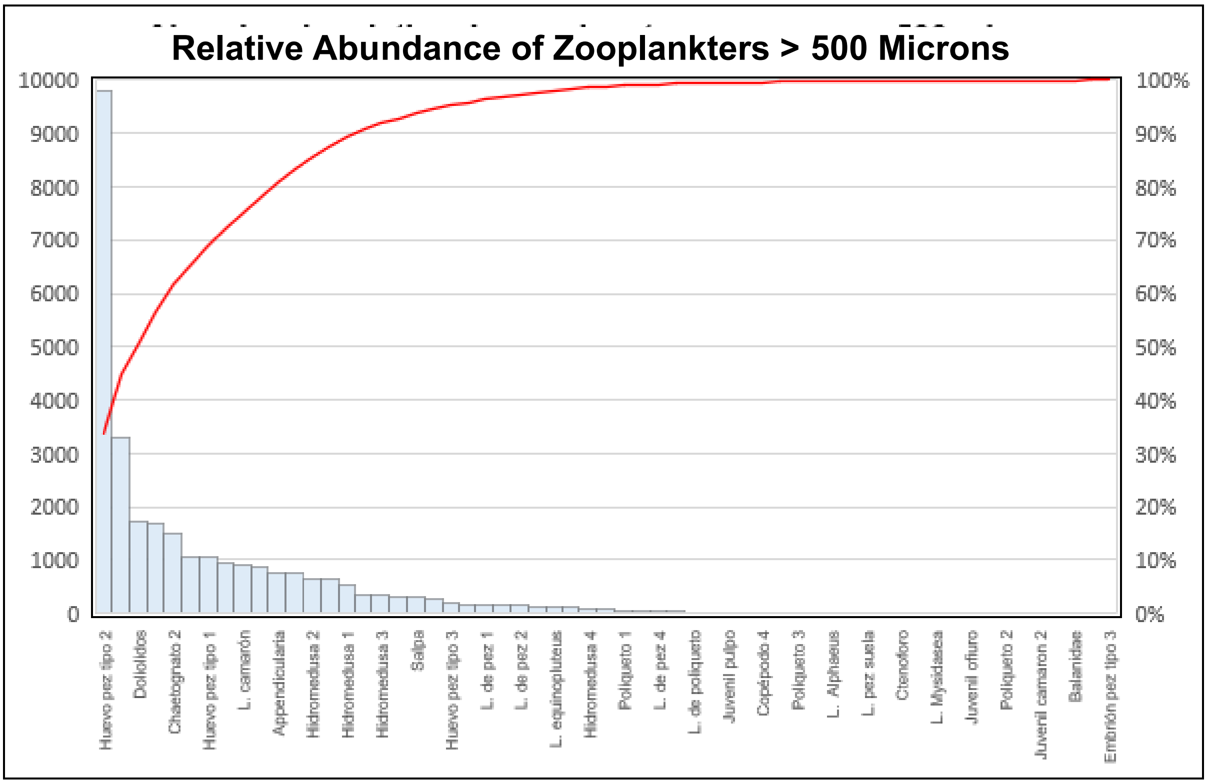
Prepared by: Ecosambito, 2020

3.3 Zooplankton > 500 Microns

In the 3-minute trawl collections with 500 micron nets, 59 different zooplankters were identified: 21 crustaceans, 3 chaetognaths, 6 polychaetes, 1 larvae, 3 urochordates, 1 ctenophore, 6 cnidarians, 3 mollusks, 3 echinoderms and 12 fish eggs and larvae, these, as with the fraction greater than 300 microns, do not make the Redlist because they correspond to initial stages of species whose adults possibly do.

Figure 17 shows the abundance of zooplankters considering all the estimates from total collections of each trawl.

Figure 18. Most Abundant Zooplankters in the Project's Area of Influence in the 2018-2020 Period.



Prepared by: Ecosambito, 2020

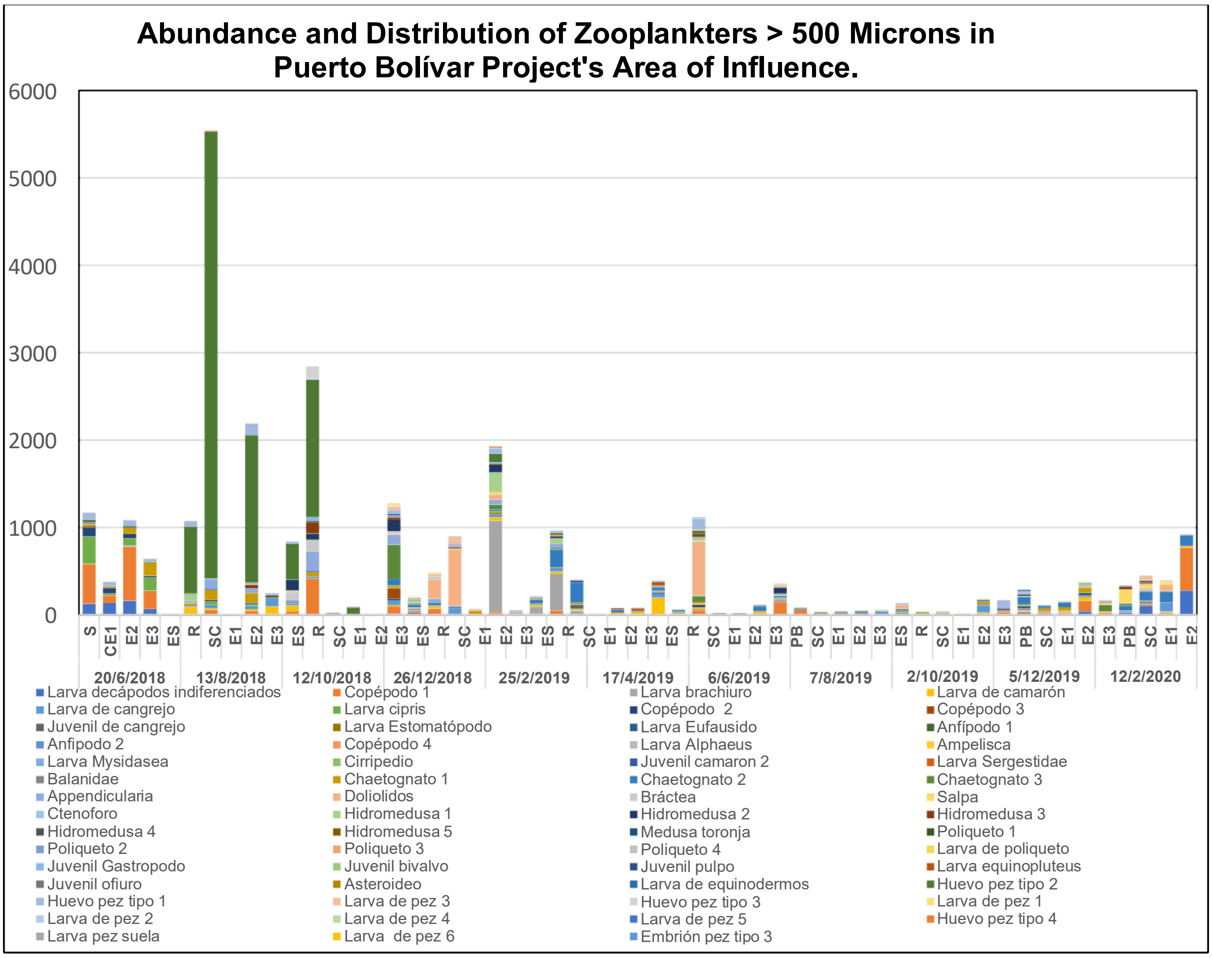
Figure 18 shows that zooplankton organisms > 500 microns are less diverse due to the disproportionate abundance of the most abundant species: the type 2 fish eggs that accounted for more than 30% of all the organisms computed and the 10 most abundant zooplankters that exceeded 78% of the estimated organisms as shown in Table 6.

Table 6. Most Abundant Zooplankters in the Fraction > 500 Microns

Ranking	Type	Relative Abundance %
1	Type 2 fish egg	33.62%
2	Copepod 1	11.28%
3	Doliolids	5.88%
4	Brachyura larvae	5.73%
5	Chaetognaths 2	5.19%
6	Egg fish type 1	3.59%
7	Larvae of undifferentiated decapods	3.61%
8	Chaetognaths 1	3.19%
9	Shrimp larvae	3.08%
10	Crab larvae	2.95%
		78.12%

Prepared by: Ecosambito, 2020

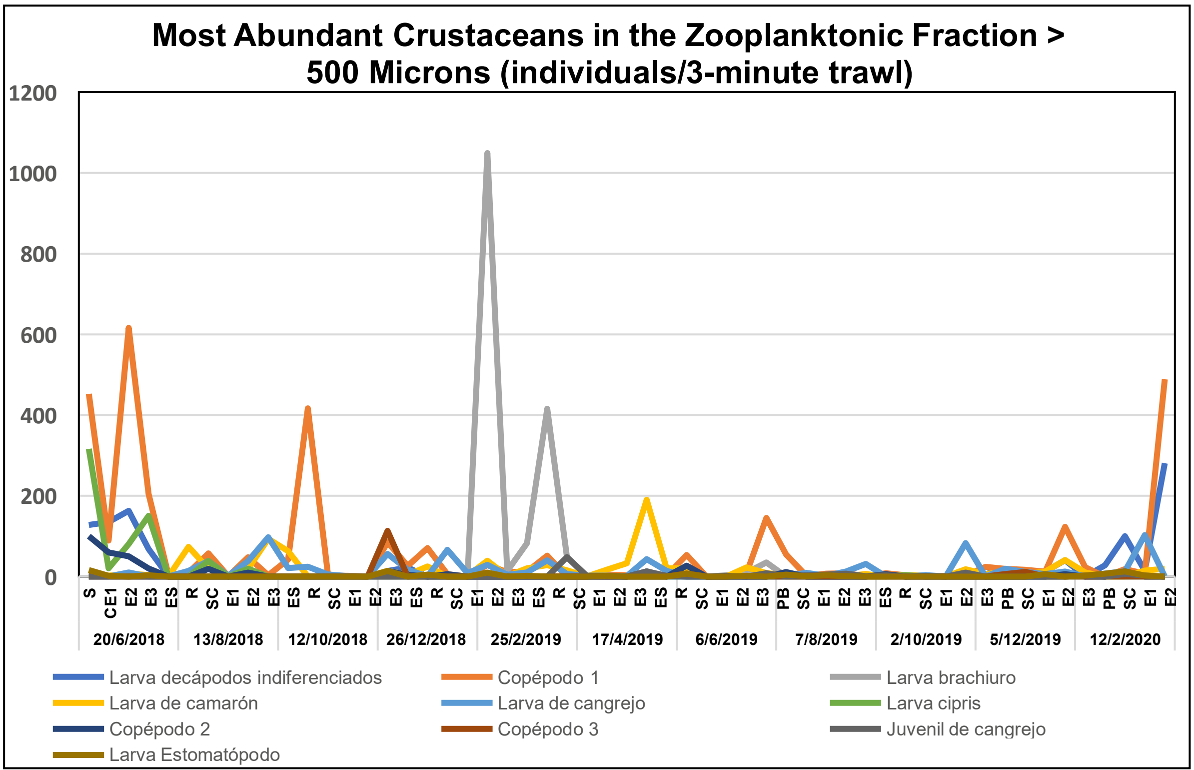
Figure 19. Abundance and Distribution of Zooplankters > 500 Microns collected during 2018-2020 Monitoring.



Prepared by: Ecosambito, 2020

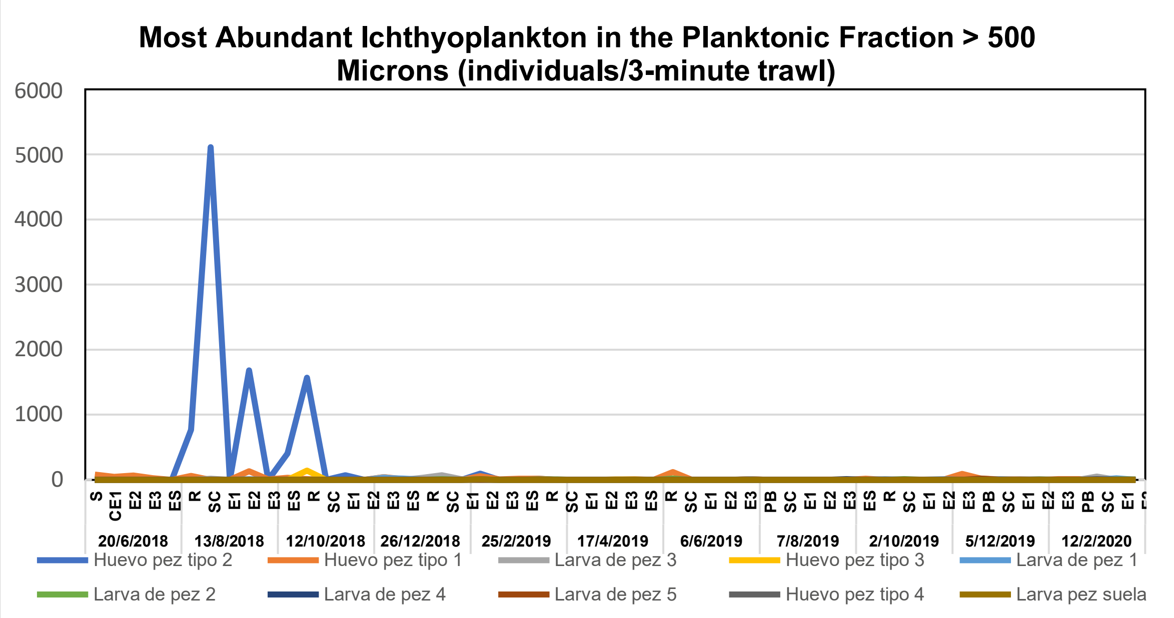
In Figure 19, it can be seen that the greatest abundance of zooplankters > 500 microns occurred in August 2018, with a significance presence of these type 2 fish eggs within the boundaries of the deposit basin for dredged material.

Figure 20. The 10 Most Abundant Crustaceans in the Zooplanktonic Fraction > 500 Microns



Prepared by: Ecosambito, 2020

Figure 21. Most Abundant Ichthyoplankters in the Zooplanktonic Fraction > 500 Microns

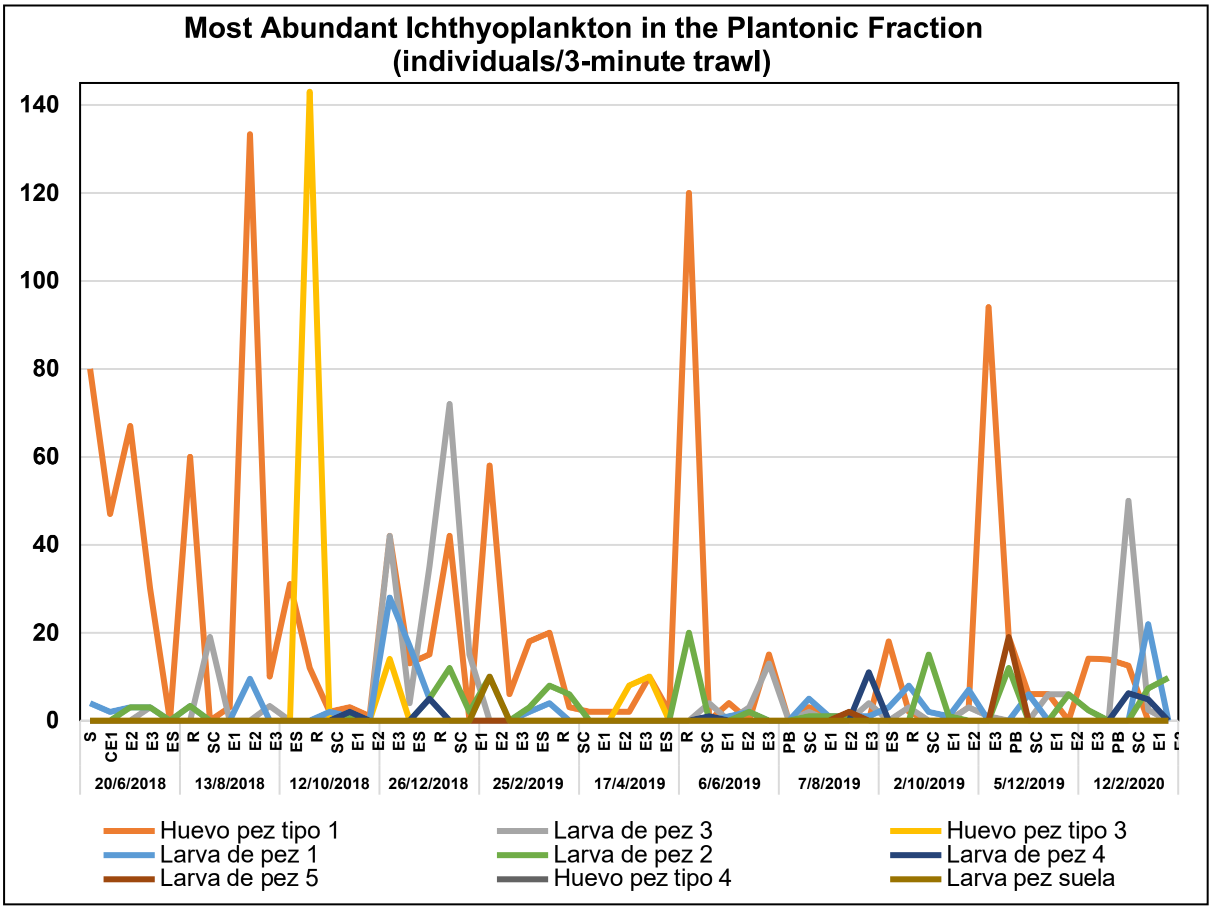


Prepared by: Ecosambito, 2020

From the "pulses" of crustacean and fish abundance in the most developed zooplanktonic community, it can be observed that the highest pulses of crustaceans occur on seasonal transition dates, while the highest pulses of fish would occur in the last four months of 2018 in the case of type 2 fish eggs. The fact that the same fish eggs type 2 were not registered on similar dates of 2019 calls our attention.

Given the disproportionate abundance of such pulse of fish eggs in 2018, these results were removed from Figure 21, which shows a continuous reproductive activity of fish throughout the period analyzed as well as the founding effect of Santa Clara Island.

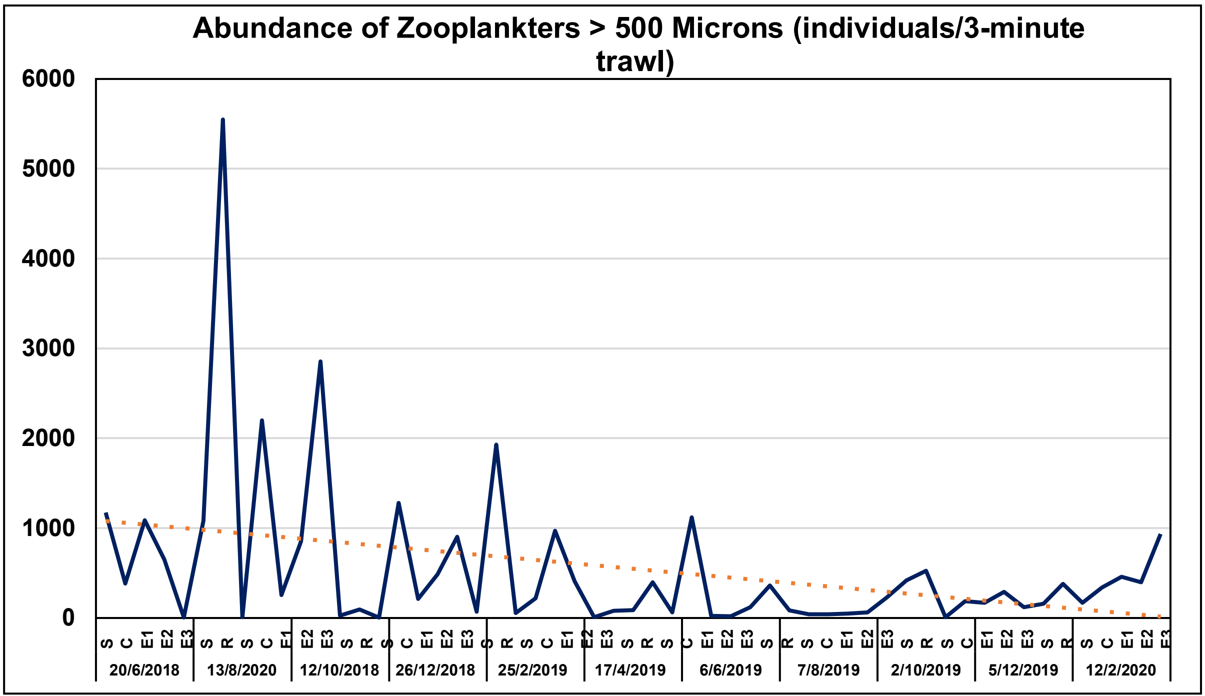
Figure 22. Ichthyioplankters Registered in this Study.



Prepared by: Ecosambito, 2020

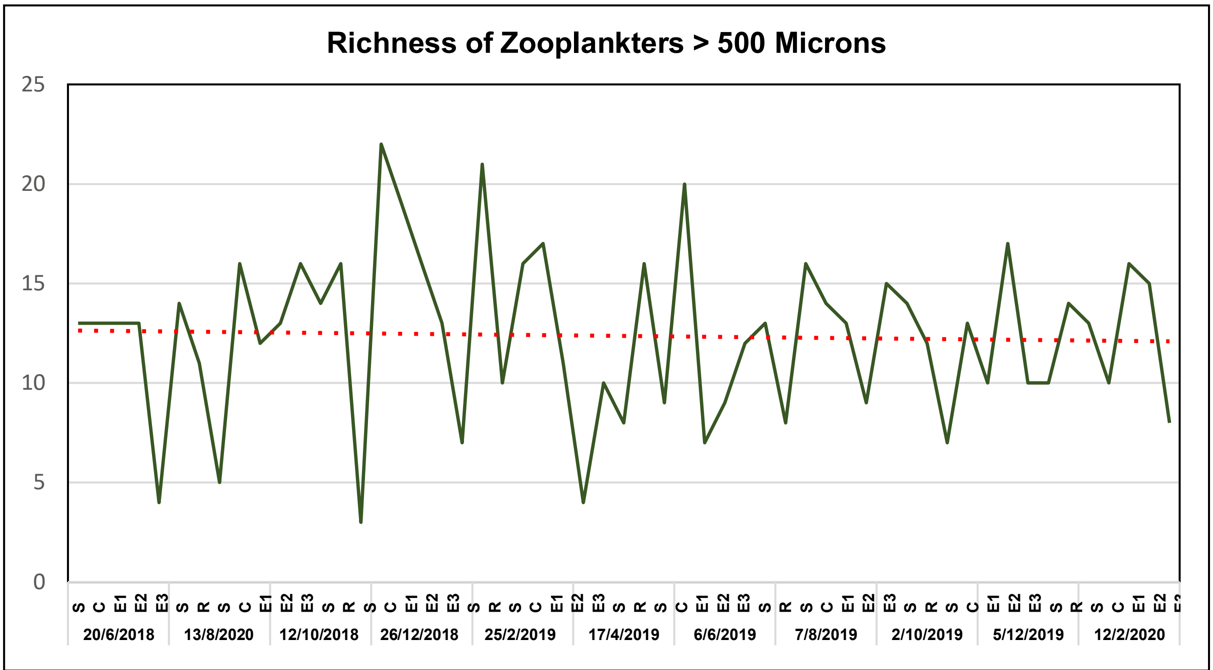
In order to better understand how this community behaves in general terms, Figures 23 to 25 depict the temporary evolution of general ecological descriptors of the zooplankter fraction > 500 microns.

Figure 23. Abundance of Zooplankters > 500 Microns



Prepared by: Ecosambito, 2020

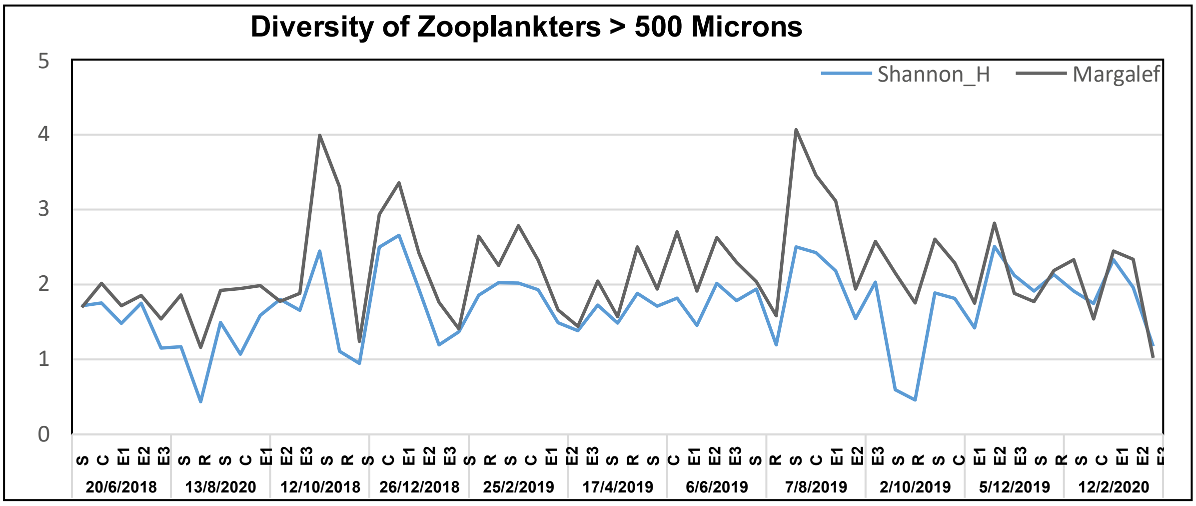
Figure 24. Temporary Evolution of Richness of Zooplankters > 500 Microns in the Project's Area of Influence.



Prepared by: Ecosambito, 2020

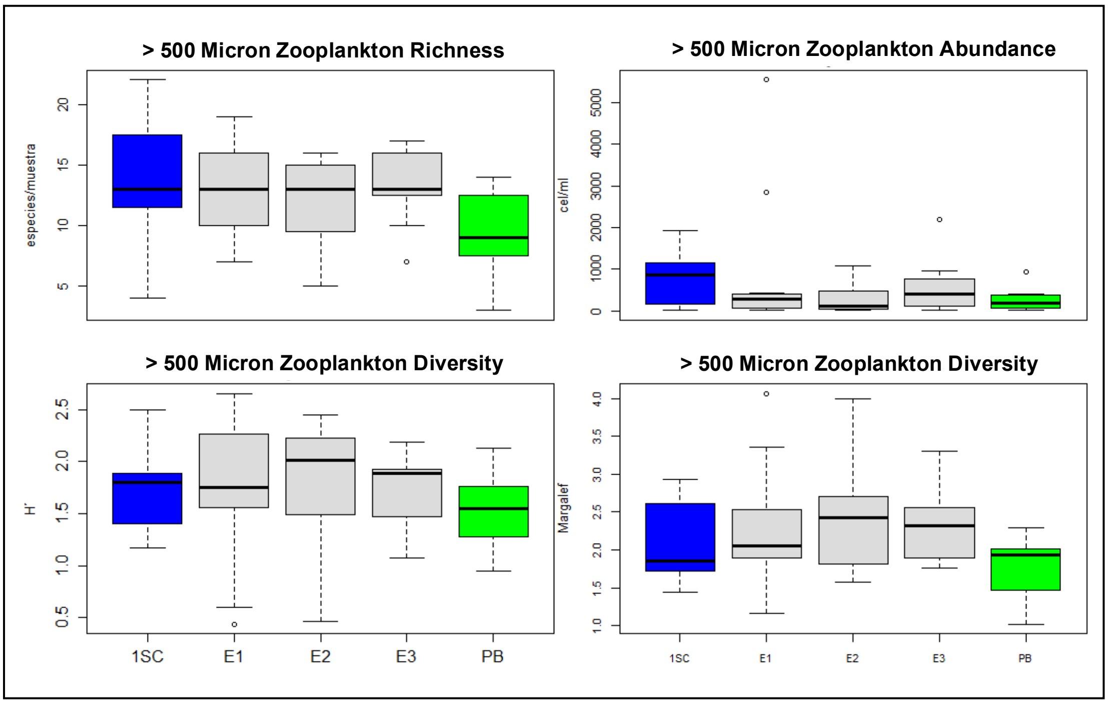
Figure 25 shows that the diversity ranges of this zooplanktonic fraction are mostly close to descriptors of low diversity that could be erroneously interpreted as a sector of poor environmental quality, but that in reality indicates the functioning of sectoral pulses that can be seen in Figure 26.

Figure 25. Evolution of Zooplankton Diversity > 500 Microns.



Prepared by: Ecosambito, 2020

Figure 26. Sectoral Comparison of Zooplankton Descriptors of the Fraction > 500 Microns



Prepared by: Ecosambito, 2020

Figure 26 shows that unlike the phytoplankton community and the fraction greater than 300 microns, there is a greater richness of beings of this zooplanktonic fraction towards the oceanic water limit and this greater richness responds to the presence of hard and mixed bottoms in the vicinity of Santa Clara Island.

3.4 Benthic Community

The monitoring samplings for the period 2018-2020 recorded a richness of 70 benthic species in the area of influence of the Project: 11 crustaceans, 30 mollusks including 1 scaphopod or sea fang, 17 bivalves and 12 gastropods; in addition to 3 echinoderms, 1 cnidarian, 1 nemertean, 21 polychaetes, 1 sipunculid, 1 priapulid and 1 flatworm. Of the 70 benthic creatures collected, two species, the snail Polinices grayi is considered vulnerable and the crustacean Alphaeus sp or pistol shrimp is considered endangered according to the IUCN Redlist.

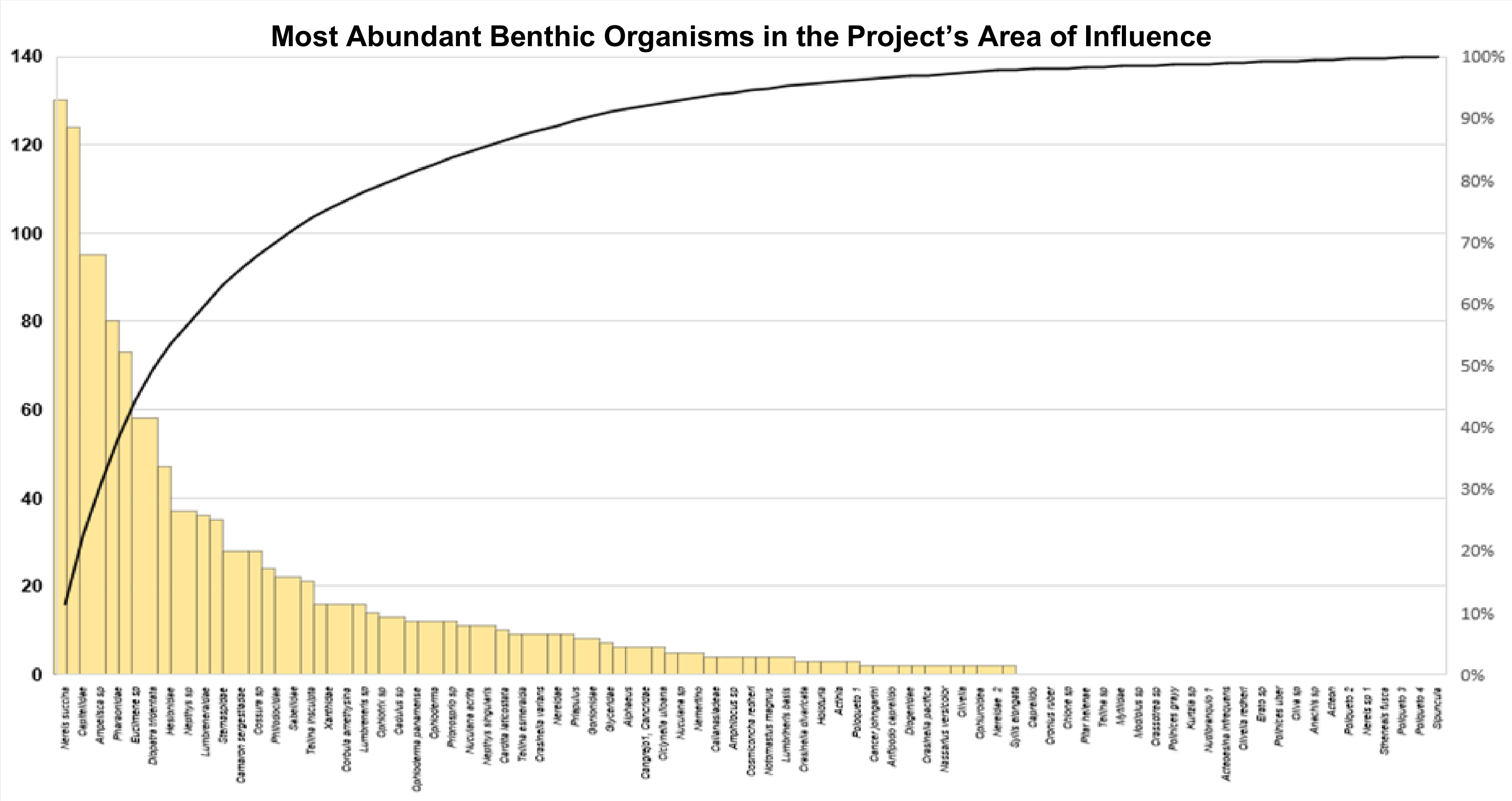
Figure 26 shows data on the total abundance of creatures collected with a Van Been dredge without discriminating between sectors and dates, as well as their temporal and spatial distribution, which appears in Figure 27, polychaetes were the most abundant species and showed considerable differences in abundance with respect to the dredging maneuvers in the sector of the deposit basin, effectively fulfilling a role as a bioindicator community of marine environmental quality given their relatively fixed residence, their long life spans and their ease of sampling, although several species were not easy to identify due to the lack of national dichotomous keys, resorting to reference texts from Mexico.

Table 7. Most Abundant Benthic Organisms found during the Monitoring

Ranking	Genus/Species	Relative Abundance %
1	*Nereis succinea*	11.5%
2	*Capitellidae*	10.9%
3	*Ampelisca sp*	8.4%
4	*Pharaonidae*	7.1%
5	*Euclimene sp*	6.4%
6	*Diopatra tridentata*	5.1%
7	*Hesionidae*	4.1%
8	*Nepthys sp*	3.3%
9	*Lumbreneraidae*	3.2%
10	*Sternaspidae*	3.1%
11	*Camaron sergestiadae*	2.5%
12	*Cossura sp*	2.5%
13	*Phillodocidae*	2.1%
14	*Sabellidae*	1.9%
15	*Tellina insculpta*	1.9%
16	*Xanthidae*	1.4%
17	*Corbula amethysina*	1.4%
18	*Lumbreneris sp*	1.4%
19	*Ophiotrix sp*	1.2%
20	*Cadulus sp*	1.1%
	Cumulative abundance	80.51%

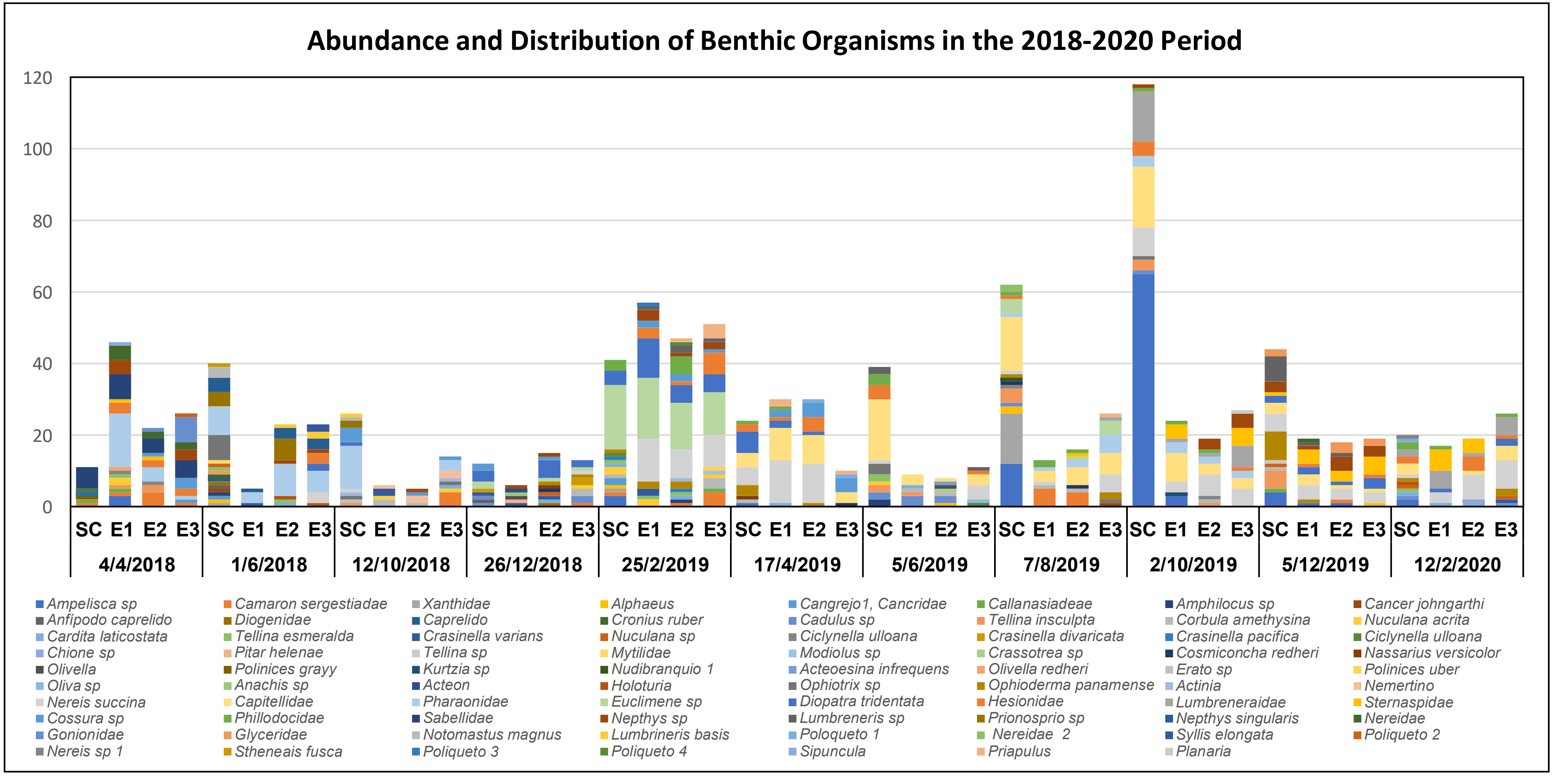
Prepared by: Ecosambito, 2020

Figure 27. Abundance of Benthic Organisms collected during the 2018-2020 Monitoring in the Project's Area of Influence



Prepared by: Ecosambito, 2020

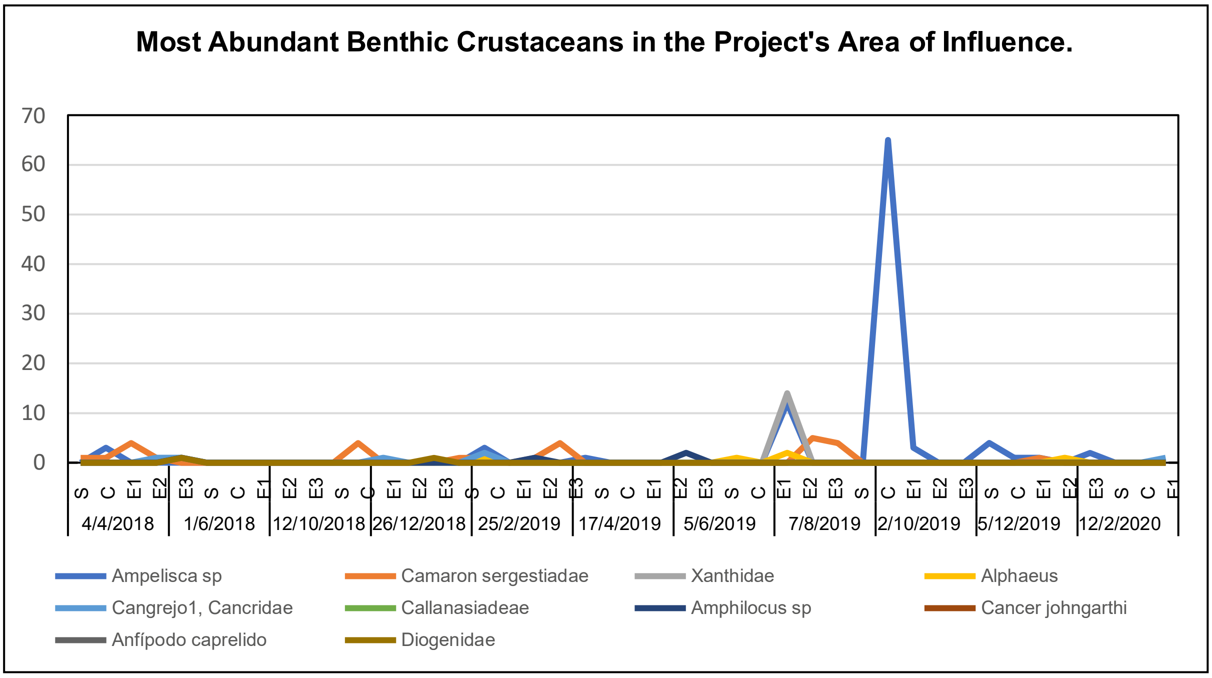
Figure 28. Abundance and Distribution of Benthic Organisms collected with Van Veen Dredge in Puerto Bolívar Project's Area of Influence.



Prepared by: Ecosambito, 2020

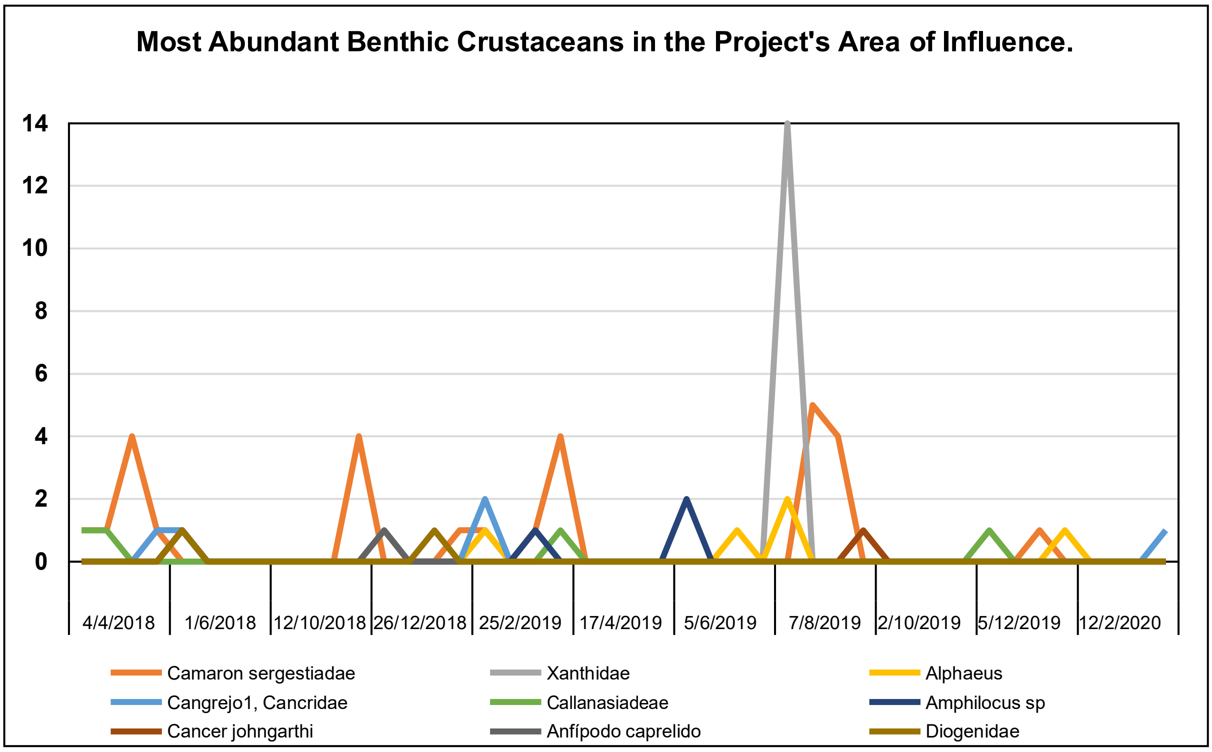
Table 7 communicates the ranking of most abundant benthic beings where the 10 most abundant beings of all collections represented 63% of the total number of individuals counted and the 20 most abundant beings represent 80% of all specimens trapped during the 2018-2020 monitoring. When analyzing the abundance of main zoological groups, figures 29 to 32 are shown.

Figure 29. Abundance of Crustaceans in Monitoring considering the 10 Most Abundant Species



Prepared by: Ecosambito, 2020

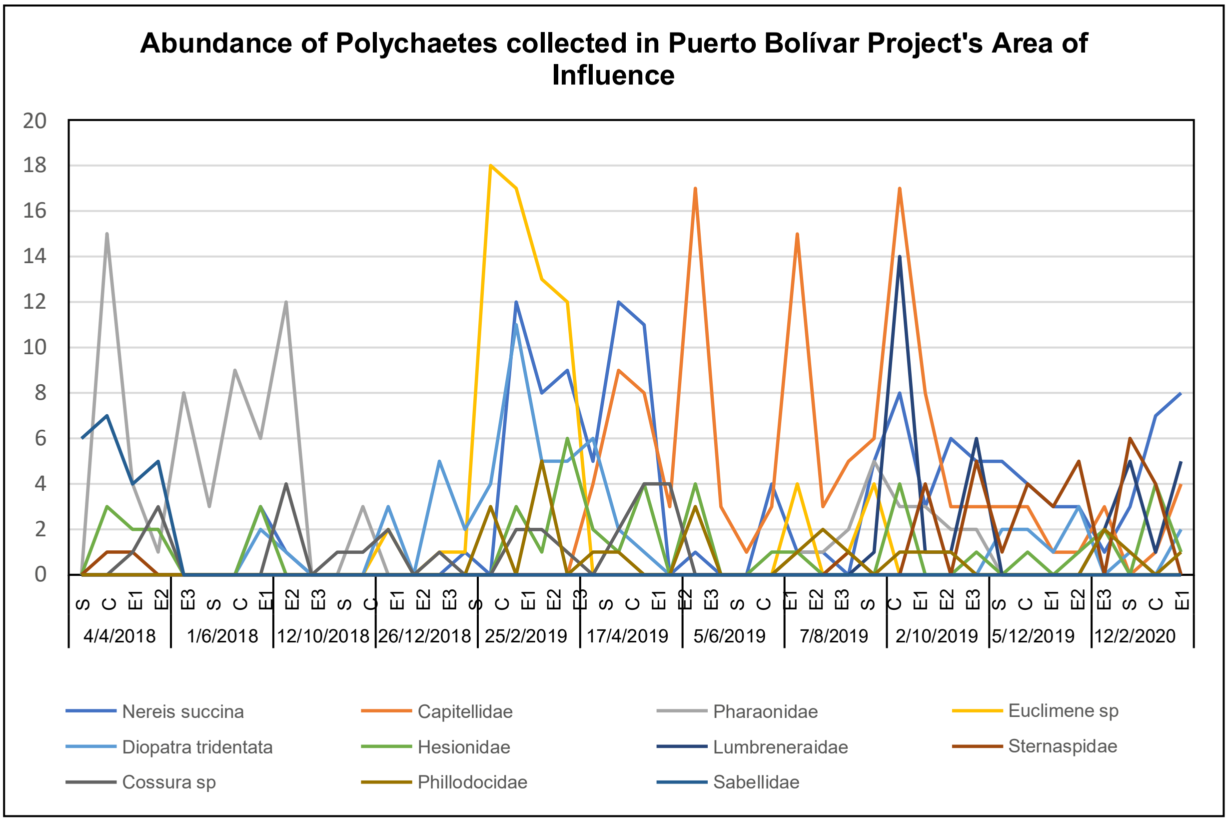
Figure 30. Abundance of Crustaceans in the Project's Area of Influence without considering the Most AbundantSpecies, the Ampelisca sp. (Amphipod)



Prepared by: Ecosambito, 2020

In Figure 29 and Figure 30, it can be seen that there are more crustaceans in the vicinity of Santa Clara Island, while Station E1, located in the deposit basin for dredged material, exhibited the least richness and abundance of such species.

Figure 31. Fluctuations of Polychaetes during the Monitoring Period

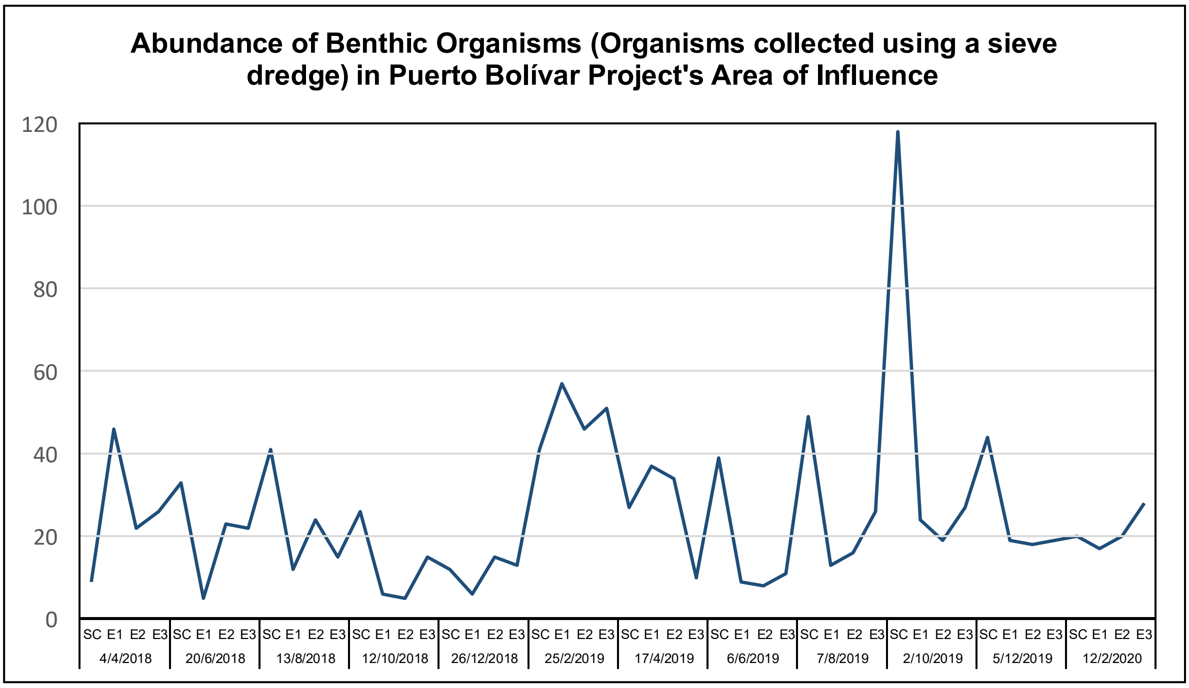


Prepared by: Ecosambito, 2020

Figure 31 shows active fluctuations in the abundance of polychaetes in the area of influence of the Puerto Bolivar Project, with maximum abundance values in the Santa Clara Island station, at this point we suggest a more exhaustive study of this zoological group given its good role as an indicator of seabed quality.

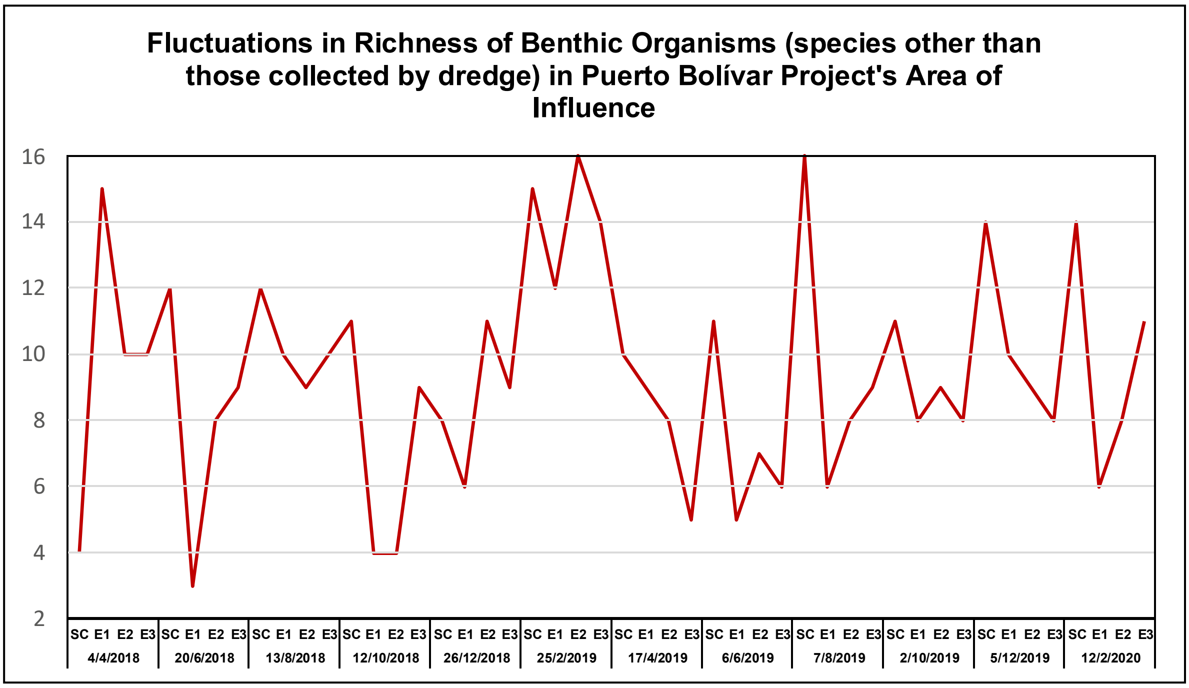
As shown in Figure 32, which integrates the total abundance of benthic beings in all samples, the period of maximum abundance occurred on October 2, 2019, which is attributed to a swarm of Ampelisca sp, as shown in Figure 29.

Figure 32. Abundance of Benthic Organisms in the Project's Area of Influence.



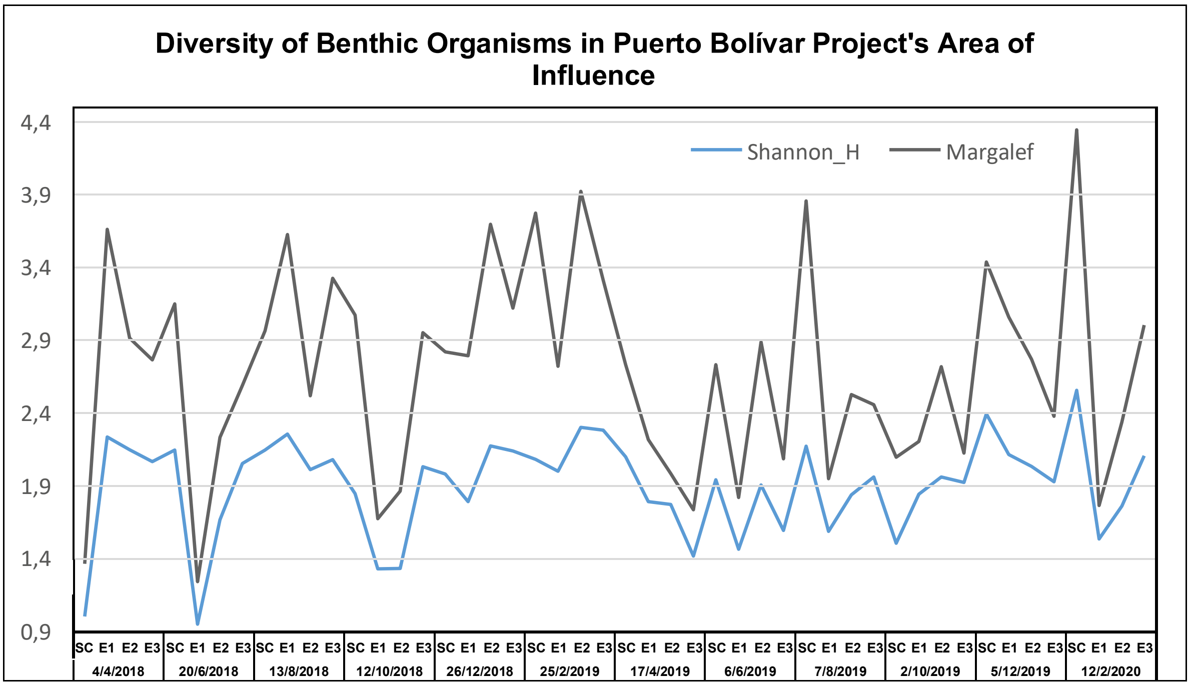
Prepared by: Ecosambito, 2020

Figure 33. Fluctuations in Benthic Richness during 2018-2020 Monitoring



Prepared by: Ecosambito, 2020

Figure 34. Fluctuations in Benthic Diversity

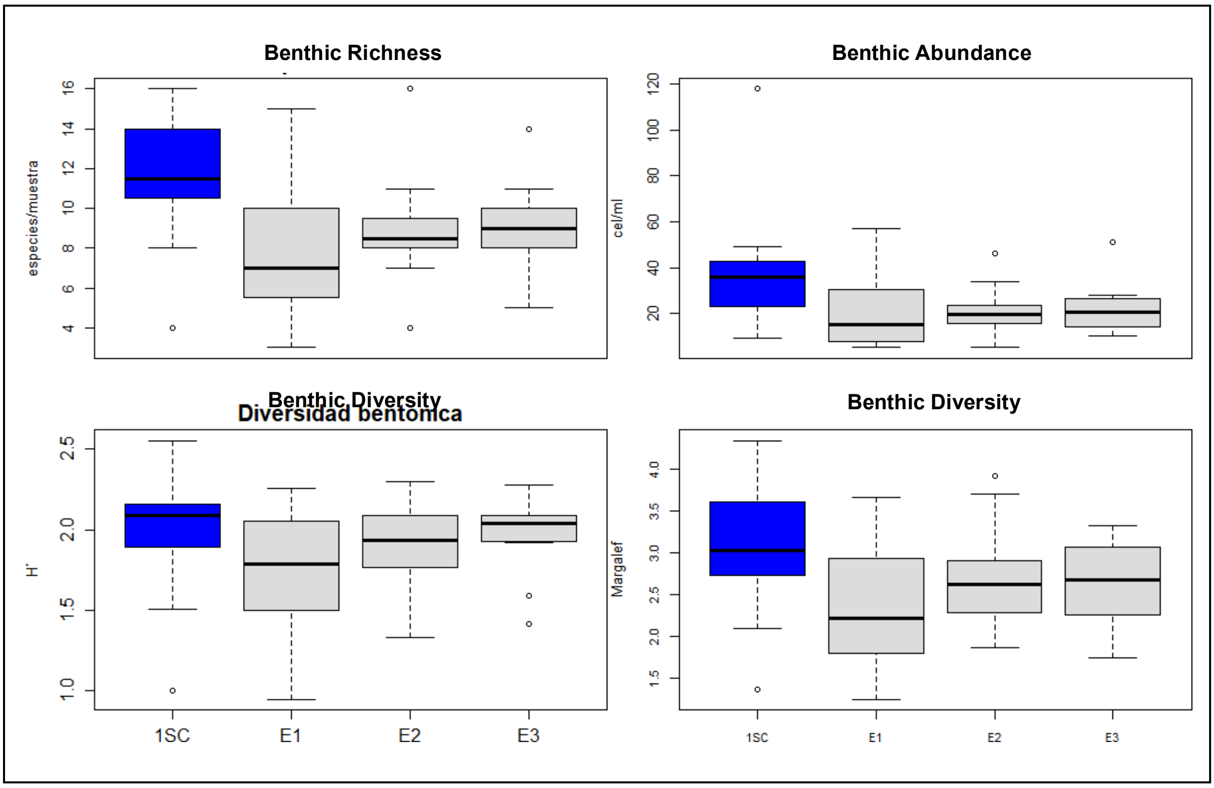


Prepared by: Ecosambito, 2020

Figure 33 and Figure 34 show a drop in richness and diversity in the dredge deposit area during dredging maneuvers, an expected situation since it would have temporarily affected small creatures that were buried under the sediments removed from the access channel and maneuvering area of Puerto Bolivar and were deposited in the bucket. However, it should be noted that not all benthic creatures succumb and the survivors, which we will call "bioengineers", begin to improve the sediment conditions and establish new benthic communities. The benthic community is resilient and hence its usefulness as a bioindicator community of change.

To understand which sites would be most affected by the dredging maneuvers, the general ecological descriptions grouped by analysis site are presented in Figure 35.

Figure 35. General Ecological Descriptors of the Benthic Community collected using 4-Lt and 10-kg Van Veen Dredges with a Sampling Surface Area of 0.08 m2 in the Area of Influence

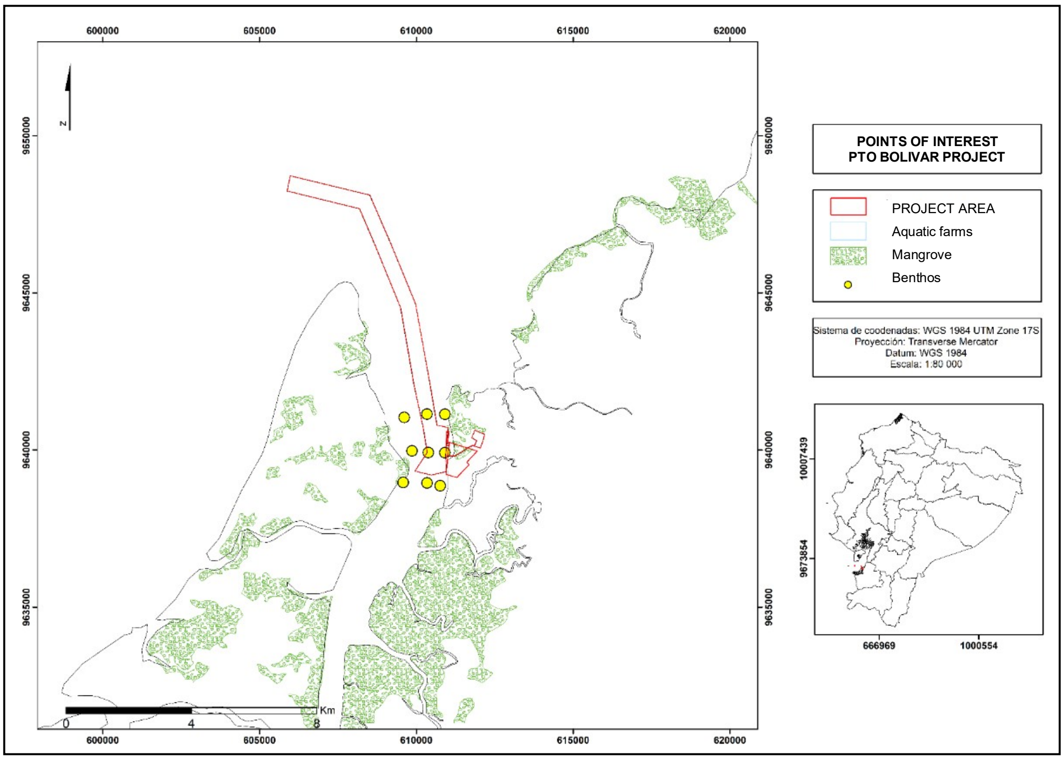


Prepared by: Ecosambito, 2020

Regarding the ecological descriptions of the benthic community, the best descriptions are associated with the most oceanic station, Santa Clara Island, a situation that is attributed to the presence of various types of bottom, since in the samples from this sector, in addition to fine or sandy sediments, the presence of gravels was observed, numerous empty shells and even pebbles of sedimentary material that facilitate the colonization of a greater number of benthic forms, while the sediments of the dredge deposit basin were characterized by silty sediments towards the oceanic sector and with an increase of sand, pyrite and organic plant matter towards the coastal sector.

In view of the lack of samplings related to the area of direct influence in the Santa Rosa estuary, on November 5, samples were acquired in 9 sites inside the Santa Rosa estuary; these are show in Figure 36. The collection method used was the same dredge that had been used in the 2018 - 2020 monitoring.

Figure 36. Benthic Sampling Sites for November 5, 2020Prepared by: Ecosambito, 2020



Prepared by: Ecosambito, 2020

Photographic Record 1. Van Veen Dredge used for Benthic Sampling and Sieving through a 500-Micron Mesh.

Prepared by: Ecosambito, 2020

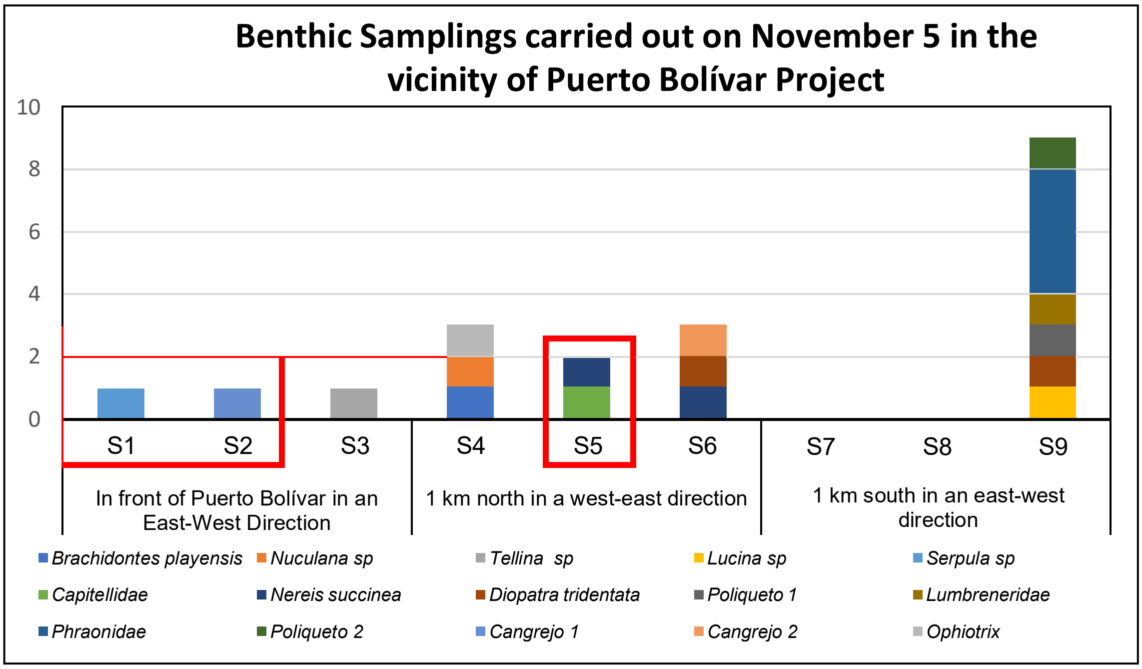
In the nine dredging operations carried out, only 20 benthic creatures of 15 different species were obtained, as well as numerous traces of other creatures, which are shown in Table 8 and Figure 37.

Table 8. Benthic Organisms collected in the Santa Rosa Estuary

Main Group	Type/genus/species	Abundance
Bivalves	*Brachidontes playensis*	1
	Nuculana sp	1
	Tellina sp	1
	Lucina sp	1
Annelida	*Serpula sp*	1
	Capitellidae	1
	Nereis succinea	2
	Diopatra tridentata	2
	Polychaeta 1	1
	Lumbreneridae	1
	Phraonidae	4
	Polychaeta 2	1
Crustacea	Crab 1	1
	Crab 2	1
Echinodermata	*Ophiotrix sp*	1
Total		20

Prepared by: Ecosambito, 2020

Figure 37. Benthic Sampling carried out on November 5 in the Santa Rosa Estuary



Prepared by: Ecosambito, 2020

Figure 37 shows the sites within the maneuvering area and access channel to Puerto Bolivar that have been dredged, which although they have few forms of life corresponding to two crabs and two polychaetes, do not present the worst state of the bottoms of the sector, a situation that occurred south of the Cabotaje dock, where two samples were azoic in the bottoms near the waterfront and middle part of Estero Santa Rosa, however near the sector with mangroves, there was the largest collection of benthic beings.

Photographic Record 2. Unidentified crab collected in the dredge sector of Puerto Bolívar's access channel; 2 were egg-bearing females, indicating a local population.

Prepared by: Ecosambito, 2020

The sample collected near the entrance of Jambelí beach resort, i.e. Point S4, presented 3 forms of life despite mainly consisting of valves and inert shells of mollusks, since there is considerable shell deposition in that place, causing the formation of a shell beach in that sector. The ecological descriptors of the benthic collections carried out on November 5 are shown in Table 9.

Table 9. Ecological Descriptors of Benthic Collections carried out on November 5, 2020

Descriptors	S1	S2	S3	S4	S5	S6	S9
Richness	1	1	1	3	2	3	6
Abundance	1	1	1	3	2	3	9
Dominance_D	1	1	1	0.3333	0.5	0.3333	0.2593
Simpson_1-D	0	0	0	0.6667	0.5	0.6667	0.7407
Shannon_H	0	0	0	1.099	0.6931	1.099	1.581
Evenness_e^H/S	1	1	1	1	1	1	0.81
Brillouin	0	0	0	0.5973	0.3466	0.5973	1.069
Menhinick	1	1	1	1.732	1.414	1.732	2
Margalef	0	0	0	1.82	1.443	1.82	2.276
Equitability_J	0	0	0	1	1	1	0.8824
Fisher_alpha	0	0	0	0	0	0	7.867
Berger-Parker	1	1	1	0.3333	0.5	0.3333	0.4444

Prepared by: Ecosambito, 2020

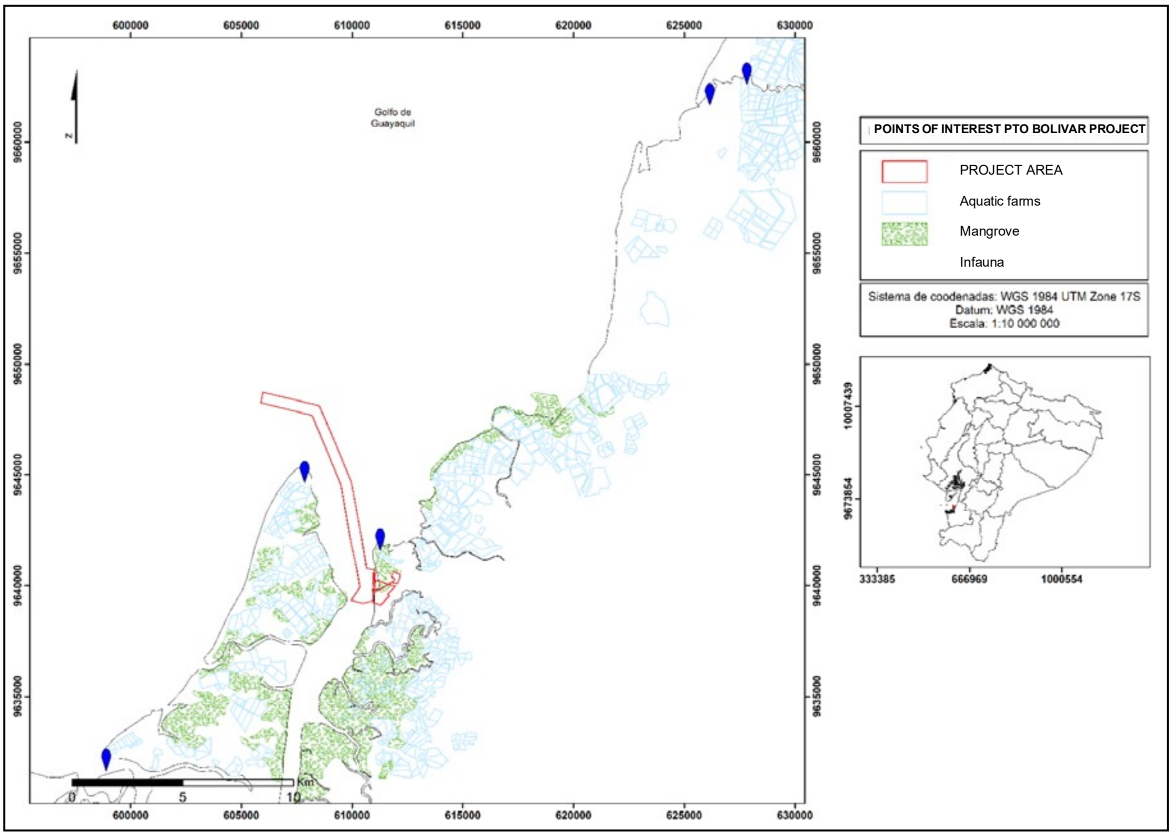
The ecological descriptions of the benthic collections show the existence of poor environmental quality conditions, an expected situation since the sediments and their life forms show cumulative impacts of different pressures such as untreated urban discharges where there will be high levels of organic compounds that will become limiting for life, the excess accumulation of organic matter decreases the oxygen levels of the sediment-water interface, becoming anoxic and even toxic. Although this situation was not confirmed in the laboratory, it was evidenced by the "rotten egg" odor of most of the stations, characterized by black sediments that denote the generation of compounds associated with sulfides and that would surely present very negative redox values.

3.5 Infauna Community

Although the infauna community was not considered in the 2017 EIA, the consulting team conducted sampling at a site near the Puerto Bolivar Project, specifically in the exposed intertidal sector called Playa Isla del Amor where it is common to observe people extracting bivalves and 4 more reference sites were located, To the north, two soft bottom sectors of the Puntilla locality called Puntilla islote also exposed to the Jambelí Channel and Puntilla interna that corresponds to beaches of sheltered sectors on the southern shore of this mouth. Towards the southern limit, Pongalillo beach was chosen, which is exposed towards the coast and shows evident signs of mangrove loss; and the exposed Jambelí beach a few meters from the lighthouse at the entrance to Santa Rosa, three of these locations correspond to muddy beaches with intertidal strips that remain exposed at low tide while Jambelí has fine sand. The location of sampling sites is shown in Figure 37. Location of infauna sampling sites, which were chosen due to the availability of previous data in the same sectors in 2013.

In these samplings, the length of the beach is estimated perpendicular to the main body of water that bathes it and, depending on the size of the beach, 10 equidistant analysis "stations" are established in the ideal situation, starting from the low flooded level to its upper end. In each station a hole is dug to quickly check the sand removed from it as the depth increases, this hole hardly exceeds 80cm because immediately the interstitial water or waves that arrive to it, demolish its contours and in a matter of minutes you have a small shallow pool. When counting the beings collected, it is possible to establish ecological descriptions where the richness of resources stands out.

Figure 38. Location of Beaches where the Infauna was analyzed.



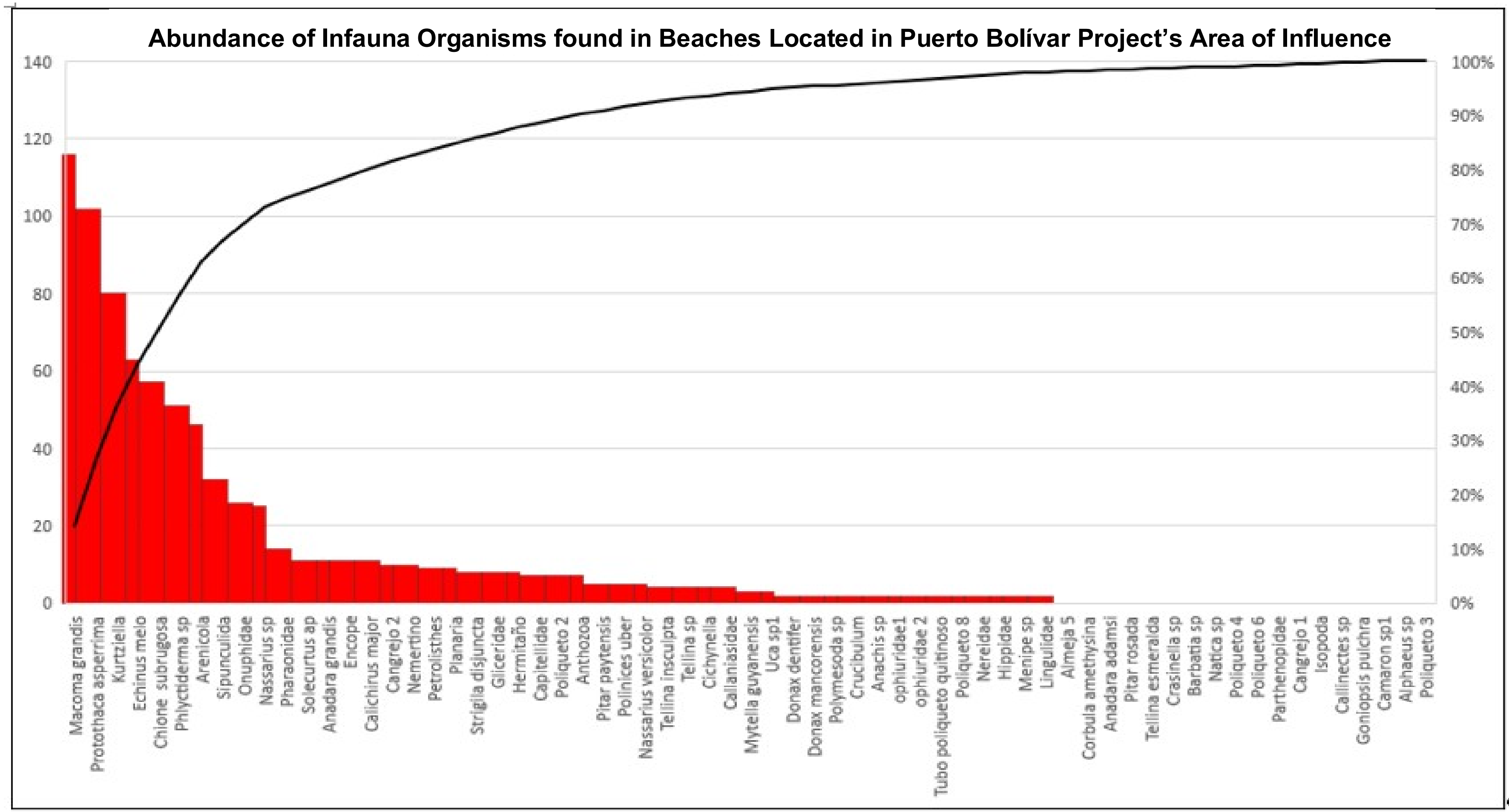
Prepared by: Ecosambito, 2020

Photographic Record 3. Infauna Sampling in Playa Isla del Amor, October 29, 2020

Prepared by: Ecosambito, 2020

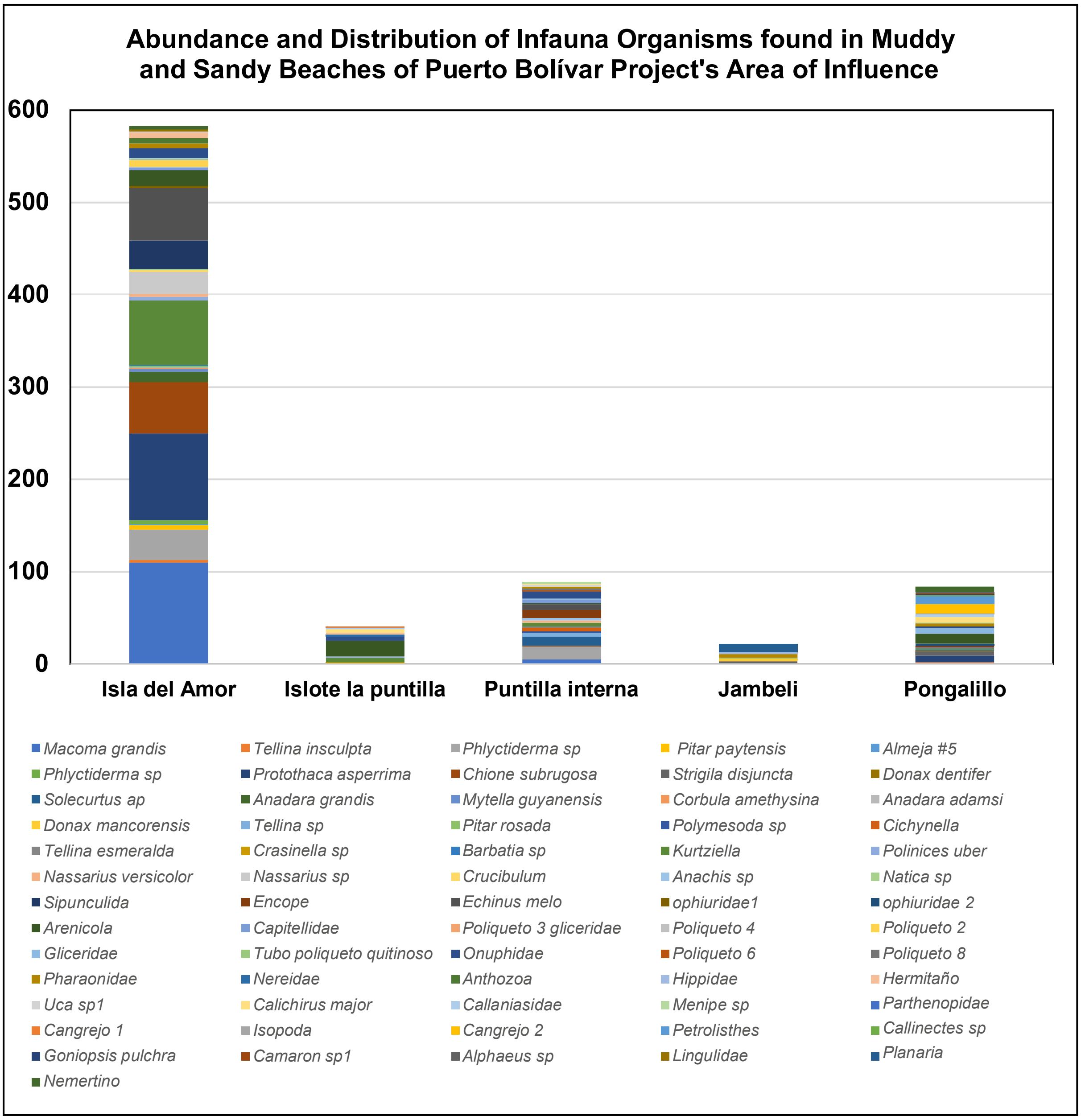
A total of 819 individuals of at least 66 species were collected in the infauna sampling: 23 bivalve mollusks, 7 gastropods, 1 sipunculid, 4 echinoderms, 12 polychaetes, 1 cnidarian, 15 crustaceans, 1 brachypod, 1 flatworm and 1 nemertean. The abundance and sectorial distribution of the collected organisms are shown in Figure 39 and Figure 39, respectively.

Figure 39. Most Abundant Infauna Organisms in the Project's Area of Influence



Prepared by: Ecosambito, 2020

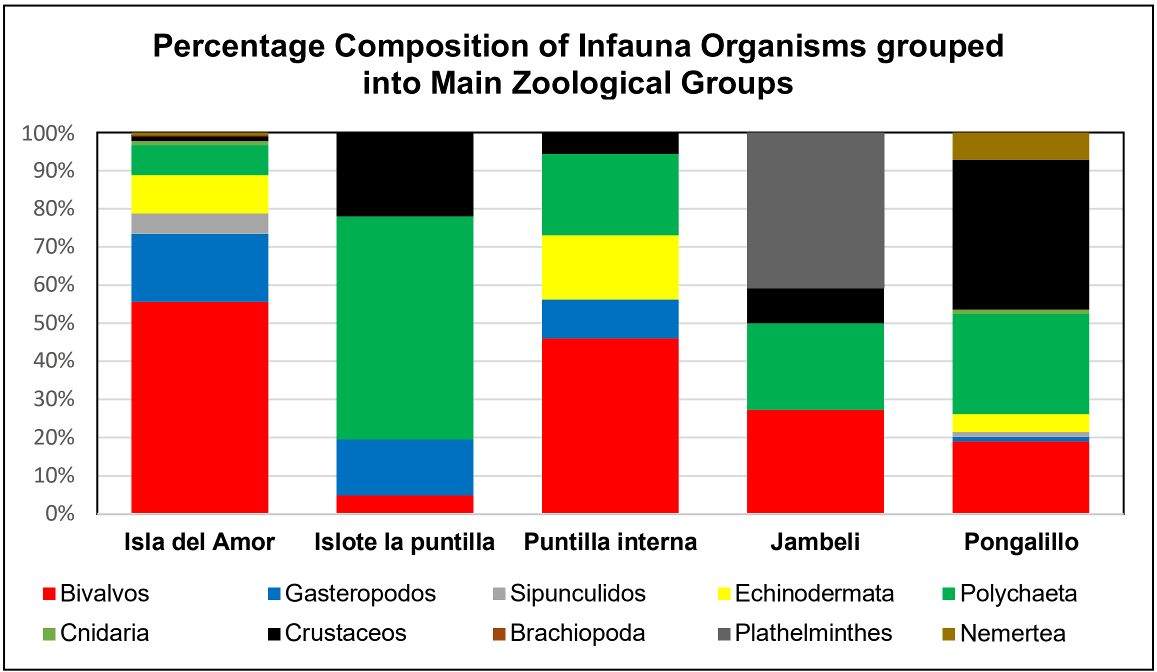
Figure 40. Abundance and Distribution of Infauna Organisms found in Beaches located in the Area of Influence



Prepared by: Ecosambito, 2020

Figure 40 shows a greater abundance of infauna on the Isla del Amor beach, the sector closest to the Puerto Bolivar Project. This beach is practically a biofilter of the excess of Séston from the Santa Rosa estuary and the outlet of the Dos Bocas stream, being really abundant in bivalves, burying urchins and sipunculids, which were observed in smaller proportions on the other beaches, being replaced mainly by crustaceans, polychaetes and flatworms, as shown in Figure 41.

Figure 41. Composition of Infauna Animals found in the Muddy and Sandy Beaches of the Area of Influence.



Prepared by: Ecosambito, 2020

The ecological descriptors of the infauna community are presented in Table 10. They reveal the existence of an intermediate diversity in Playa Isla del Amor, La Puntilla internal sector and Playa Pongalillo. This is close to a condition of high diversity in the Shannon index (when 3.00 bits are exceeded) and, with respect to the Margalef index, these three beaches appear to have a high diversity, understanding them as sectors of good environmental quality because they exceed the value of 5. In the opposite situation, Playa Jambelí and Islote La Puntilla are closer to low diversity values. In the case of the former, this condition is attributed to the abrasive effect of the fine sand, while the islet presents an excess of shells and under them muds that are anoxic at first sight.

Table 10. Ecological Descriptors for the Infauna of the Beaches analyzed in the Project's Area of Influence.

Descriptor	Isla_del_Amor	Islote_la_puntilla	Puntilla_interna	Jambeli	Pongalillo
Richness	36	12	24	7	25
Abundance	583	41	89	22	84
Dominance_D	0.1049	0.2195	0.07587	0.2397	0.07455
Simpson_1-D	0.8951	0.7805	0.9241	0.7603	0.9255
Shannon_H	2.626	1.943	2.836	1.664	2.837
Evenness_e^H/S	0.3839	0.5819	0.7105	0.7546	0.6828
Brillouin	2.524	1.619	2.483	1.332	2.467
Menhinick	1.491	1.874	2.544	1.492	2.728
Margalef	5.496	2.962	5.124	1.941	5.417
Equitability_J	0.7328	0.7821	0.8924	0.8553	0.8815
Fisher_alpha	8.481	5.709	10.79	3.544	12.04
Berger-Parker	0.1887	0.4146	0.1573	0.4091	0.131

Prepared by: Ecosambito, 2020

Among the 66 benthic infauna in the area of influence, none show populations of concern except for the genus of the burying urchin Echinus melo, which appears as near threatened, NT, the clam Polymedosa inflata appears in the LC category (low concern) and two more snails of the Nassaridae family appeared with insufficient data in the DD category. There are no vulnerable or critically endangered species in this community, although it should be noted that there are very few population studies of marine resources that lack commercial value.

3.6 Ichthyofauna

The ichthyofauna of the sector of influence was exclusively monitored at 4 sites (the same as the benthos sites) at sea. At each sampling site, fishing was carried out with standardized effort that consisted of a set of a 3.5" electro-welded plastic monofilament net, two cloths long, which was left to work for 30 minutes from the moment the watering of the gear was finished.

At this point, it is important to highlight the importance of fishing in the local context, with an estimated 3,000 fishermen engaged in extractive work, motorized coastal artisanal fishing is carried out practically throughout the Jambelí channel and coastal waters of the Jambelí archipelago, as well as in the vicinity of Santa Clara Island.

In the high seas fishing records for the period 2018 to 2020, the capture of 53 fish and 4 crustaceans was reported, also releasing 5 species of international concern of batoids, 4 of them registered in IUCN Redlist:

- White-horned guitarfish Rhinobatus leucorhynchus (VU)
- Pygmy manta ray Mobula munkiana (VU)
- Duck ray Mylibatis longirostris (VU)
- Beaked skate Urotrygon rogersii
- Rostroraja equatorialis rays (VU).

Figure 42 and Figure 43 show the total estimate of resources captured and their temporal evolution, figures from which it can be seen that Peprilus medius or Redfish was the most captured resource and its maximum record was 117 pieces on June 6 in the vicinity of Santa

Clara Island. The 10 most abundant resources in terms of the number of fish caught represented 80.95% and the 20 most caught resources represented 92.59% as shown in Table 11.

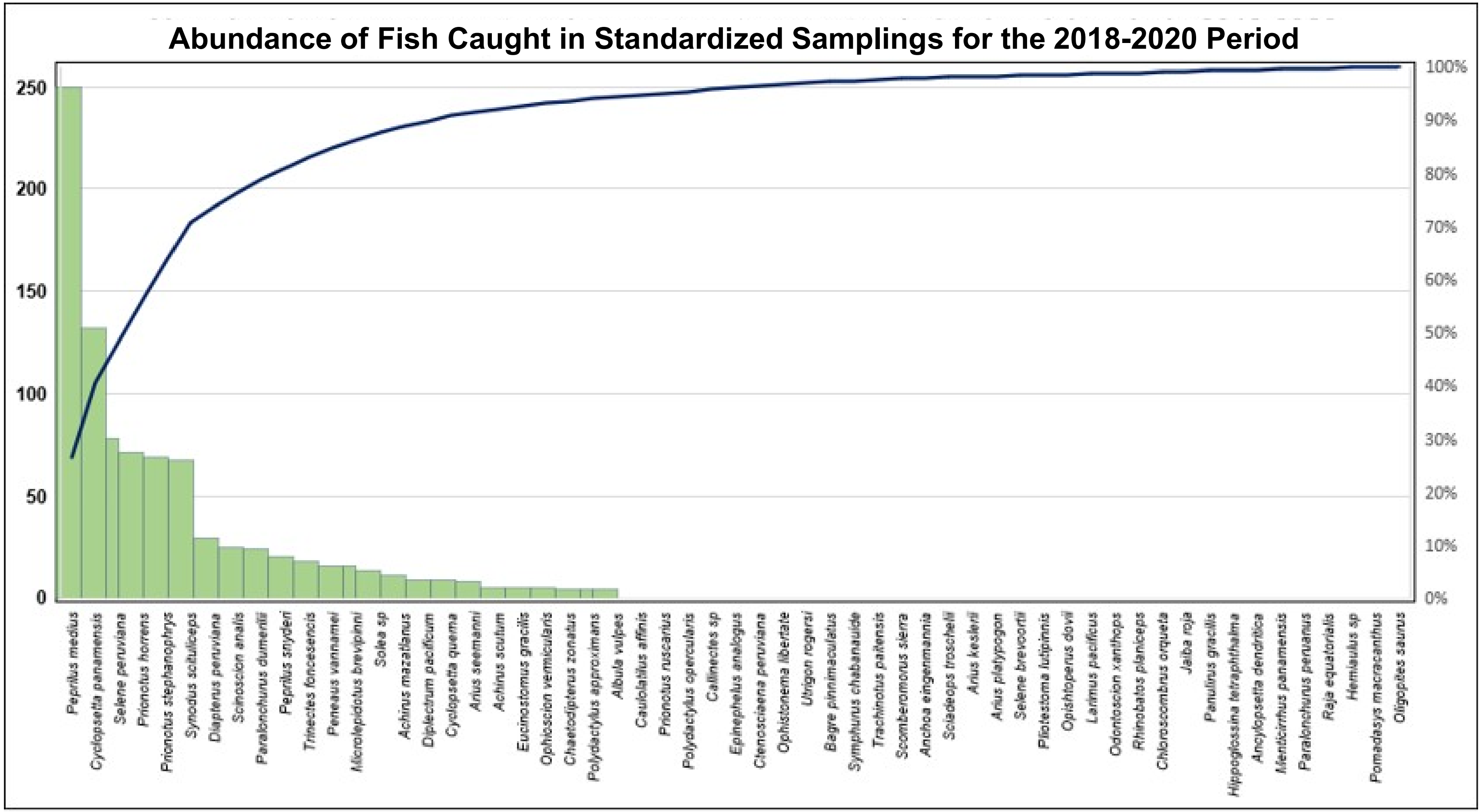
When considering fisheries conducted with atarray in the period 2019 (Figure 44), the record of species increases a total of 71 species of fish caught in period 2018 - 2020, within which appeared 4 more species of international concern and that in the same way were released in good condition and that were:

- Seahorse Hippocampus ingens (VU).
- Flat Guitarfish Rhinobatos planiceps (VU)
- 2 types of thornback ray Raja sp (VU)

Photographic Record 4. Peprilus medius or Pacific harvestfish, the resource that was most frequently caught in the high seas during the 2018-2020 period in Santa Clara Island and in the deposit basin for dredged material.

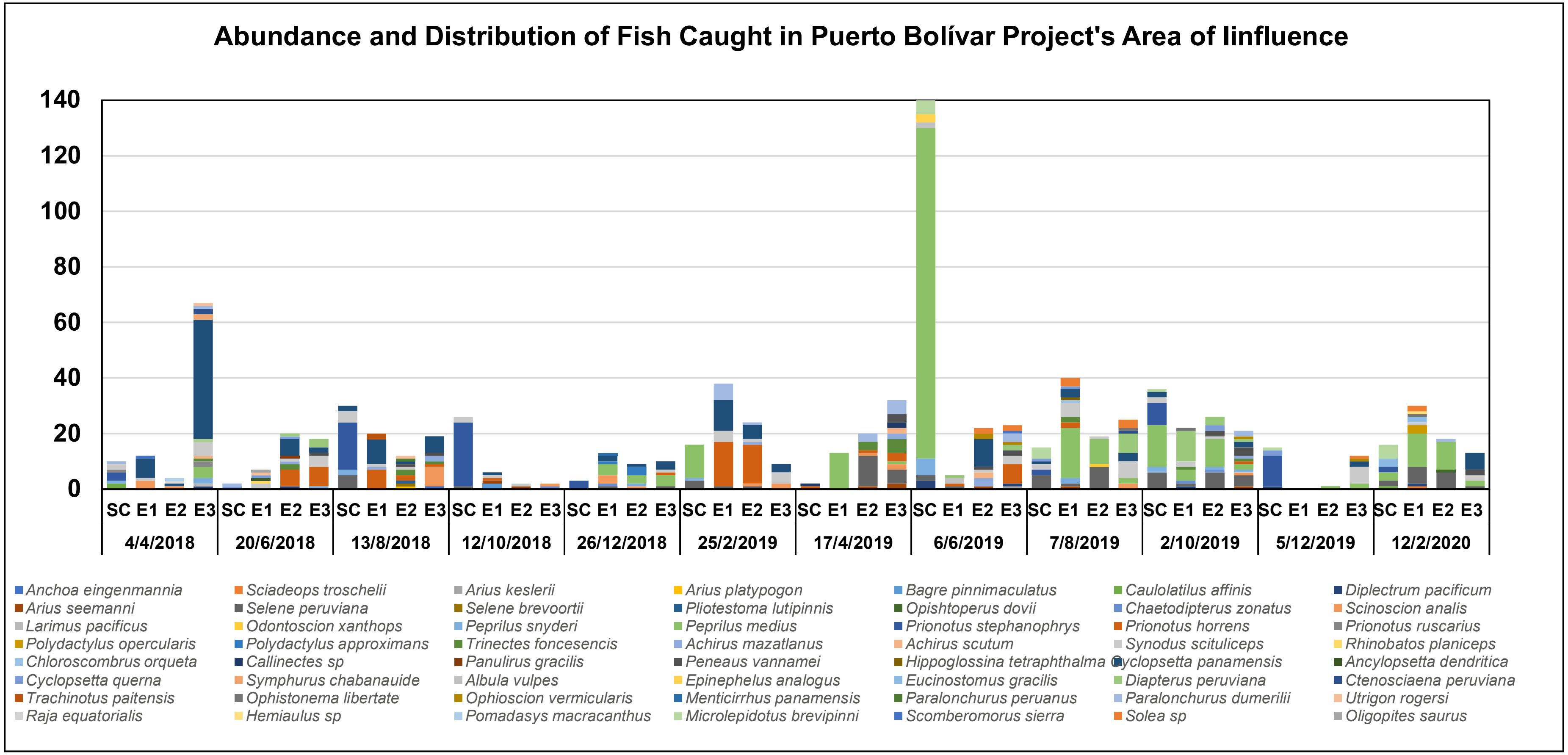
Prepared by: Ecosambito, 2020

Figure 42. Numerical Composition of Catches during the 2018-2020 Period in Puerto Bolívar Project's Area of Influence. Prepared by: Ecosambito, 2020



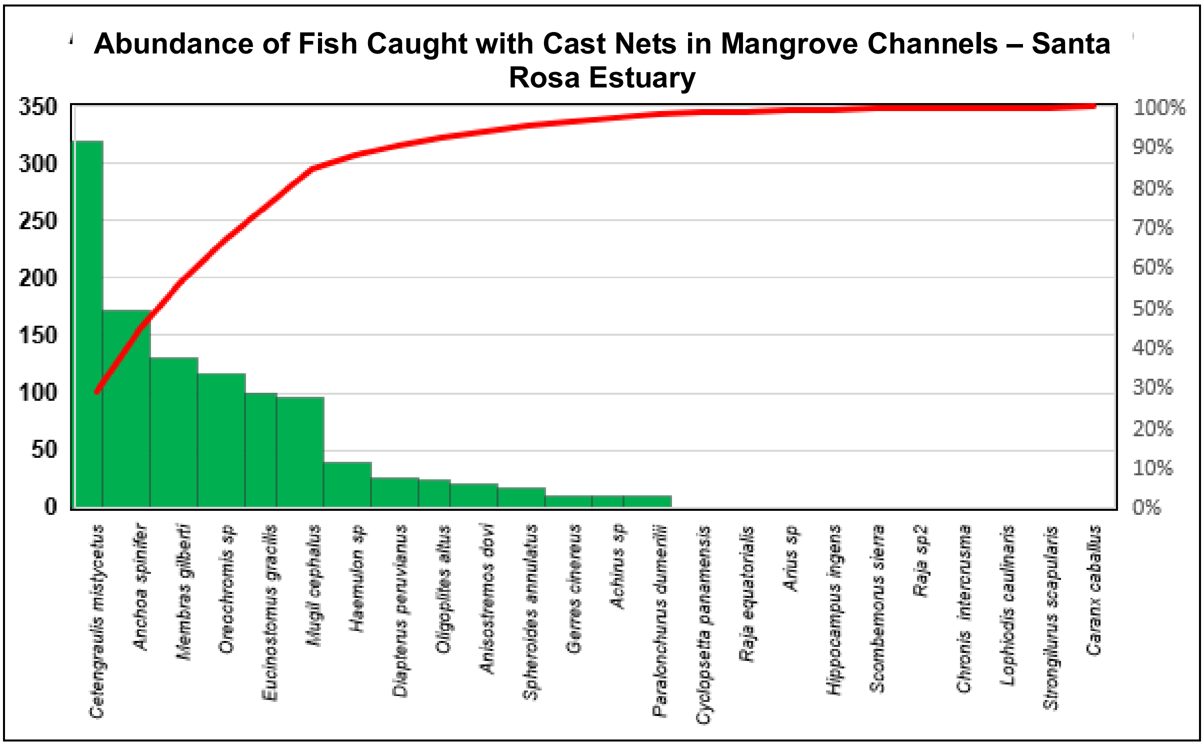
Prepared by: Ecosambito, 2020

Figure 43. Abundance and Distribution of Catches of Fish and Crustaceans during the 2018–2020 Period



Prepared by: Ecosambito, 2020

Figure 44. Main Juvenile Fish Species caught with Cast Nets in Mangrove Channels and Main Water Body of the Santa Rosa Estuary



Prepared by: Ecosambito, 2020

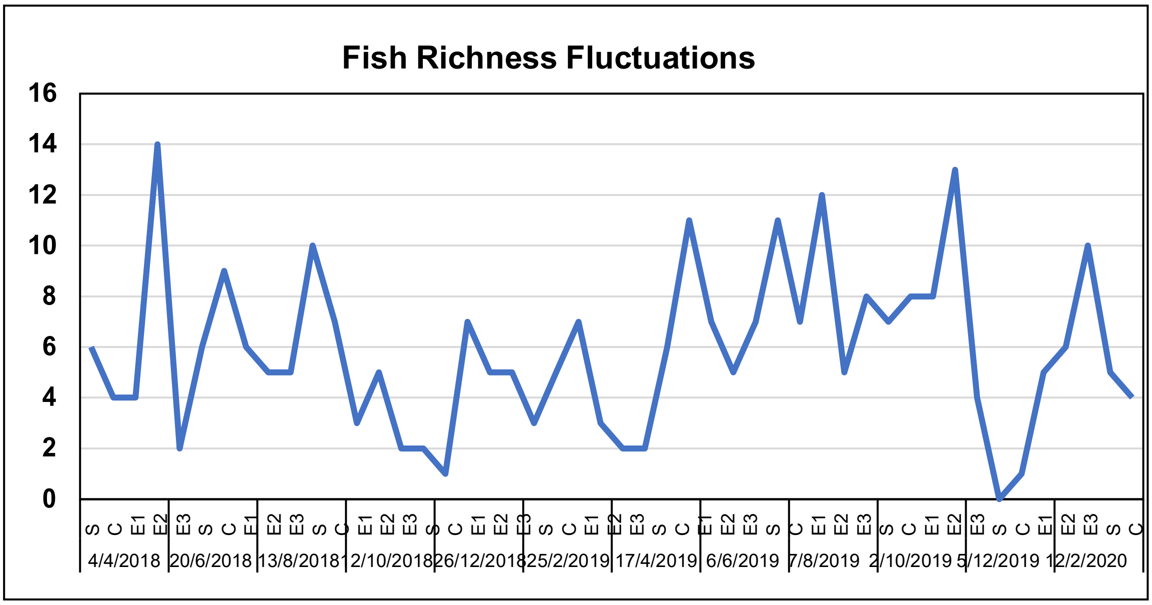
Table 11. The 20 Most Caught Resources in Terms of Abundance in the Area of Influence of the Deposit Basin for Dredged Material according to 2018-2020 Records

No.	***Scientific Name***	**Individuals Caught**	**Relative Abundance %**
1	*Peprilus medius*	250	26.46%
2	*Cyclopsetta panamensis*	132	13.97%
3	*Selene peruviana*	78	8.25%
4	*Prionotus horrens*	71	7.51%
5	*Prionotus stephanophrys*	69	7.30%
6	*Synodus scituliceps*	67	7.09%
7	*Diapterus peruviana*	29	3.07%
8	*Cynoscion analis*	25	2.65%
9	*Paralonchurus dumerilii*	24	2.54%
10	*Peprilus snyderi*	20	2.12%
11	*Trinectes foncesencis*	18	1.90%
12	*Peneaus vannamei*	16	1.69%
13	*Microlepidotus brevipinni*	16	1.69%
14	*Solea sp*	13	1.38%
15	*Achirus mazatlanus*	11	1.16%
16	*Diplectrum pacificum*	9	0.95%
17	*Cyclopsetta querna*	9	0.95%
18	*Arius seemanni*	8	0.85%
19	*Achirus scutum*	5	0.53%
20	*Eucinostomus gracilis*	5	0.53%

Prepared by: Ecosambito, 2020

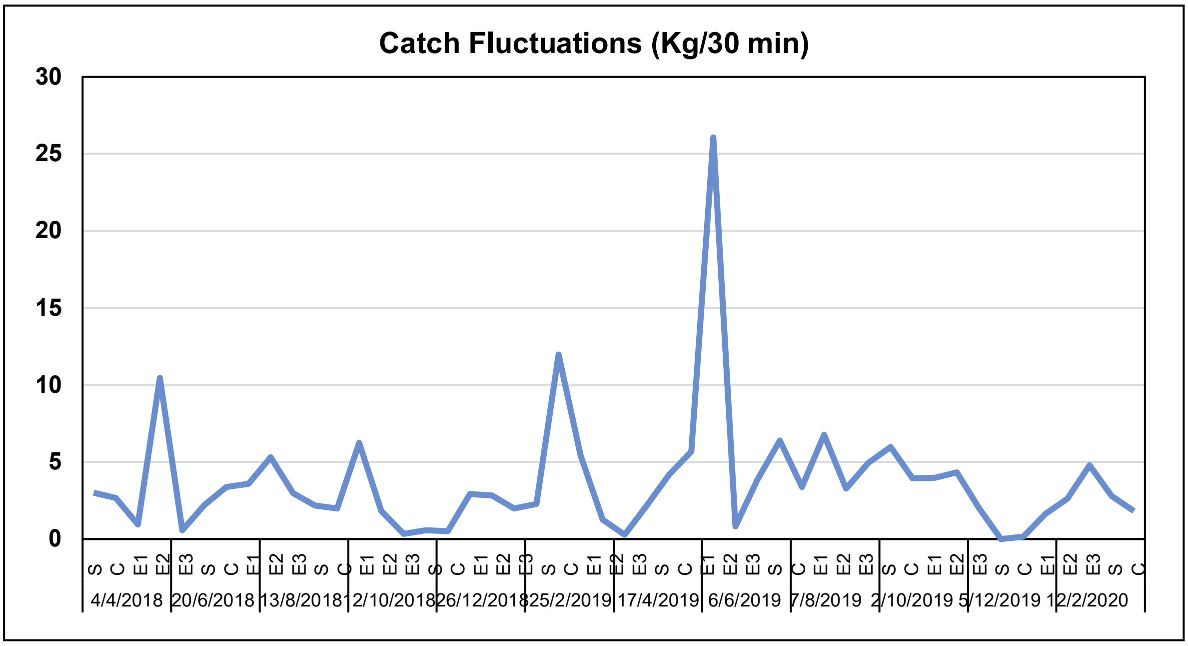
Fluctuations in resource richness, biomass caught and catch diversity indices for the 2018-2020 monitoring period are illustrated in Figures 45 to 47. Figure 47 shows that, in all fishing monitoring campaigns, the greatest richness of species caught occurred within the deposit basin for dredged material and, in general terms, there is a greater presence of different species between the second and third quarters of each year, i.e. in the winter-summer transition of the Ecuadorian coast and it is likely that this sector corresponds to an ecotone between oceanic and coastal ichthyic communities.

Figure 45. Richness of Resources Caught in the High Seas during the 2018-2020 Period



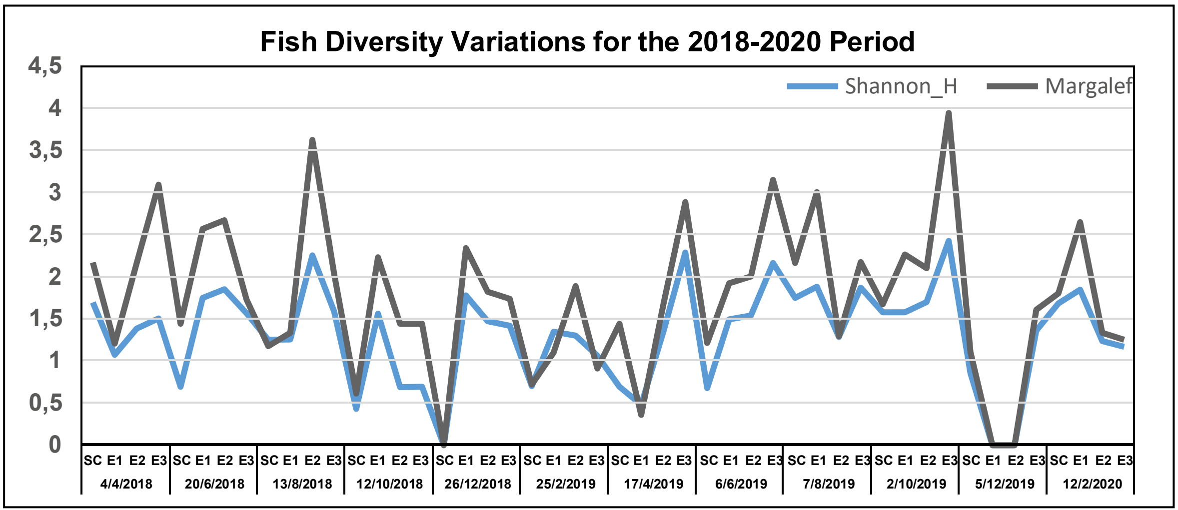
Prepared by: Ecosambito, 2020

Figure 46. Total Catch Variations by Station (Kg/30 min)



Prepared by: Ecosambito, 2020

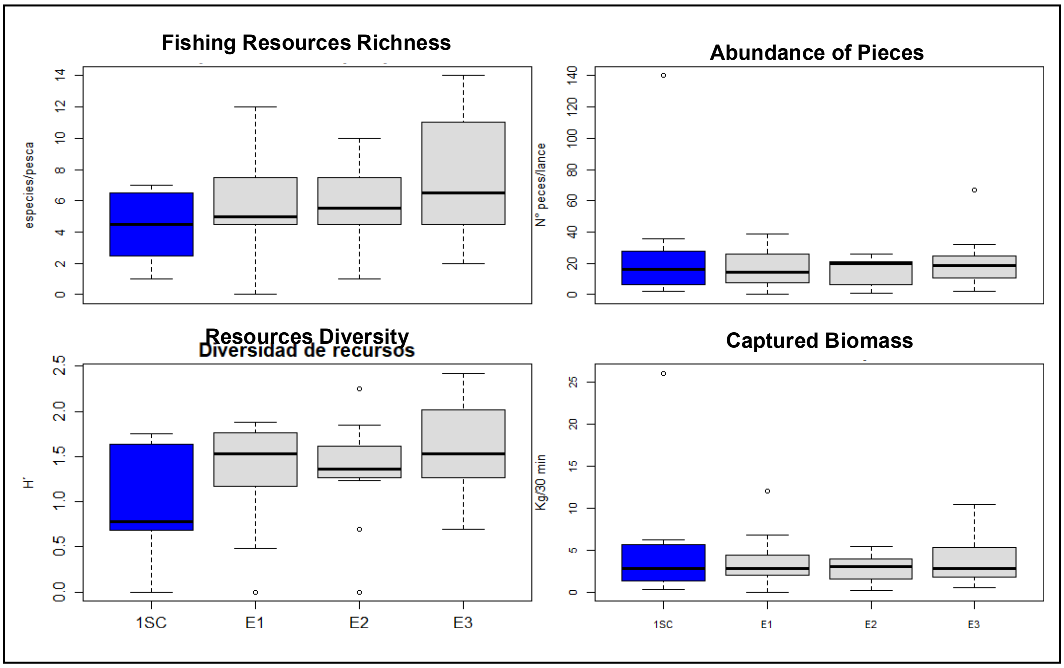
Figure 47. Fluctuations in Diversity of Fishing Resources Caught



Prepared by: Ecosambito, 2020

As regards the biomass captured at each site, Figure 46 shows that the highest catches occurred during the fishing activities carried out near Santa Clara Island, which has the category of Marine Reserve. When analyzing the diversity of catches, this community recorded values ranging from low to medium diversity and3 fisheries were unsuccessful, i.e. there were no catches. Figure 48 shows the differences between sampling sites by integrating these values into a database and analyzing them.

Figure 48. Ecological Descriptors of Fish Caught in the High Seas during the 2018-2020 Period.



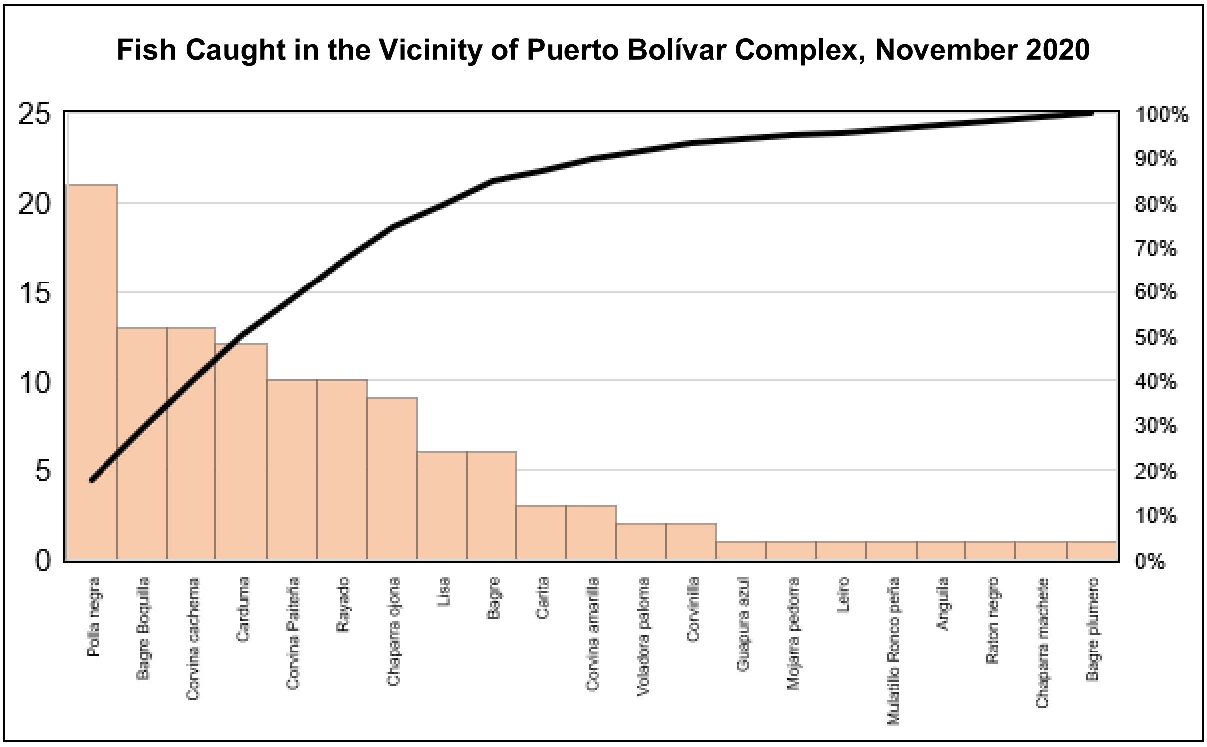
Prepared by: Ecosambito, 2020

After reviewing the 2017 EIA document, which reported the presence of 9 species of fish in the area near the Puerto Bolivar Project where 3 sets were made with 3.5" mesh without specifying the number of cloths used or the working time of the gear and which resulted in the capture of 117 pieces being the most abundant species the corvina cachema Scinoscion analis followed by the Lisa Mugil cephalus, it was decided to observe the evolution of the presence of fish in the vicinity of the Project, On November 4, two simultaneous fishing operations of only 20' duration were carried out using nets with 2¾" mesh eyes and eight long cloths, coordinating with local fishermen who, based on their expertise, decided to make "bowling" type casts, that is to say, they emulated a seine net by spreading the net in a circular fashion and then retrieving it. This method works because most of the species have demersal behavior and being enclosed makes it difficult for them to escape. Photographic Record 5 shows images of the catches made and Figure 49 and Table 12-Table 1 describe the total catch of fish as well as the ecological descriptions.

Photographic Record 5. Fishing operations carried out in the vicinity of Puerto Bolívar.

Prepared by: Ecosambito, 2020

Figure 49. Abundance of Fishing Resources Caught in the Vicinity of Puerto Bolívar



Prepared by: Ecosambito, 2020

Table 12. Ecological Descriptors of Fish Catches in the Vicinity of the Project

Descriptor	Mi_trigueñita	Don_julio_II
Richness	14	15
Abundance	60	58
Dominance_D	0,1056	0,1445
Simpson_1-D	0,8944	0,8555
Shannon_H	2,4	2,255
Evenness_e^H/S	0,7871	0,6355
Brillouin	2,09	1,94
Menhinick	1,807	1,97
Margalef	3,175	3,448
Equitability_J	0,9093	0,8326
Fisher_alpha	5,743	6,56
Berger-Parker	0,1833	0,2759

Prepared by: Ecosambito, 2020

When considering the catches made in the vicinity of Puerto Bolívar, including the standardized catches in the high seas, the casts using cast nets, and the catches near Puerto Bolívar, the catch richness is 72 species of 21 fishes. The ecological descriptors of the catches in the vicinity of Puerto Bolívar on November 4 place this body in a condition of intermediate diversity.

3.7 Seabirds

No specific update study was available for this group of animals; therefore, this baseline used records of previous interventions carried out in 2013 by ornithologist Francisco Sornoza during the 2D seismic prospecting conducted in the Jambelí channel and archipelago and in the Santa Clara island. In these interventions, seabird species were identified, inventoried and photographically recorded, determining the abundance, diversity, density and populational trend of the recorded birds with the greatest importance in terms of their aggregations and fishing activity, and bioindicator species were also identified. During such study, seabird watching tours as well as seabird identification and geo-referencing activities were carried out. The sites were toured on an 8.5 m fiber with a Yamaha 75 Hp engine in the “Prior to the operations” phase (October 6 to 10, 2013), “During the operations” phase (November 11 to 15 and November 29 to December 1, 2013) and “After the operations” phase (December 16 to 22, 2013).

Species richness in the Jambelí channel and archipelago, Puna Island and Santa Clara Island totaled 104, corresponding to 18 orders and 41 families. The order with the largest number of species was Charadriiformes (38), followed by Passeriformes (22) and Pelecaniformes (10). The family with the largest number of species was shorebirds or Scolopacidae with 18 species. Another family with a representative number of species was Ardeidae (9), followed by Charadriidae and Laridae (6).

Table 13 and Table 14 show the data compiled from such study, having selected sites that would be part of the Project's current area of influence, in addition to Santa Clara Island, which is outside the radius of influence of the offshore deposit basin for dredged material.

Table 13. Estimation of Seabird Species Richness in the Project Area in 2013 (Ecuambiente 2013)

Site	Species*	Families	Orders
Southwest Zone			
Cruce del Bravo	36	21	9
Estero La Calavera	29	17	7
Bajo de Pongalillo	8	6	5
Isla del Amor	15	10	5
Faro de Jambelí	23	15	6
Islet in front of Puerto Bolívar	19	13	7
Santa Clara Island			
Santa Clara Island and boulders	12	8	5
Bajo del Burro	8	5	4
Northeast Zone			
Río Jubones	50	27	12
La Puntilla	53	28	15

* Includes species recorded through direct observation and singing and unidentified species – Prepared by: Ecosambito, 2020

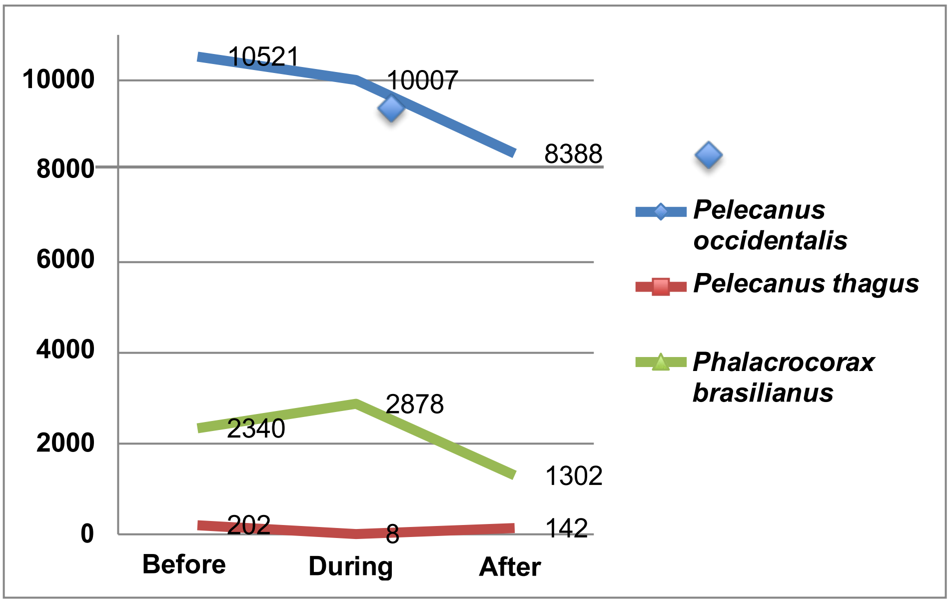
Table 14. Ecological Descriptors and Estimated Bird Density in the Study Sites in 2013. (Ecuambiente, 2013).

Site	Richness	Mean Abundance	H' in Average	1-D in Average	Average Density (ind/km^2)
Southwest Zone					
Cruce del Bravo	36	451	1.453	0.550	184.082
Estero La Calavera	29	1276	1.774	0.732	319.000
Bajo de Pongalillo	8	1274	0.396	0.252	25480.000
Isla del Amor	15	1178.33	0.605	0.288	78555.556
Faro de Jambelí	23	312	2.663	0.906	10400.000
Islet in front of Puerto Bolívar	19	3213.33	1.411	0.632	3213.333
Santa Clara Island					
Santa Clara Island and boulders	12	11635	1.207	0.659	50586.957
Bajo del Burro	8	689.50	1.096	0.591	55160.000
Northeast Zone					
Río Jubones	50	9429.67	1.636	0.700	628.644
La Puntilla	52	3503	2.101	0.799	700.600

Prepared by: Ecosambito, 2020

In that study, it was estimated that the 3 most abundant seabirds in the area were the Brown pelican (*Pelecanus occidentalis*), followed by the Peruvian pelican (*Pelecanus thagus*), and then by the neotropical cormorant (*Phalacrocorax brasilianus*).

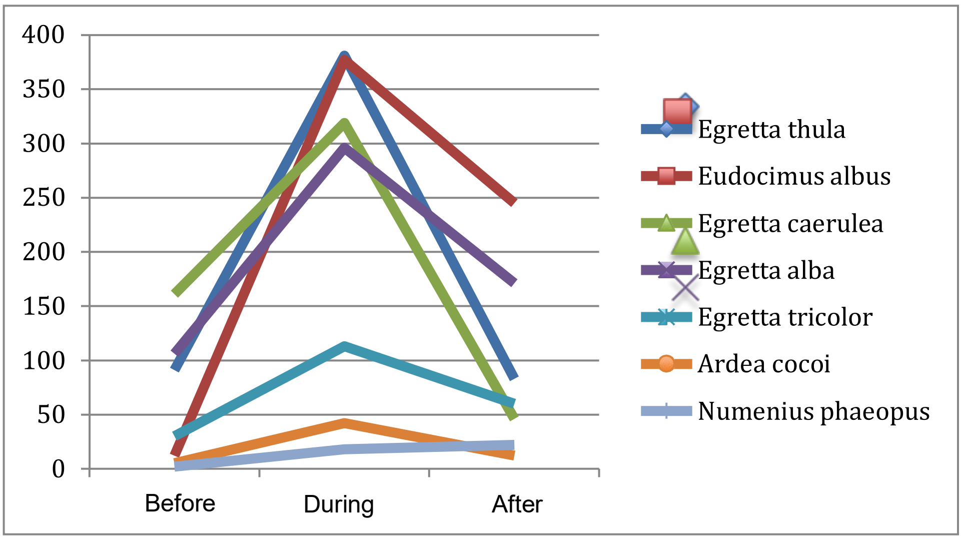
Figure 50. Populational Fluctuations of the 3 Most Abundant Seabirds in the Southwest Area (Jambelí Archipelago).



Prepared by: Ecosambito, 2020

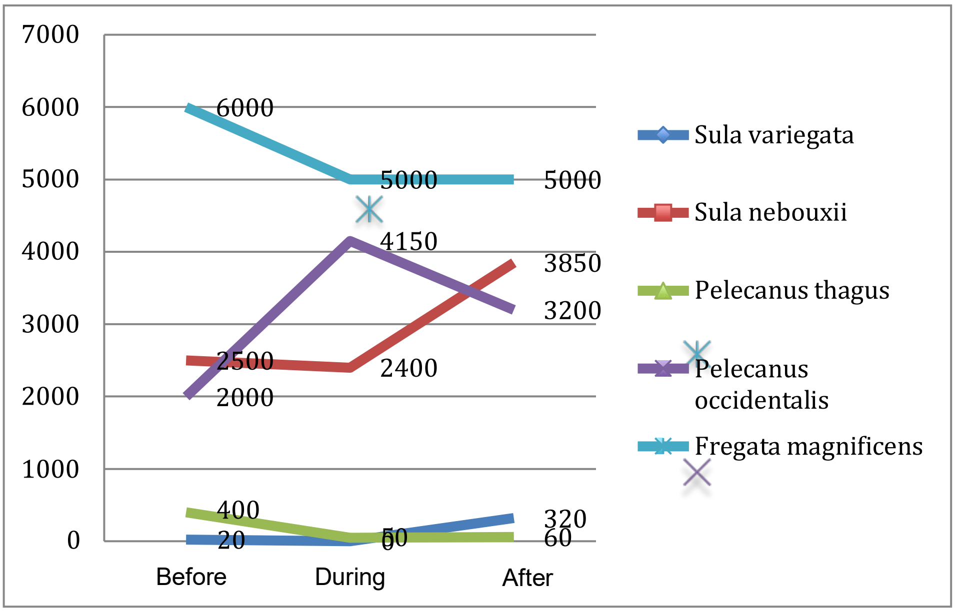
Figure 50 shows the fluctuations in the abundance of these species during the seismic data acquisition maneuvers of 2013, concluding that the pelicans were not affected by the sonic pulses and that their reduction is due to migratory processes, while the neotropical cormorants would have been affected by the subsea noise.

Figure 50: Populational Fluctuations of Wading Birds in the Jambelí Archipelago at Count Sites.



Prepared by: Ecosambito, 2020

Figure 51. Populational Fluctuations of the Most Abundant Birds in Santa Clara Island, Fourth Quarter of 2013.



Prepared by: Ecosambito, 2020

Although no bird censuses were conducted during the 2020 study period, it is evident that the same species in addition to Fregata magnificens and representatives of Laridae (gulls and terns), Sulidae (boobies), are the most abundant seabirds in environments associated with the high seas and mangroves of the Jambelí archipelago as well as wading birds both on beaches and mangroves.

Photographic Record 6. Brown pelicans and Peruvian pelicans, birds linked to artisanal fishermen, wait for fish discarded by fishermen and fishermen tolerate them; during the November 2020 observation activities, the rescue of a pelican that was entangled in a net by fishermen was observed.

Prepared by: Ecosambito, 2020

A study conducted in 2016 identified 50 common birds in the Jambelí archipelago (Orihuela - Torres et al, 2016). The first 10 birds identified were as follows:

1. *Fregata magnificens*, Frigatebird
2. *Sula nebouxii,* Blue-footed booby
3. *Phalacrocorax brasilianus,* Neotropical cormorant
4. *Pelecanus occidentalis,* Brown pelican
5. *Nycticorax nictycorax,* Black-crowned night heron
6. *Nyctanassa violacea,* Yellow-crowned night heron
7. *Boturides striata,* Striated heron
8. *Ardea cocoi,* Cocoi heron
9. *Ardea alba,* Great egret
10. *Egretta tricolor,* Tricolored heron.

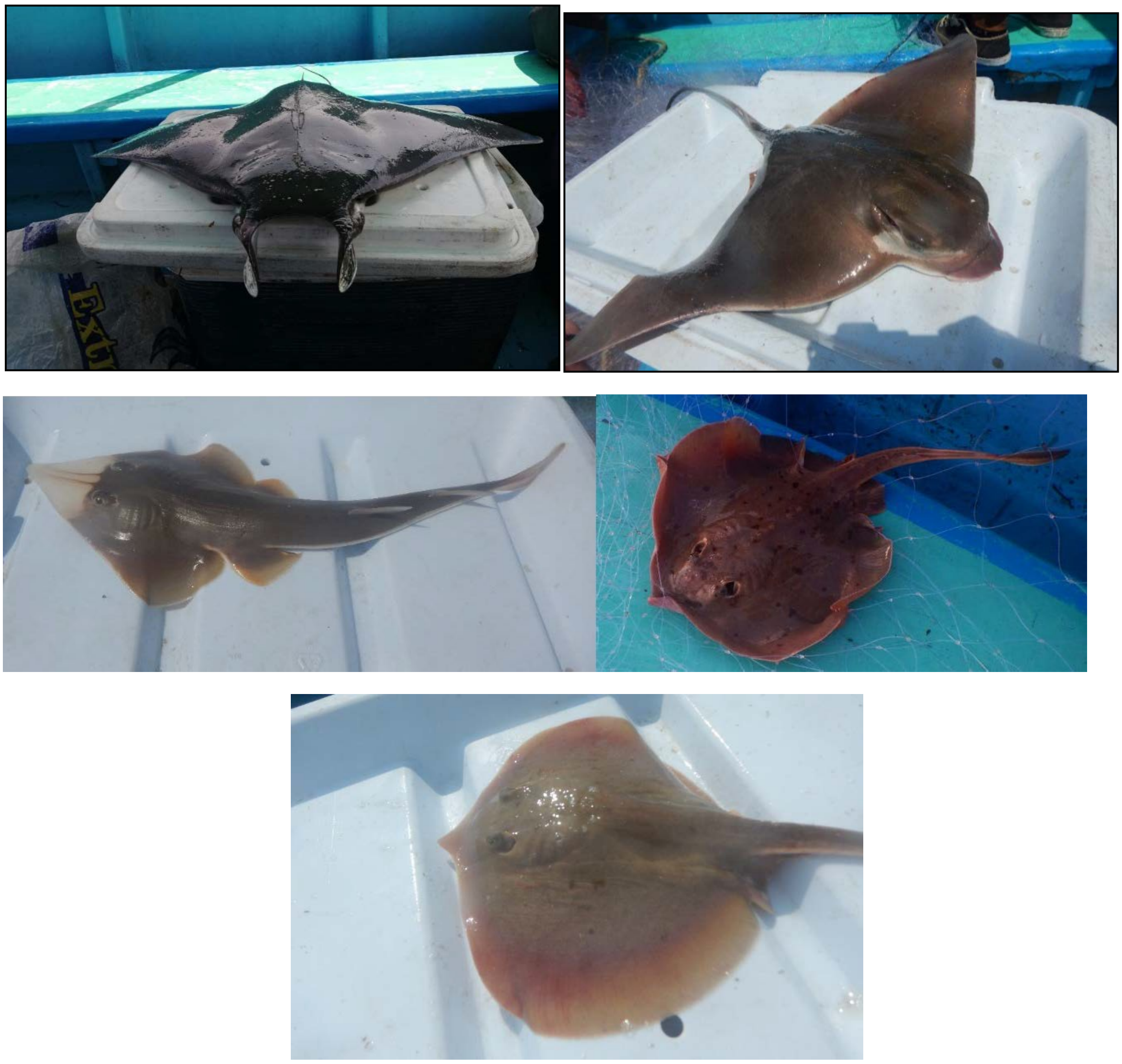
3.8 Protected Marine Fauna (Mammals, Reptiles and Cartilaginous Fishes)

Regarding records on the presence of protected marine life, during the 2018-2020 fishing monitoring, the release of at least 8 species of fish considered vulnerable in the IUCN redlist, which, although not listed as protected marine life in the Ecuadorian legislation, are included in international agreements for their protection, among which the following stand out:

- Guitar ray, *Rhinobatus leucorhynchus*

- Munk's devil ray, *Mobula munkiana*
- Snouted eagle ray, *Myliobatis longirostris*
- Roger's round ray, *Urotrygon rogersi*
- Hawaiian sting ray, *Dasyatis brevis*
- Seahorse *Hippocampus inges*
- Thorny rays (2 species) *Rostroraja equatorialis and Raja sp.*

Photographic Record 7. Protected species released during fishing monitoring, from top to bottom and from right to left: Munk's devil ray, snouted eagle ray, guitar ray, Roger's round ray and Hawaiian sting ray.



Prepared by: Ecosambito, 2020

Although there was no exclusive monitoring for marine mammals, during the biological monitoring conducted in the period 2018-2020 there were two interactions with marine mammals: Sea lions Otaria flavescens (LC) or species of low concern despite the fact that in Ecuador its population is reduced compared to populations in Peru and Chile, these inhabit rocky areas of Santa Clara Island and when fishing near the island twice nibbled fish caught in the net.

The second species with which we had interactions corresponded to 2 troops of striped dolphins, Stenella coeroleualba (LC) that were observed transiting inside the dredge deposit bucket heading northwest. Previous records of these oceanic dolphins report their presence in the area from September to January, with reports of troops exceeding a thousand individuals in the vicinity of Santa Clara Island, however in the two encounters with these dolphins, the first occasion was estimated at 120 animals and the second occasion between 70 and 80; On both occasions the presence of calves was observed and the initial approach of a patrol of larger adult males that scanned the boat confirming the absence of risk was notorious, however the bow ride behavior of playing with boats crossing and jumping in front of the boats was not noticeable and they were not looking for any interaction.

Photographic Record 8. Troops of striped dolphins (Stenella coeroleualba) crossing the Project's deposit basin for dredged material.

Prepared by: Ecosambito, 2020

The most emblematic protected being of the Ecuadorian coast and that is related to tourism interests is the Humpback Whale Megaptera novangliae (LC) that arrives from Antarctic waters to the coasts of Ecuador and southern Colombia in mid-May each year to hold courtship and copulation in a period where they practically do not feed, The date of courtship and their return to southern waters occurs in mid and late October, during the period 2019 was observed on two occasions but very far away a couple of specimens of this cetacean, however it is important to mention that they are hardly observed entering the Jambelí channel and the probability of encountering them in the dredge deposit bucket is minimal.

In fact, in the opinion of the author of this report, stopping dredging maneuvers on dates when this cetacean is present, even if it is a precautionary approach, is an exaggerated measure because these whales have been monitored for decades and their routes are well described: in the last decades using satellite monitoring it has been determined that whales would hardly enter the Jambelí channel because they require clear waters and most sightings of which there is even a tourist offer are associated with the visit to Santa Clara Island as shown in Figures 52 and 53 obtained from Felix and Guzman (2014) and Ecuambiente (2016).

Photographic Record 9. Green sea turtles (Chelonia mydas) found in the vicinity of Las Huacas (Courtesy of Guardianes del Mar) and dead adult floating between Bajo Alto and Playa Coco.

Prepared by: Ecosambito, 2020

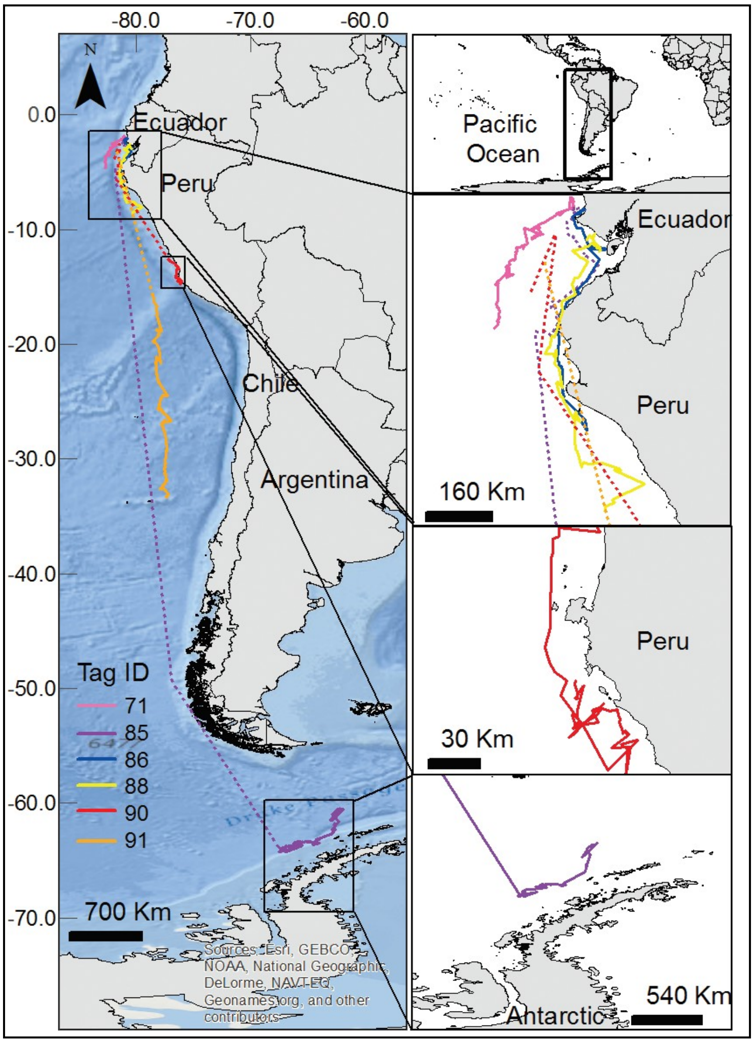
It is important to mention that all cetaceans are protected by Ecuadorian law as are all species of chelonians, having recorded only two encounters in the period 2018-2020 with green turtles Chelonia mydas species considered endangered according to IUCN Redlist and were observed in the navigation path to the dredging deposit bucket as well as on three occasions floating corpses were found in the vicinity of El Bravo and during November 2020 between Bajo Alto and Playa Coco.

Recent communications with "Guardians of the sea" which is a process of environmental education promoted by the Ecuadorian Navy with children of the Huacas in the archipelago of Jambelí, communicate that the beaches in the vicinity of the Huacas could possibly be a nesting area, because in the last weeks of November 2020 juveniles of this turtle have been found.

Other protected species recorded in the vicinity of Santa Clara Island are the whale shark Rhyncodon typus, which is commonly observed on the gas platforms of the Amistad field located to the south of Santa Clara Island, as well as the giant manta Mobula birostris, with the last report of reproductive aggregations in the Amistad field area in 2012.

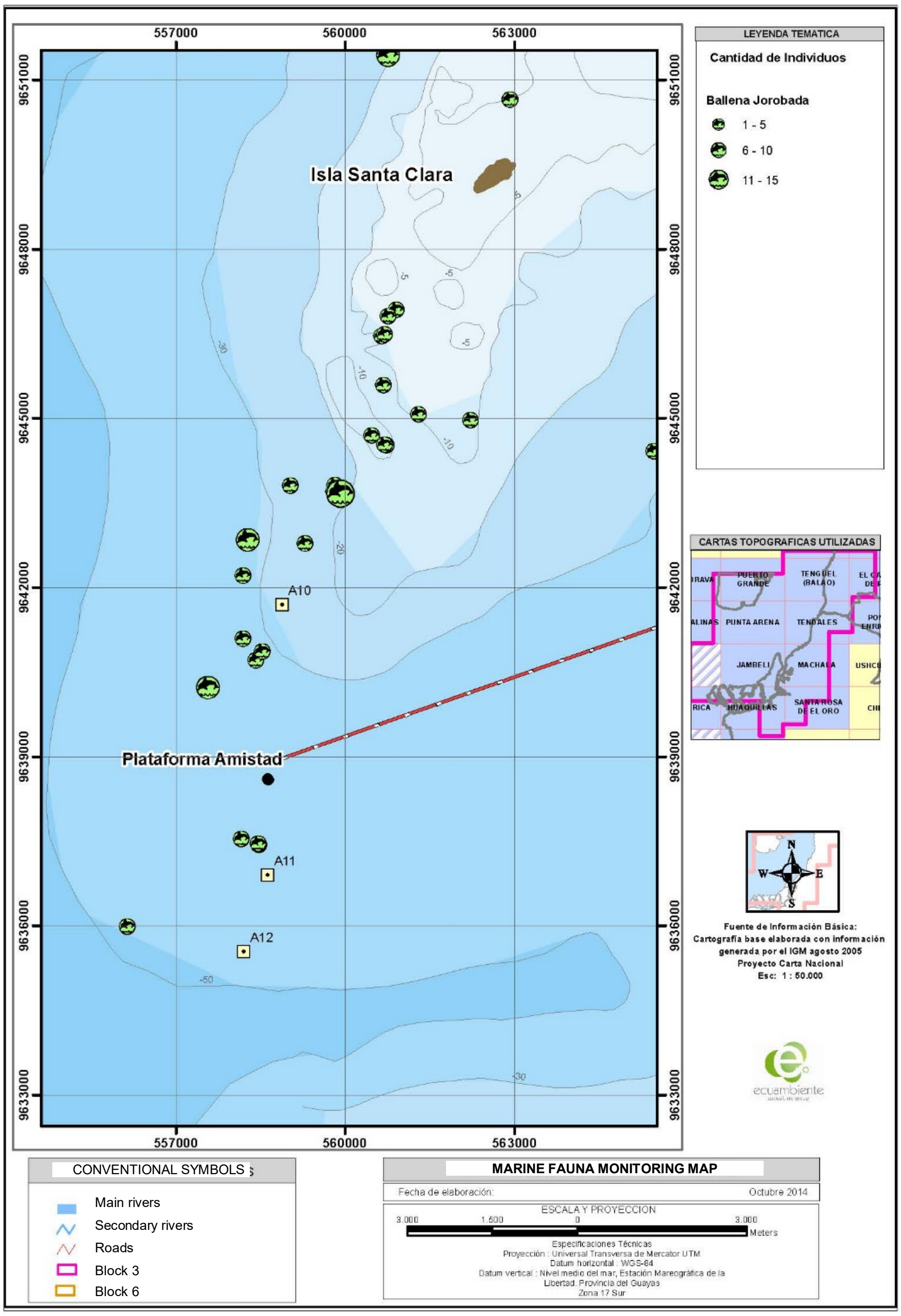
Finally, it is proposed to increase the monitoring of these creatures in the area of influence of the Puerto Bolivar project associated with the monitoring of underwater noise levels, and for this purpose the acquisition of a hydrophone should be managed.

Figure 52. Migration Routes of Megaptera Novangliae obtained through Satellite Monitoring (Felix y Guzman, 2014).



Prepared by: Ecosambito, 2020

Figure 53. Coordinates of Watching and Estimation of the Number of Humpback Whales (Megaptera novangliae) obtained through Visual Records in August 2014 (Ecuambiente, 2014).



Prepared by: Ecosambito, 2020

4. Comments

Table 14 contains a compilation of the marine species richness recorded during the fieldwork carried out in the current period and the monitoring activities undertaken in the 2018-2020 period. Even though several species were recorded under more than one category, given that, as established in the general considerations, the feasibility of quick quantitative samplings that are easy to replicate was proposed as categorization, it is evident that the planktonic creatures observed correspond, in their meroplanktonic fraction, to creatures subsequently described as benthos, infauna and nekton.

Table 15. Records of marine species collected and captured in the area of influence of the Puerto Bolívar project

Main Group	Phytoplankton	Zooplankton (>300 microns)	Zooplankton (>500 microns)	Benthic Community	Beach Infauna	Ichthyo-fauna
	Bacillariophyta 123 species	Crustacea 22 types	Crustacea 21 types	Crustacea 12 species	Crustacea 15 species	Pisces 72 species
	Myozoa 43 species	Chaetognata 3 types	Chaetognata 3 types	Scaphopoda 1 species	Bivalvia 23 species	
	Protozoa 14 species	Polychaeta 7 types	Polychaeta 6 types	Bivalvia 18 species	Gastropoda 7 species	
	Cyanophyta 10 species	Larvacea 1 type	Larvacea 1 type	Gastropoda 12 species	Echinodermata 4 species	
	Charophyta 1 species	Urochordata 4 types	Urochordata 3 types	Echinodermata 3 species	Polychaeta 12 species	
		Cnidaria 5 types	Ctenophora 1 type	Cnidaria 1 species	Cnidaria 1 species	
		Mollusca 3 types	Cnidaria 6 types	Nemertea 1 species	Brachiopoda 1 species	
		Echinodermata 1 type	Mollusca 3 types	Polychaeta 28 species	Platyhelminthes 1 species	
		Pisces 8 types	Echinodermata 3 types	Sipunculida 1 species	Nemertea 1 species	
			Pisces 12 types	Priapulida 1 species	Sipunculida 1 species	
				Platyhelminthes 1 species		
Sub-total	191	54	59	79	66	72

Prepared by: Ecosambito, 2020

Regardless of the accuracy in filtering richness and diversity data in this compilation, it should be kept in mind that diversity studies are not always compatible with the needs of a project, because to achieve an adequate knowledge of the biodiversity of an area requires years of monitoring and training of the observer team in new methods for the study of marine life.

Thus, when contrasting the data in this report against bibliographic sources, it would seem that the results achieved are very poor, but in reality they are not and reflect a great wealth of life forms coexisting in habitats that are not very diverse due to the scarce differences in depth and the scarcity of hard bottoms in the Jambelí Channel and Archipelago as well as in inland waters. In this sector outside of Santa Clara Island, all the hard bottoms are artificial, except for small "pebbles", which are the result of very exceptional catches, such as the fact that 2 seahorses were caught in the Santa Rosa estuary in front of the Puerto Bolivar facilities but in an entrance towards Jambelí, a situation that shows small "mini reefs" in this estuary, as well as the unique catch of the Damselfish, *Mulatillo* or *Ronco Peña* as it is called by local fishermen, referring to the species *Stegastes acapulcoensis*, which is typical of reefs.

In this way, we found that the extinct National Fisheries Institute (INP) estimated in 2017 a richness of 13 species of chondrichthyans or cartilaginous fish and 153 species of actinopterygians for the province of El Oro, totaling 166 species (Herrera et al, 2017), which were recorded through years of observation of landed catches obtained with different fishing gear at 21 sites in the province of El Oro, in addition to observation by diving and conducting tours in internal areas; against only 48 catches of 30 minutes with 3.5" nets in 4 sites plus two catches with 2 ¾" nets and 70 casts of cast nets that revealed 81 different fish, almost half of the species estimated for El Oro.

Photographic Record 10. "Duron", fish of the Gobidae family, collected on the muddy beaches of Pongal and Hippocampus ingens or "seahorse" collected with a cast net at the southern entrance of the AUSCEM "Vikingos del mar" in Jambelí. less than 2 km from Puerto Bolivar project.

Prepared by: Ecosambito, 2020

Regarding marine invertebrates, Maria Jose Brito and Elba Mora Sanchez, from the former INP, published in 2017 the book "Moluscos marinos distribuidos en la primera milla de la costa ecuatoriana" (Marine mollusks distributed in the first mile of the Ecuadorian coast), where 66 species of mollusks were identified through manual collection assisted by shell fishermen or collectors from the study site, while in the present study 66 species of marine invertebrates were recorded from the beach infauna, 30 of which were mollusks that were collected in 5 different sites, specifically at Playa Isla del Amor it is noted that abundance of buried life forms, with36 marine life forms identified, 20 of which were mollusks.

This result is achieved in a morning of work in 8 analysis stations that are close to the results obtained by Narvaez et al (2019), who recorded 27 mollusks in Isla del Amor after placing 9 stations (each with 3 replicates in 3 strata–low, medium and high–with respect to the intertidal width, i.e. with 9 1-m2 quadrats) distributed throughout the island; these were checked on a monthly basis from May to October 2016.

Regarding the vulnerability of the marine life studied and the presence of endangered species in this study, according to the IUCN Red List database, only 8 fish are in the vulnerable category and were immediately released in good condition, as well as cephalopods that were incidentally collected with nets; in the rest of the zoological groups analyzed, basically all the animals described correspond to species not considered in this database because it focuses mainly on higher vertebrates. Of the protected marine creatures, the one that should be taken more carefully and even strengthen local conservation initiatives corresponds to the green turtle Chelonia mydas, the only endangered species observed in this study.

The records achieved in this report are considered adequate with respect to the sampling effort and provide a methodology that is easy to replicate allowing for an adequate statistical temporal contrasting as long as sampling units are distributed proportionally to the different sectors to be monitored.

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ENVIRONMENTAL AND SOCIAL ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– ASSESSMENT OF ECOSYSTEM SERVICES –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

The Puerto Bolívar Project, like most port projects, is located in a sector where some economic activities converge depending on the proper functioning of the different habitats making up the coastal marine ecosystem. This ecosystem provides multiple environmental services where the provision of goods – particularly in relation to fishing – is its most self-defining environmental service because, in the Ecuadorian jurisdiction, fishing resources are public access resources, whose trade supports the economy of thousands of families.

The Puerto Bolívar Port Terminal Project, managed by Yilport Terminal Operations (YILPORTECU) S.A., is located in one of the most productive environments of coastal marine ecosystems: estuaries with mangroves, forests adapted to exist at the land-sea interface which are scarce worldwide. These ecosystems are of great ecological importance since, in addition to providing goods through specific fishing activities, they provide other regulatory and environmental support services, drawing more and more attention to their conservation, and in Ecuador these ecosystems are protected.

This report briefly characterizes the main fishing activities developed in the area of direct influence and buffer zone of the Puerto Bolívar Project, starting from the description of modes and means required to be developed, and then describing fishing variables obtained from the record of catches stated by members of the association of artisanal fishermen "San Antonio" of Puerto Bolívar, whose productive descriptions were compared with data collected in the project area of influence using the same methodology at similar dates in 2013 to check for year-to-year differences.

Subsequently, the main environmental services will be discussed, emphasizing the sectors with mangroves close to the port facilities of Puerto Bolívar.

1. Introduction

Environmental or ecosystem services include those goods and services of common benefit that represent global benefits that can transcend a territory. According to UNEP[1], UNDP[2], FAO, IUCN and CGIA in the "Millennium Ecosystem Assessment" carried out in 2002, environmental services are grouped into 4 main categories such as the provision of goods, regulation services, cultural services, and support services.

Table 1 lists the environmental services identified in the project area of influence, as well as the descriptions suggested for assessment.

Table 1. Ecosystem services identified in the project area of influence

Category	Definition	Identified goods or services	Suggested indicators and means of verification
1.- Provision of goods	Direct use goods generated in a certain area	Fishing activities in the area of influence, Exploited fishing resources.	Fishing statistics, seasonal comparison with fishing production in the project area of influence
2.- Regulation of environmental quality	Climate regulation services, water purification, erosion control, flood control, etc.	Role of mangroves as barriers against marine erosion and adverse climatic events, functioning of mangroves as biofilters.	Multi-year comparison of mangrove cover in the area of influence. Sediment quality sector comparison
3.- Cultural services	Non-material benefits that enrich the quality of life, such as cultural diversity, recreation, religious and spiritual values, scientific knowledge, traditions.	Tourist activities, local scientific production	Number of tourists and visitors and average daily expenditure according to scientific publications
4.- Support	Services required to produce other services, such as primary production, soil formation, oxygen generation, flow of energy through food chains and biodiversity	Sediment retention by mangroves and mangrove accretion for colonization of more species Primary productivity as a source of energy for the development of food chains. Biodiversity, genetic reserves	Time evolution of Phytoplankton abundance using standardized methods of international use. Descriptive of ecological diversity

2. Methodology

2.1 Provision of goods: Description of fishing activities in the Project area of influence.

The description of fishing activities in the project area of influence is carried out in accordance with the following steps:

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[1] United nations environment program, www.unep.org

[2] United nations development program, www.undp.org

a) **Estimate of seafarers in the project sector of influence.** For this purpose, the hypothesis considering the maximum on-board crew was used, that is, the number of crew members the fishing fleet would have, after accounting for vessels classified by type on Sunday, November 1 of the current year.

Photograph 1. Boats.- they do not have compartments to preserve fish. 'Fibras'.- Small fiberglass boats with cellar-type compartments.

Photograph 2. Industrial fishing boats

b) **Observation trips for fishing operations in open sea and inland waters:** The main fishing grounds near Puerto Bolívar were accessed, and fishermen were interviewed during their fishing tasks about the gear and fishing methods they used, in addition to reviewing their catches.

Photograph 3. Fishermen during fishing operations

c) **Productive monitoring or fishing statistics:** During November 2020, monitoring of fishing production or catch of 10 vessels was arranged with the association of artisanal fishermen "San Antonio" of Puerto Bolívar, through a fishing record sheet for each fishing trip, and it was expected to have 250 record sheets under the assumption that the vessels would make 25 trips in the best scenario. A fishing record sheet sample is shown in Annex 1, and variables are extracted from this sheet and entered into calculation templates such as Catch composition and value of first-sale of resources captured, Catch (Total biomass and biomass for each resource captured, expressed in lb/fishing trip, duration of tasks or time out of port, effective fishing time (working time of gears used) estimated in hours; CPUE[3] (total biomass or biomass of a specific resource divided by the estimated effective fishing time in lb/fishing hour, expenses incurred or investment in fishing trips (US$/fishing trip), and the profit per trip (US$/vessel/fishing trip).

When estimating catch statistics using different fishing gear, as well as estimating the artisanal fishing fleet, it is feasible to make assumptions to help value fishing production in the area of influence. These data allow us to measure the value of local fishing productivity.

d) **Statistical comparison of local fish production:** The fishing statistics obtained during November 2020 were compared with fishing statistics collected with the same

[3] Catch per unit of effort

methodology in November 2013, when the artisanal fishing productivity was recorded during the 2D seismic data collection in block 3J Jambelí.

2.2 Environmental regulation services and support services: Description of mangroves in the project area of influence.

The description of services provided by mangroves and associated water bodies included a review of relevant bibliographic background, as well as studies focused on the local conditions of mangroves in the area of influence of the Puerto Bolívar Project. Both services (regulation and support) are focused simultaneously when referring to a particular ecosystem that combines both services in common processes.

2.3 Cultural services.

Tourism. - There are communities and social groups that benefit from tourism through the scenic resources of the Santa Rosa channel and the Jambelí archipelago.

The Malecón de Puerto Bolívar is a traditional recreation area for the citizens of Machala, who visit it, both for its scenic quality and for its gastronomy.

Jambelí beach and El Faro are widely visited throughout the year, both by locals and foreigners, particularly by the inhabitants of the southern highlands of the country.

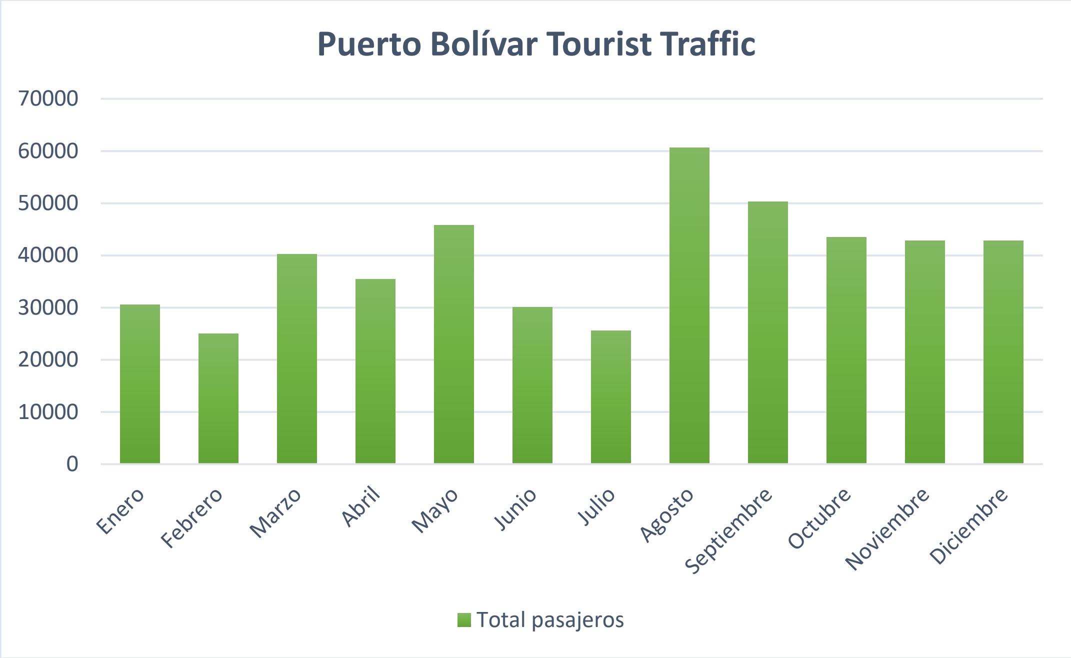
Sea transport. People that inhabit and sustain themselves from the ecosystem of the Project area depend on sea water and estuaries to be able to transport themselves and develop their supply activities, sale of products, and trade with mainland population, in general. On the other hand, in the Puerto Bolívar Cabotage Pier, there are two tourist transport cooperatives: Cooperativa 31 de Julio and Cooperativa "Rafael Morán Valverde", each one has 15 registered vessels.

These 30 vessels, with capacity for 43 passengers each, carry out the passenger transport to Jambelí Island, taking approximately 40 minutes. The tours take place throughout the morning, from the Puerto Bolívar cabotage pier to Jambelí Island. In the afternoon, from 3 PM, the tours get back to Puerto Bolívar.

The data on the frequency of trips, provided by Betty Sánchez, Manager of the Rafael Morán Valverde Cooperative, in an interview on November 2, 2020, are shown in Table 2.

Photograph 4. Upper: Tourist transport to Jambelí Island. Lower: Jambelí Beach (El Telégrafo, 2020)

Table 2. Total passengers transported to Jambelí Island, yearly estimation.



January, February, March, April, May, June, July, August, September, October, November, December, Total passengers

Research.- scientific research is a cultural service that is still underused. However, there are more and more institutions, particularly NGOs, that promote research in mangroves, dry forests, sea and estuaries. The most active ones include: Fundación Heifer, Conservación Internacional, Cooperación Alemana, GIZ, Universidad Particular de Loja.

3. Results

3.1 Provision of goods. Fishing activities in the project area of influence

3.1.1 Modes and means for fishing activities observed in the project area of influence

The main modes of fishing activities in the province of El Oro and in the Project area of influence are summarized in Table 2 where the means required for fishing are described. Although not all modes are used for fishing in the area of direct influence, all of them are operationally related to the project area of influence or Puerto Bolívar from where most of the vessels dedicated to fishing set sail.

Table 3. Modes and means of fishing in the area of influence

MODE	Means and characteristics
PAP - Pedestrian artisanal fishing	***Intertidal harvesters*** (seafood gatherer).- shellfish, clams, mussels, oysters and red crabs.
PAF - Fishing with passive or fixed gear	***Intertidal nets, Bottom-set gill nets, Fish weir, Fyke nets***, focused on the capture of pelagic and coastal demersal fish, crustaceans and mollusks.
PAC - Non-motorized coastal artisanal fishing	***Wooden/fiberglass 'bongo' boats***, 3-5 m in length, 1-2 fishermen/bongo, used for shrimp, demersal, coastal pelagic, estuarine fish.
PACM - Motorized coastal artisanal fishing	***7.5-9 m, 40/75 Hp Fiberglass boats***, 2-3 fishermen/boat, used for shrimp, demersal, coastal pelagic, large fish
PAA - Artisanal open-sea fishing	***7.5-9.5 m fiberglass boats with 1-2 75-Hp engines***, 3 fishermen/boat, used for coastal pelagic, oceanic pelagic fish in the vicinity of Santa Clara Island.
PI - Industrial fishing	***Vessels of up to 18m***, 6-9 crew members, seine nets or "boliches", catch carried out outside of 8 nautical miles from the coastline
AQUACULTURE*[4]	996 shrimp farms totaling 41,637 hectares in the province of El Oro in 2018; 652 farms (20,886 ha) operating in beach and bay areas and 344 farms (20,751 ha) operating in highlands.

Pedestrian artisanal fishing, PAP. This fishing mode exclusively requires the displacement and physical work of a person who uses resistant clothing to move in intertidal sectors such as mangroves and muddy beaches, plus the use of hooks if the fishermen focus on the catch of red crabs *Ucides occidentalis*.

It is difficult to estimate the number of people dedicated to this activity, since their number is variable and will fluctuate depending on the need for local consumption (livelihood) and the commercial demand for exploited resources that will be sold, with "pulses" of resource

[4] Although aquaculture is not an extractive activity, its resources compete with fishing products in the market. There are few artisanal producers in the project area of direct influence, and thus it is mainly an industrial activity.

exploitation with less economic interest, while resources with higher prices have a more continuous exploitation.

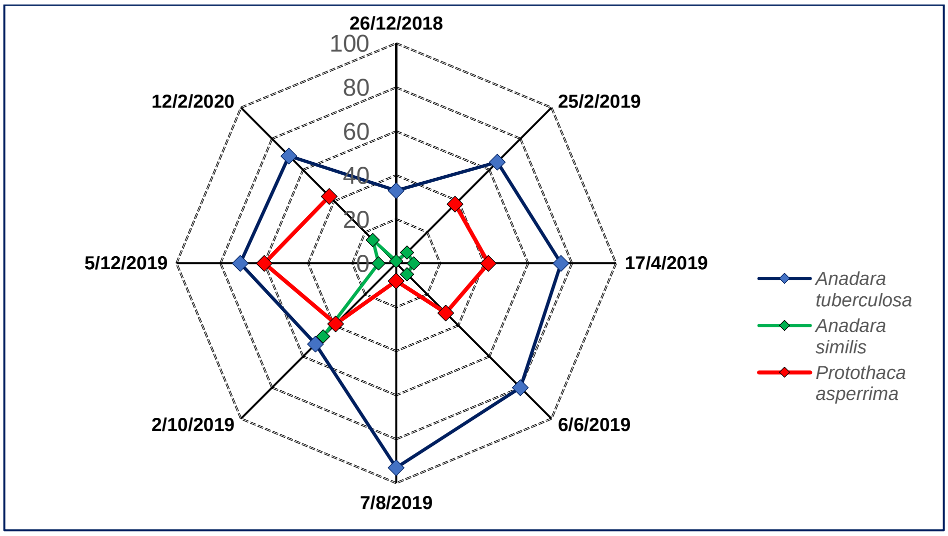
This activity takes place in 3 different habitats, i.e. mangroves, intertidal beaches and rocky shores. The mangroves near the Terminal are granted in concession to associations of fishermen and tourist entrepreneurs, and their members have the exclusive right to catch black shells *Anadara tuberculosa*, *Anadara similis*, mussels *Mytella guyanensis*, swamp clams *Protothaca asperrima* and red crabs *Ucides occidentalis*. However, in practice, these sectors do not have permanent security and are continuously exploited by gatherers not belonging to the associations, thus resulting in conflicts between custodial fishermen and transgressive gatherers.

Shellfish gathering in mangroves close to the Project is variable, and both *A. tuberculosa* and *A. similis* have a permanent ban for minimum extraction size established at 45 mm of valve width (Ministerial Agreement No. 005 of August 2, 2005). The average catch of a shellfish gatherer in a 4-5 hour work task is estimated at 300 shellfish, with great variability per sector. Young gatherers with greater displacement speed manage to catch over 500 shellfish and exceptionally they can reach 1000 units per day.

Photograph 5. Alexis claims to gather from 500 to 1000 shellfish per shift in mangroves "where there are shellfish" near Puerto Bolívar. He was put to the test on November 5, 2020, and managed to gather 155 shellfish in one hour.

In the 2018-2020 period, 8 bivalve abundance samplings were carried out with individual gathering of 1 hour at the AUSCEM (Sustainable Use and Custody Agreement of Mangrove Forests) “Vikingos del Mar” on the east margin of Jambelí Island, particularly in mangroves at the entrance arm to said town from the Santa Rosa estuary. An average gathering included 67 “female” shellfish *Anadara tuberculosa*, 13 “male” shellfish *Anadara similis*, 44 mussels *Mytella guyanensis*, 37 white clams *Protothaca asperrima*, 4 shellfish *Anadara grandis* and 5 striped clams *Chione subrugosa* in one hour. When considering the total of individuals gathered independently of the species, the mean bivalve abundance in this sector of mangroves amounted to 148 ± 49 individuals in one hour. The fluctuation of abundance of collected resources present in the 8 monitoring samplings carried out at the AUCEM "Vikingos del Mar" is observed in Figure 1.

Figure 1. Fluctuation of commercial bivalve abundance in the 2018-2020 period at the AUSCEM "Vikingos del Mar"



Photograph 6. Anadara tuberculosa and Mytella guyanensis

Photograph 7. Anadara similis and Anadara grandis

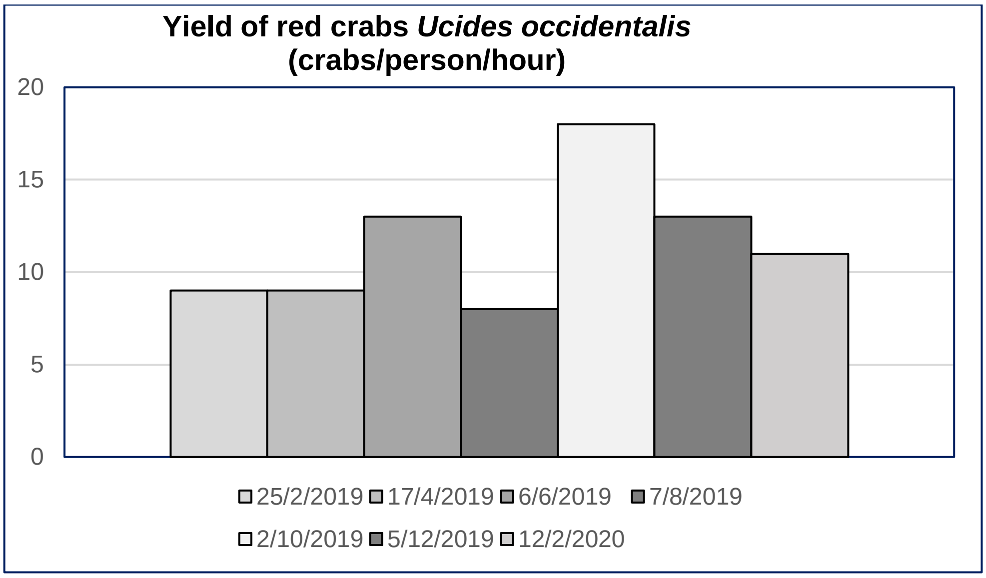
At the AUSCEM "Vikingos del Mar", red crabs *Ucides occidentalis* are also gathered. An experienced crabber can obtain from 1 to 1.5 "plates" (a plate = 48 crabs) of crabs in a workday of 4-6 hours, and in periods of greater abundance, an experienced crabber could reach 2 "plates". In the 2019-2020 period, the productivity of crabs at the "Vikingos del Mar" area was tested, always using the same crabber that had an average catch of 11.57 ± 3.45 crabs per hour. (Figure 2).

The red crab resource is regulated with a minimum extraction size of 7.5 cm in cephalothoracic width and two temporary extraction bans associated with reproductive events of this species from February 15 to March 15 and from August 15 to September 15 of each year as decreed and regulated by Ministerial Agreement No. MPCEIP-SRP-2020-0013-A, of January 17, 2020.

Photograph 8. Red crabs Ucides occidentalis

Photograph 9. Crabber. Please note the hook used to remove crabs from their caves

Figure 2. Crab yield in mangroves of the AUSCEM "Vikingos del Mar"



During the current COVID 19 pandemics, the price of this resource, like most fishing resources, fell dramatically to US$ 15 for a plate of crabs, a price that would be paid for a dozen crabs under normal circumstances.

This situation illustrates the dependence of these resources on the tourist activity of the Machala-Puerto Bolívar conurbation, where the resources gathered in mangroves are used in multiple dishes offered in local restaurants.

The mangrove concessions, or AUSCEM[5], are restricted to emerged forests and do not include water bodies and intertidal sectors as such, thus there are 2 sites of the Santa Rosa estuary located to the north of the port facilities of the Puerto Bolívar Port Terminal with low slope beaches and muddy and mixed bottoms with open public access where two clam types are mainly gathered, i.e. the striped clam *Chione subrugosa* and the swamp clam or white clam *Protothaca asperrima* in addition to scarce shellfish *Anadara grandis* and mussel *Mytella guyanensis* and other bivalves of no commercial interest.

Photograph 10. Striped clam Chione subrugosa and white clam Protothaca asperrima

In these beaches, individuals and family groups from Puerto Bolívar can achieve gatherings with variable yields depending on sex, age, physical condition, and the expertise of a gatherer. This situation was observed in the bimonthly monitoring of 2019-2020 on the beach near the AUSCEM "Isla del Amor", the closest to the Puerto Bolívar Port Terminal. In December 2018, a 27-year-old young man filled a 20-liter bucket with 1432 individuals of 8 different bivalve species in one hour, while in February 2019 in exactly the same place, a woman of almost 50 years old gathered 303 individuals of 4 different species in the same period of time.

[5] Sustainable Use and Custody Agreement of Mangroves

Photograph 11. Clam gatherers on Isla del Amor beach and clam tradable unit

As mentioned above, not all the bivalve individuals collected from beaches and mangroves are proper for trading. Shellfish, mussels and two types of clams are in demand in Puerto Bolívar, and the most precious resource is the black shellfish *Anadara tuberculosa*, which would cost, on dates of greatest demand, about US$ 15 under normal circumstances, while mussels are sold from US$ 1.5 to US$ 2 per 100 individuals, and striped and white clams are sold from US$ 3 and US$ 5 per a 20-liter bucket that can contain from 1400 to 1900 individuals depending on its average size.

White and striped clams lack a minimum size for regulated extraction and are exploited mainly by lower-income family groups, and dozens of restaurants take advantage of this situation and use these clams to increase the profitability of dishes that include various seafood, increasing the proportion of these clams in dishes called “pailas marinas”, “maremotos”, “festines de mariscos”, etc., which would hardly have more than 8 black shellfish per serving but can contain dozens of clams called “machaleras”, a local name for striped clams.

The pedestrian extraction of oysters is restricted to the artificial breakwaters of the Jambelí beach resort, made up of 5 rockfill structures where an encrusting benthic community has developed and includes rock oysters *Stiostrea prismatic* that are exploited by fishermen from that beach resort and their soft parts are sold at US$ 10 per 1-liter plastic container. Please note that this resource does not present continuous gathering and would have a specific demand since the oysters that develop in the intertidal zone are quickly harvested, but not its subtidal fraction, which is exploited by diving.

Photograph 12. Stiostrea prismatic oysters in artificial stonework or breakwaters at the Jambelí beach resort

Fishing with passive or fixed gear, PAF.- This type of fishing includes the so-called “caleteras” (bottom-set gill nets) or “tapes” (fish weirs), which are located in intertidal spaces, where an extensive row of wooden posts fixed on soft bottoms is installed to tie nets made of unknotted polyester multifilament or black Rachel multi-filaments with mesh diameters of 1”, or black twisted thread nets called "camaroneras” (shrimp catchers), with mesh sizes from 1¼” to 2”.

These nets may exceed 1 kilometer in length and are tied to the base of the posts used, remaining extended over the bottom during low tide and are tied to the top of the posts to form a screen during high tide. Therefore, these nets work during high tide and once the tide begins to drop, multiple fish, crustaceans and mollusks that entered the mangrove edges are trapped. Then the nets are checked, and seafood is collected manually at the next low tide.

Please note that this fishing method is questioned and is considered harmful since it lacks selectivity and employs a maximum of 3 people. That is the reason why it is banned by Ministerial Agreement No. 134 of May 24, 2007, which allows its use exclusively on Puná Island, as cited:

“Article 4.- In the bioaquatic species reproduction reserve zone (one mile) for the exclusive case of Puná, the use of “caleteras” (bottom-set gill nets) is allowed subject to the following considerations:
a) A lower section with a height not exceeding 0.80 m of PA multifilament, with an effective mesh size not less than 38 mm (1’ ½”).

b) An upper section with complementary height at the maximum high tide, with an effective mesh size of not less than 63 mm (2’ ½”).

The owners of the bottom-set gill nets shall request their respective authorization from the General Directorate of Fishing within 60 days of the issuance of this Agreement. Those who do not obtain authorization within the aforementioned period will not be able to fish with said nets which will be confiscated and destroyed. The General Directorate of Fishing shall carry out the respective controls of the technical characteristics of the nets based on the results and recommendations of the study carried out by the INP for this type of nets in Puná.”

The same agreement sets out: *“Obstruction of estuaries, mouths of estuaries or rivers is prohibited, in accordance with the provisions of Article 5 of Ministerial Agreement 03317 published in Official Gazette No. 141 of August 6, 2003.”*

Despite this prohibition, two extensive bottom-set gill nets were observed on the inner margin of the Jambelí island towards the north of the Santa Rosa estuary, which are shown in Photograph 13.

Photograph 13. Bottom-set gill net identified in the Santa Rosa estuary. Please note the port complex Puerto Bolívar Project to the left in the upper photograph.

Fyke nets.- Passive nets that emulate a shrimp trawl, but their wings, instead of being dragged by “arms” of shrimp boats, are tied to a “V-shaped” row of posts at whose vertex (both rows do not meet) a cylindrical funnel-shaped net is fixed. The net small opening remains open and is closed for a period of 1 or two hours during the period of greatest intensity of tidal currents, so a type of bag is formed when water level is falling (“vaciante”, or falling tide net) or rising (“creciente”, or rising tide net). Multiple seafood species dragged by local currents get trapped, and the main objective is 3 species of shrimp, i.e. *Protrachipene precipua* or pomade shrimp, *Penaeus vannamei* or white shrimp, and *Trachypenaeus byrdi* or zebra shrimp, in addition to fish. However, mainly in the capture of fish, this art, like the bottom-set gill nets, affects small juvenile fish because of its low selectivity, and therefore a high rate of bycatch and fishing discards occurs.

For these reasons, this practice has been highly questioned and is currently under the regularization process by Agreement No. MPCEIP-SRP-2020-0077-A of July 8, 2020, which establishes a period of 2 years to regularize its operation.

In the Project area of influence, the only fyke nets observed were located in two sectors of La Puntilla in the north end of the area of influence and in the vicinity of Bajo Alto, which is located far to the north of the project. Although fyke nets could not be counted efficiently because there was a low tide and the risk of being stranded because local fishermen install specific demarcations to access certain sectors of the coast. After conversations with local fishermen, this type of fishing method is said to need two people, but they work exclusively during spring tide (‘aguaje’), and the number of workers may increase when the catch is good. A good catch is considered 5 containers of shrimp and fish (around 350 lb).

Photograph 14. Left: fyke nets for shrimp and fish, in the vicinity of Bajo Alto. Right: the highest concentration of this gear in the La Puntilla sector

Non-motorized coastal artisanal fishing, PAC.- Fishing with drift nets or hooks mounted on hand lines, which are used on fragile boats called “bongo” where bow and stern are not differentiated and are manually propelled using oars or by wind when using “crab” nets. On November 1, 14 “bongo” boats tied to smaller boats from Huaylá estuary were counted. These smaller boats would mainly be used to transport people to boats.

This mode of fishing is in clear decline. During the first week of November 2020, only 3 fishing bongo boats were observed to the south of the Santa Rosa estuary, in a small fishing cove on the inner margin of Pongal island, named after the estuary that flows into this sector called “Guajabal”. 2 houses and 8 boats were observed, 3 of which were bongo boats that would be used to catch large fish inside mangrove channels because they used 7”-mesh size electro-welded plastic monofilament nets and hooks.

Photograph 15. "Guajabal" fishing cove, where bongo boats focused on fishing activities were observed

Motorized coastal artisanal fishing, PACM.- Definitely the main mode of fishing in the Project area of influence and in most fishing coves of the province of El Oro. It requires the work of fishermen in smaller boats (6.6-9m), mainly made of fiberglass, which are propelled by outboard motors ranging from 15 to 75Hp, and even vessels with 2 outboard motors were observed. The latter are used to fish out of port for periods of time below one day. This fishing mode involves the use of various nets. Electro-welded plastic monofilament (or MONO in Spanish) nets predominate with variable mesh size depending on the main target resource.

To describe the fishing operations and obtain variables from this fishing mode, the number of vessels at anchor on November 1 (Sunday before the Day of the Dead) was estimated, and most fishermen do not go sail on this day. Data from estimates of the artisanal fishing fleet and seafarers from previous research were kept in relation to fishing coves near Puerto Bolívar that could not be directly accounted for in this study.

The current estimate of Puerto Bolívar fishermen responds to the criterion of the maximum number of on-board crew members the different types of boats would have if all of them were in operating conditions. The estimate of the fleet and associated seafarers is observed in Table 3.

Table 4. Estimated number of artisanal fleet and seafarers

Fishing cove	Estimated number of vessels			2013 Estimate*	2013 INP estimate**	Current study
	Bongo boats (1.5 fishermen)	Wooden boat (2 fishermen)	Fiberglass boat (2.5 fishermen)			
Puerto Bolivar	17	28	943	2820	1825	2439
*La Puntilla***	*25***	*15***	*9***	*101*	*100*	
*Bajo Alto***	*50***	*120***	*5***	-	*414*	
Tendales	*20***	*14***		-	*120*	
Jambelí Beach	-	-	-	*50*	-	*50**
Total	17	28	963	2870	1825	2489

*Ecuambiente (2013). Oceanographic Component, fishing modes associated with the 2D seismic survey carried out by ENAP SIPEC in Block 3J Jambelí

**Marco Herrera, Romulo Castro, Dialhy Coello, Ingrid Saa and Esteban Elias (2013), Fishing coves and artisanal fishing settlements in Ecuador, Volume 2, Instituto Nacional de Pesca (National Fishing Institute), Special Bulletin Year 04 No. 1.

The boat types considered for fishermen estimates included bongo boats where 1 to 2 people would work. That is why and average value of 1.5 fishermen regularly work per Bongo boat, and 2-3 fishermen per fiberglass boat; so an average of 2.5 fishermen for each vessel is considered.

In this study, the number of 17 fiberglass boats counted out of the water was not entered since they remained in the fiberglass workshops. Vessels that would operate in "El Macho" estuary, in the northern sector of Machala or at the end of Huaylá estuary were not counted either because of security reasons upon following the advice of local fishermen who accompanied this activity and who recommended not to enter these marginal neighborhoods to carry out counts. However, fishermen claimed that there would be no more than 15 fiberglass boats and 20 boats propelled with small engines for pedestrian fishing and fishing in mangrove mouths. On November 1, the return and departure of vessels from Huaylá estuary were observed.

Thus, the margin of error in the estimate is considered between 50 and 60 minor vessels, that is, in the project area of direct influence, it could be stated that there are from 2,500 to 2,600 fishermen using the PACM mode.

Photograph 16. Left: Boats that lack compartments to preserve fish and require short trips. Right: Fiberglass boats of greater length with cellar-type compartments, the most widely used vessel in the artisanal fishing subsector in the area of influence.

Regarding the trends observed based on reviewed assessments, in 2013, the former Instituto Nacional de Pesca (National Fishing Institute) estimated that in Puerto Bolívar there were a total of 80 canoes or bongo boats, 180 wooden boats and 1200 fiberglass boats. Rounding and decreasing numbers for a period of 7 years are drawing attention. However, on Sunday May 12, 2013 (Mother's Day), the Ecuambiente consulting team recorded, in the same sector, a total of 44 bongo boats, 72 wooden boats and 870 fiberglass boats. If we consider the total number of vessels in this count, there were 986 vessels in the same sector, while 988 vessels were counted in this study. This situation shows the reconversion of the fleet, thus the number of bongo boats and wooden boats decreased and the number of fiberglass boats increased. The latter would have increased practically by 100 units in this period.

Regarding PACM mode fishing during November, data were recorded on fishing operations of 10 fiberglass vessels that set sail from the Huaylá estuary for daily activities. 250 fishing records were compiled in sheets similar to those used in 2013. After being entered into the freeware R and filtering similar data from 2013 to 2020 to remove fishing grounds reported exclusively in 2013, and despite the fact that in both periods the catches were not georeferenced, fishermen use common names for fishing sectors based on coastal demarcations and navigation buoys.

After filtering data, the universe of records in 2013 was reduced to 353 observations. Figure 3 shows general descriptions of both periods of time. From 2013 to 2020, the hours out of port have decreased. This leads to a decrease of total catch considering the different gears used and the variety of resources captured, which leads to a decrease in fishing profit.

Figure 3. General fishing variables in November 2013 and November 2020

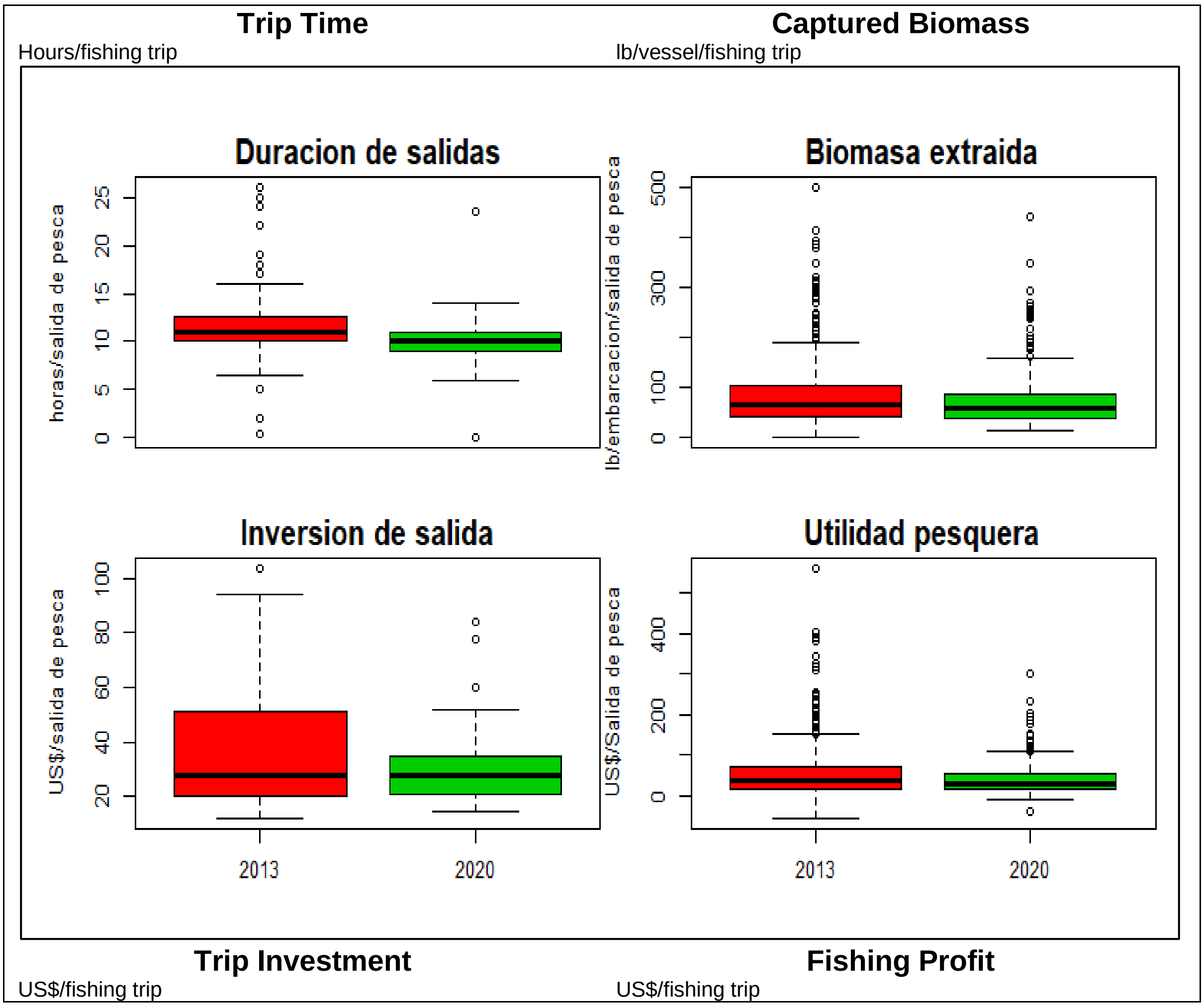


Table 5. PACM global fishing descriptions as set sail from Puerto Bolívar

Period	November 2013	November 2020
Time out of port (hours)	11.24±3.12	10.11±1.97
Catch, Total biomass (lb/fishing trip)	93.28±79.30	75.78±60.30
Trip expense or investment (US$/fishing trip)	37.80±22.13	31.3±15.07
Fishing profit (US$/fishing trip)	55.32±73.45	43.23±43.12

Figure 4. Main resources captured in PACM

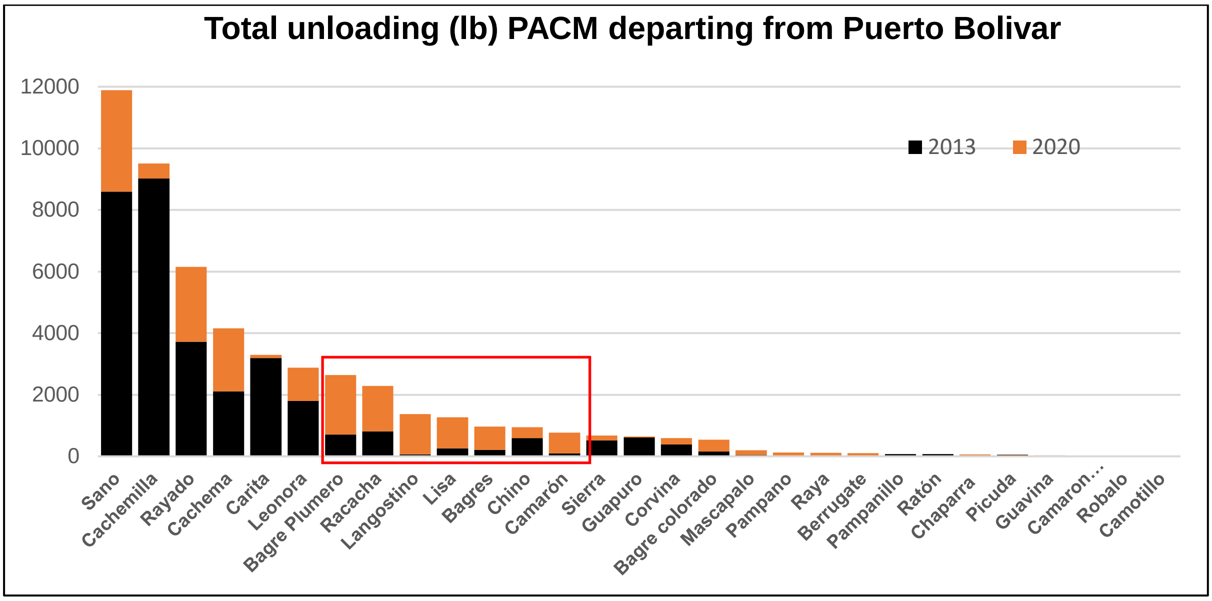


Figure 4 shows the abundance of catch of 29 resources as reported by fishermen. The wealth of resources captured is obviously greater and it is difficult to establish because of the way fishermen trade their catches in Puerto Bolívar. Certain resources have fixed first-sale prices., while other species are traded together based on a common size. Thus, a "Sano" encompasses fish from which up to 2 or 3 sections can be obtained if they are cut into medallions or cross sections to be put into a plate after being gutted, and a "Racacha" generally encompasses smaller fish and fish within a "Sano" that would have to be put in whole units in an inexpensive plate for lunch that costs around US$ 2.5 in Puerto Bolívar.

Figure 4 highlights target resources that would show a change trend in catches and are associated with resources that would have a greater relationship with the project area of direct influence since they are more coastal in nature and whose catch has increased as compared to 2013. The mean values of the main fishing variables observed in Table 4 show a decrease in fishing productivity after 7 years, and this situation can have various interpretations, in addition to the evident increase in the general extractive pressure for the area of influence, due to the increase in fiberglass boats. However, in the author's opinion, this decrease would also be related to a serious externality affecting artisanal fishing activity, i.e., piracy.

This assertion is based on the fact of the continuous pirate attacks during fishing operations in open sea as claimed in interviews with fishermen. This is the main problem identified by fishermen themselves which makes them restrict catch to daylight, work in groups and sail near the coastline. This situation is manifested in the reduction of the average time of trips observed in Figure 3, where a greater number of upper extreme values are observed in 2013, and a decrease of practically 1-2 trip hours is observed between both periods.

Among the resources exploited in the area of influence, the biggest fishing bet in the Jambelí Channel in the third quarter of each year is the capture of croaker/'cachema' *Scinoscion analis*. This species may be sold at US$ 100 in first sale if a large fish is caught using green electro-welded plastic monofilament nets with mesh size greater than 4.5" (usually 6") or green twisted thread net. The total catch of croaker (large fish) reported was 382 lb in 2013 and 214 lb in 2020, and 'cachema', which is the same species with smaller size and can be captured with 2

¾” mesh-size nets, had a similar catch with 2107 lb reported in 2013, and 2050 lb in the current period.

Photograph 17. Croaker/cachema Scinoscion analis with first-sale price of US$ 2.8 in 2013 and US$ 2.9 in 2020

The second most attractive target resource for fishermen in the area of influence, which represents a lower risk of pirate attacks, is the shrimp *Penaeus vannamei*, which is caught with 2.5” – 2 ¾”, 3” – 3.5” mesh size electro-welded plastic monofilament nets and has catch records that rose from a total of 67.5 lb in 2013 to 1307.8 lb in 2020, with maximum catches of 7.5 and 50 lb/boat/fishing trip respectively. Small shrimp (‘camarones’), which encompasses individuals of the same species but smaller in size, reported total catches of 95.5 lb in 2013 and 668.75 lb in 2020 with maximum catches of 7.5 lb and 52.75 lb/boat/fishing trip respectively.

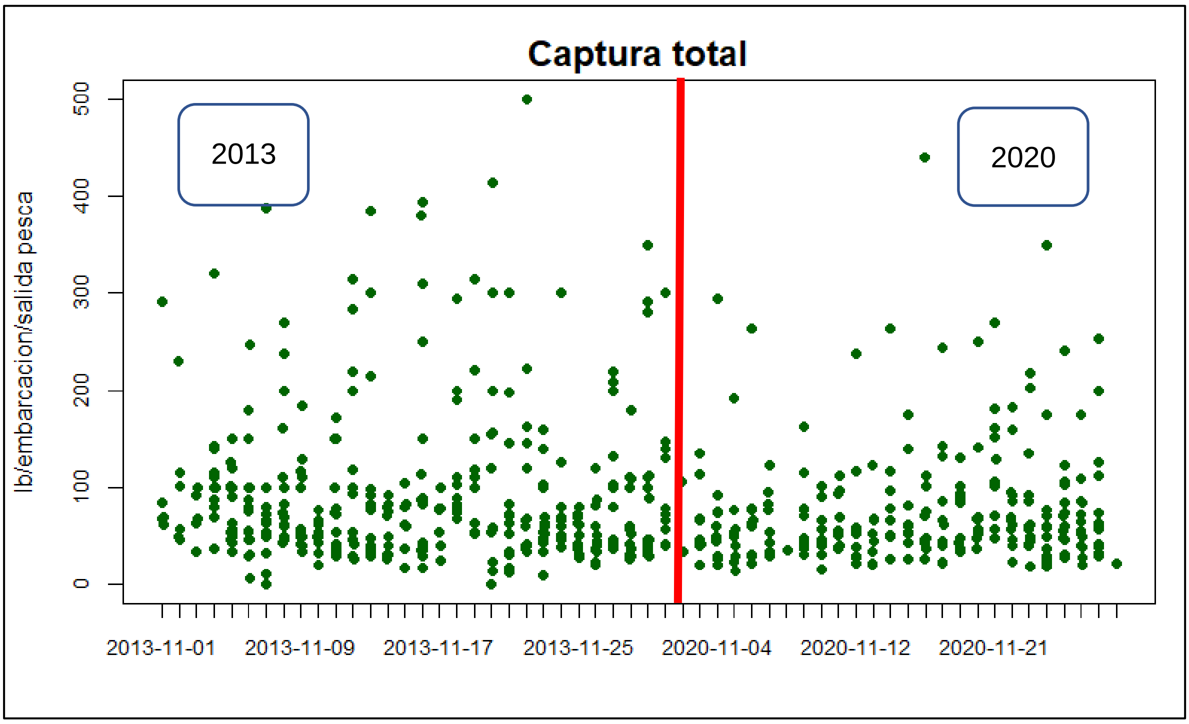
Photograph 18. As for shrimp Penaeus vannamei, a full 20-liter bucket is considered a good catch. "20 units per bucket is a very good catch", said the fishermen. Shrimp had a maximum price of US$ 5.5 in 2013 and did not exceed US$ 4 in 2020

Fish of the *scianidae* family represent the largest natural supply of well-marketed fish since these fish have different prices from ‘Sano’ to ‘Racacha’, although specimens of ‘Rayados’ and ‘Ratones’ are part of a ‘Sano’ because they are medium-sized.

Photograph 19. Top-rated sciaenid species from top to bottom: Croaker/’cachema’ Scinoscion analis, yellow croaker Scinoscion albus and Chinese croaker Nebris occidentalis

A time series of data of catches by a vessel in a fishing trip is observed in Figure 5. It is observed the influence of tidal cycles showing sinusoidal trends associated with cycles of higher productivity related to periods of spring tide (‘aguajes’), where tidal currents acquire greater speed, and the intertidal height is amplified. During spring tide, the tide rises and falls rapidly, while during neap tide (‘quiebras’), the intertidal rise and fall takes longer.

Figure 5. Fishing productivity fluctuations in November 2013 and 2020



Lb/vessel/fishing trip, Total catch

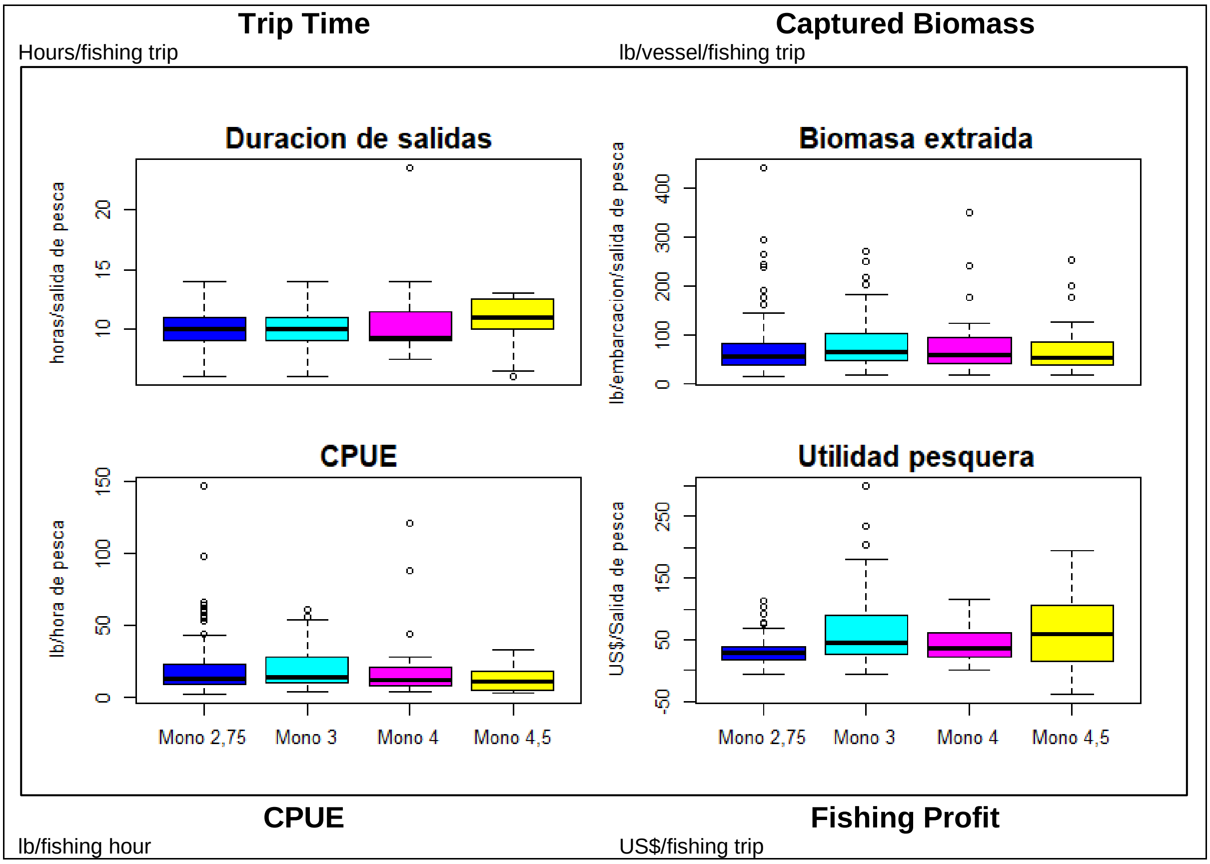
Figure 5: Fishing productivity fluctuations in November 2013 and 2020

During collection of fishing information for this period, improvements were achieved for the analysis of fishing productivity. In the 2013 sheets, fishermen only reported data on time out of port as total time of daily fishing work. In this period, it was urged to record the effective working time of fishing gear, that is, fishermen reported the number of times fishing gear was mounted and the average time of use. Therefore, the time of gear underwater or effective work could be estimated. After the effective working time and the total catch mass were known, it is feasible to estimate the CPUE[6], in lb of catch per working hour. The main fishing variables categorized by fishing gear in 2020 are shown in Table 5 and Figure 6, respectively.

Table 6. Fishing variables associated with the main gears used in the project area of influence.

Variable/Fishing Gear	**2 ¾” Monofilament**	**3” Monofilament**	**4” Monofilament**	**4.5” Monofilament**
No. of records	145	52	23	30
Time out of port	9.96±1.55	10.14±1.70	10.54±3.32	10.78±1.90
Average catch (lb/fishing trip)	71.37±58.52	87.22±59.28	84.81±77.63	70.39±55.11
CPUE (lb/fishing hour)	19.18±18.86	19.90±15.45	21.46±28.09	12.95±9.02
Profit (US$/vessel/fishing trip)	30.57±20.46	66.21±64.54	44.78±30.74	63.42±60.60

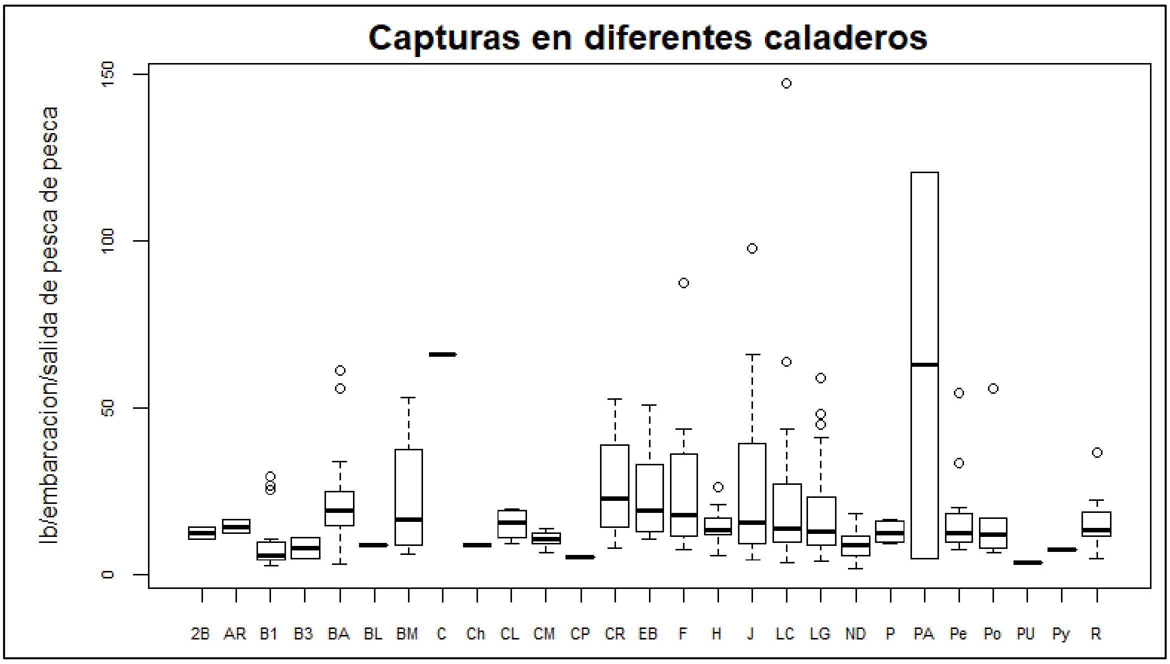
Figure 6. Fishing variables classified by fishing gear used in PACM in November 2020



[6] Catch per unit of effort

Figure 7. Catches classified in different fishing grounds in November 2020: 2B= 2 buoys, AR= Outside the river, B1= Buoy 1, B3= Buoy 3, BA = Bajo Alto, BM= Boya Amarilla, C= El Coco, Ch = Chupadores, CL= Cabeza de Loma, CM= Canal del Medio, CP= Caña Parada, CR= Costa Rica, EB= El Bravo, F = El Faro, H= Las Huacas, J= Jambelí, LC= Loma Chica, LG= Loma Grande, ND= Not determined, P= La Poza, PA= Punta Arena, Pe= El Petrolero, Po= La Polanca, PU= La Puntilla, PY= Punta Payana, R= El Rio

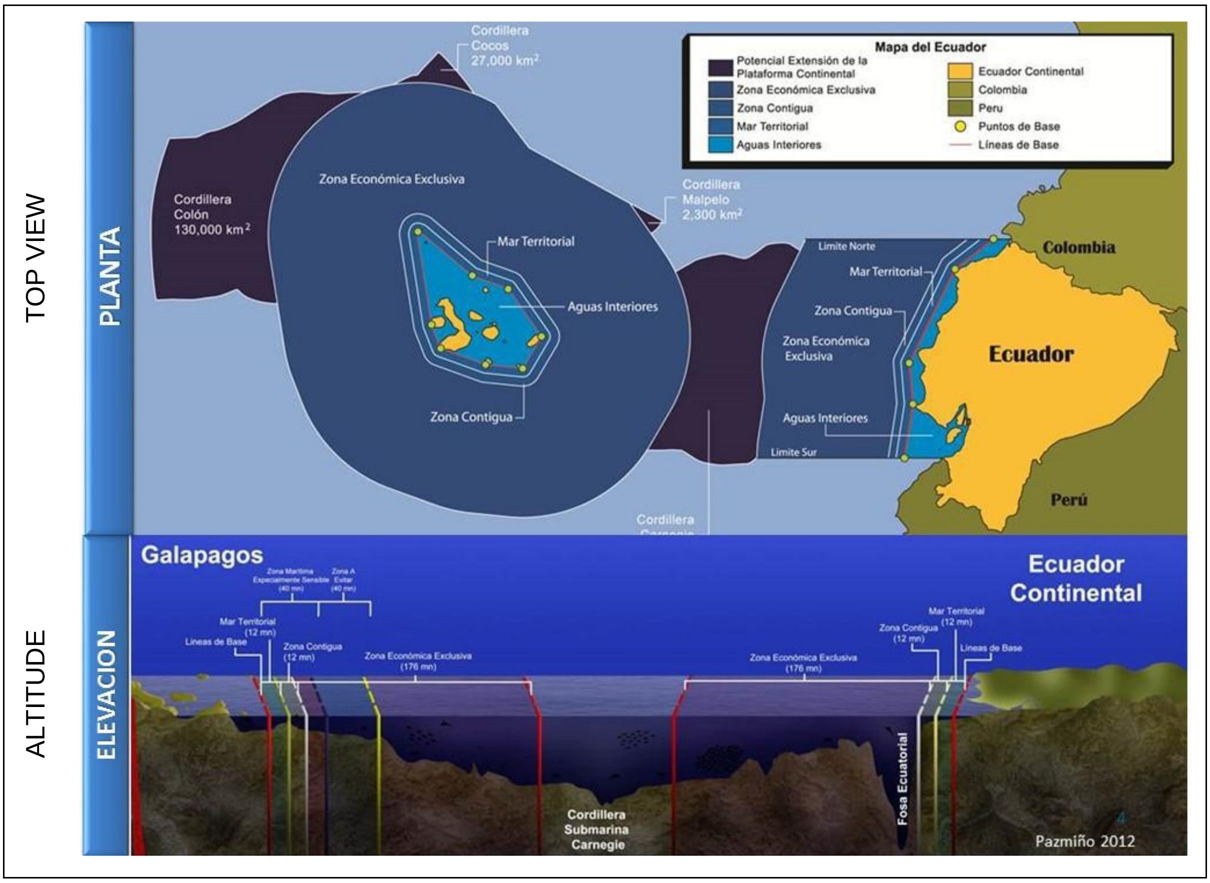
Catch at different fishing coves



Lb/vessel/fishing trip

Artisanal open-sea fishing, PAA: This modality differs from PACM in that fishing trips are more distant from the coast. The criterion to establish the limit between coastal or neritic waters and oceanic waters is the presence of the continental slope, that is, the distance from the coast where the continental platform ends, and the depth is increased as seen in Figure 8.

Figure 8. Jurisdictional maritime spaces of Ecuador, as taken from the Plan for the Management of Coastal Marine Space. (SENPLADES, 2016)



Based on the criteria for the marine-coastal zoning of Ecuador, the entire Gulf of Guayaquil would correspond to coastal waters. However, in terms of fishing operations, it could be assumed that the starting limit of oceanic waters is beyond 20 nautical miles from the coast. Fishing activities in oceanic waters or "open sea" require greater logistics and investment, and fuel use can exceed 100 gallons and generally involve the use of 8 or 9-inch trammel nets, or multiple hooks mounted on spools. Oceanic trips generally take longer than 18 hours out of port, and trips taking up to 4 days are generally planned. In Ecuador, artisanal fishermen make trips beyond 200 miles or the Exclusive Economic Zone (EEZ).

However, this fishing method is not regularly used in the Province of El Oro, although it could be considered that fishing operations in the vicinity of Santa Clara or beyond the gas platforms of Block 6 could be considered oceanic since there is no intertidal mixing of waters. These sectors are characterized by very transparent waters with a dark blue color that can be seen from a distance, unlike the light color of coastal waters.

Industrial fishing, PI: Fishing operations carried out in vessels with greater length and draft with decks and superstructures allowing the work of crews of several people. In Ecuador, this fishing type differs from artisanal fishing because fishing gear is handled by machines, while artisanal fishing is carried out through the physical labor of fishermen.

According to the document ‘Puertos, Caletas y Asentamientos pesqueros artesanales del Ecuador’ [Ports, Coves and Artisanal Fishing Settlements in Ecuador] (INP, 2014), in 2013, 85 industrial ships operated in Puerto Bolívar, and on Sunday, November 1 of this year, 84 boats tied alongside or at anchor in docks of the Huaylá estuary were counted.

Photograph 20. Industrial vessels of different lengths and sizes observed on November 1

Conversations with industrial vessel crew members show that regularly the crew in these vessels ranges from 6 to 9 people. Therefore, the number of industrial ship crews could exceed 500 seafarers. The main fishing operation of this fleet is capture with seine nets, and these vessels are locally called “bolicheros”.

Information on industrial catches from first source could not be accessed, and publicly accessible statistical reports generated by the IPIAP[7] are out of date and present general data of the total monthly catch by species, without specifying the ports of unloading.

When reviewing the compiled report for the period 2004-2017, there are reports of species classified as small pelagic, which include records in Metric Tons: Southern sardine *Sadinop sagax*, Mackerel *Scomber japonicus*, Round sardine *Etrumeus teres*, ‘Chuhueco’ *Cetengraulis misticetus*, ‘Pinchagua’ *Opisthonema sp*, Anchovy *Engraulis ringens*, ‘Botellita’ *Auxis spp*, Horse mackerel *Trachurus murphyi* and ‘Picudillo’ *Decapterus macrasoma*.

A second category called “Others” includes 25 fish recorded in 2017 with common names. The 10 most captured resources of that period included ‘Corbatas’, ‘Barriga Juma’, ‘Trumpetas’, ‘Lisa’, ‘Gallineta’, ‘Menudo’, ‘Carita’, ‘Hojita’, Rabo Blanco’ and ‘Chazo’. This situation would be linked to an existing conflict between artisanal and industrial fishermen – the invasion of industrial vessels that carry out fishing operations within the 8-mile coastal strip, determined as a Fishing Zone for decades and ratified as artisanal in the Organic Law for the Development of Fishing and Aquaculture of April 17, 2020, whose Article 104 sets out:

“Area for Artisanal Fishing. *Declare an area for artisanal fishing, extending within eight nautical miles. This area allows for catch of bioaquatic species, from the low-water line along the continental coast of Ecuador towards the sea, except for the reserve mile as provided in this Law.*

[7] Instituto Publico de Investigación en Acuicultura y Pesca [Public Institute for Aquaculture and Fishing Research] (formerly Instituto Nacional de Pesca INP)

The corresponding geographical coordinates and their respective reference points will be established by ministerial resolutions issued by the governing body. These coordinates shall set out the allowable fishing operations and fishing gear, the reserve areas, the areas called 'corralitos' (little pens) and other measures of fishing management.

Based on available scientific evidence and on the socioeconomic results of the fishing activity, according to the fishing type, fishing management systems, allowable catch quotas, fishing seasons and zones, regulation of fishing efforts, fishing methods, minimum catch sizes and other regulations that require the preservation and rational exploitation of hydrobiological resources, the governing body may extend – but may not reduce – this area beyond 8 nautical miles, with the aim of safeguarding the conservation of hydrobiological resources.

In this area, industrial fishing activity is prohibited, except for the extraction of Titi shrimp in the areas called 'corralitos'. The following activities will be exclusively allowed: a) Extraction or capture of fish, crustaceans and mollusks by artisanal fishermen; b) Activities of artisanal mariculture in the areas assigned for it; and c) Extraction of existing resources under all forms of fishing, solely for scientific purposes."

The continuous invasions of industrial boats in search of better catches near the coast, has led to clashes between artisanal and industrial fishermen. Assaults on industrial vessels by artisanal fishermen were reported, with 20 reports of these events during the first half of 2017. This was the cause of the strike of artisanal fishermen in Puerto Bolívar on August 17, 2018, where they blocked the passage of vessels to the Huaylá estuary (El Telégrafo, 2017), and incidents involving infiltrators who looted and attacked the Captaincy's offices of the Ecuadorian Navy in Puerto Bolívar were recorded.

Another aggravating factor in this conflict were recurrent events of small pelagic fish, mainly 'carduma' or 'chuhueco' *Cetengraulis misticetus* that appeared floating near the mouth of the Santa Rosa estuary and that were presumably discarded from industrial vessels because of the opportunity of more profitable catches.

Photograph 21. Fish Cetengraulis misticetus aground in Jambelí beach "We believe that an industrial fishing vessel took a school of this fish and threw it into the sea," said Jorge Luis Vaca, Chairperson of the Jambelí Parish Council. (El Universo, 2014).

3.2 Regulation and support services: The role of mangroves in coastal estuaries

Coastal wetlands comprise communities of characteristic plant formations such as mangroves, marshes, and cyanobacterial mats, which are often distributed as zones parallel to the coastline, responding to elevation gradients that determine the frequency of tidal flooding (Robertson and Alongi, 1992).

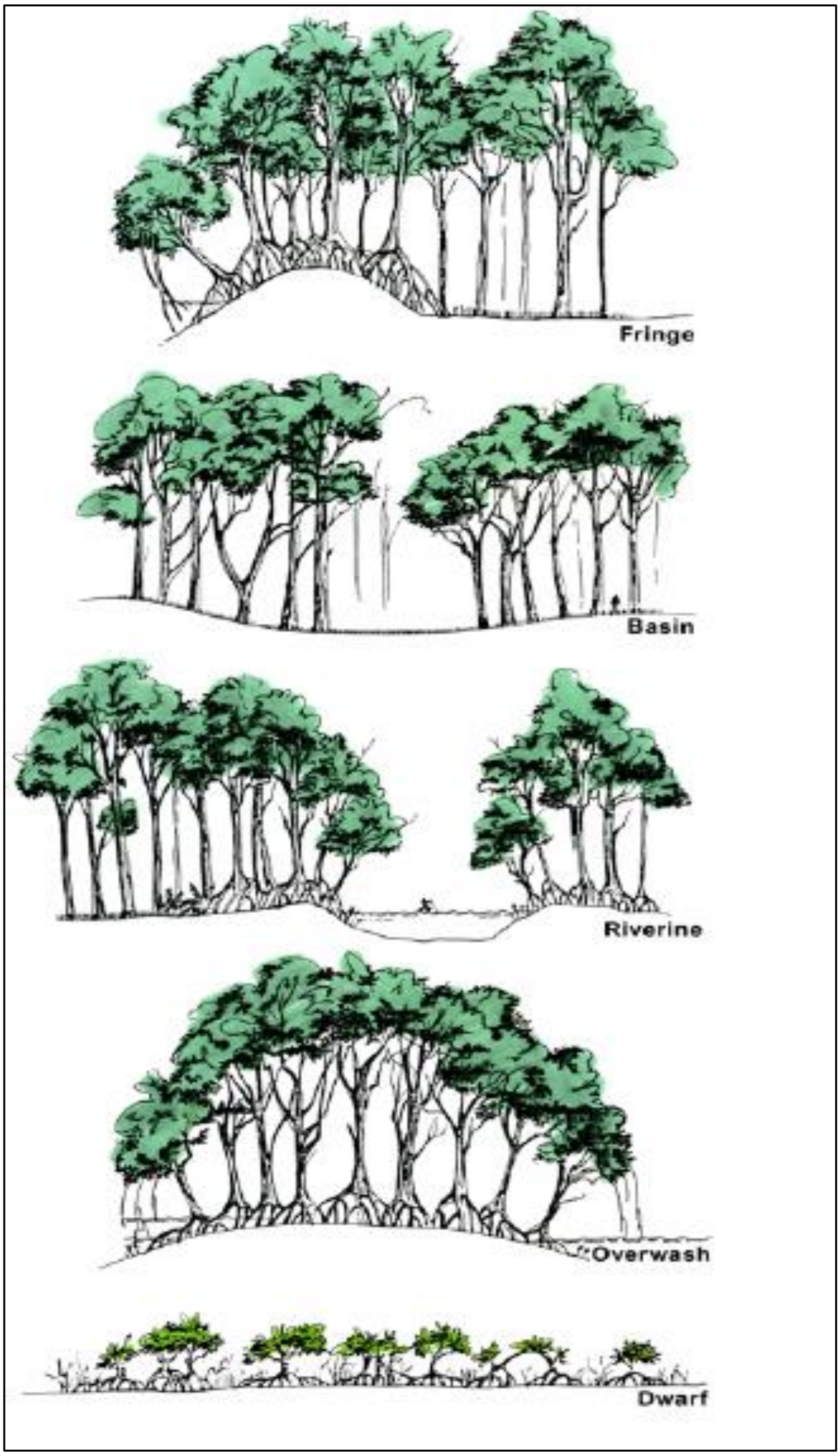
Mangroves are a characteristic type of coastal wetland occurring in the tropical and subtropical intertidal zones and are made up of facultative tree formations or thick halophytic plants (Ball and Farquhar, 1984). They have in common a wide variety of morphological, physiological, and reproductive adaptations that allow them to inhabit extreme environments with an unstable substrate, high contents of organic matter, high temperatures, large fluctuations in salinity and low oxygen concentrations. (Tomlinsom 1986, Hutchings and Saenger, 1987).

In Ecuador, mangroves dominated by Rhizophora are flooded 700 times per year, while those dominated by *Laguncularia*, *Avicennia* and *Conocarpus* are flooded half the time (Bodero, 1993). *Rhizophora mangle* has full exposure to tidal variation and its long supporting roots extending from the trunk and branches stand out, forming frameworks that increase its stability and trap sediments. At a higher altitude, there is the black mangrove *Avicennia germinans* that has long horizontal roots with protrusions called pneumatophores, which emerge and remain exposed to the air and contribute to the stabilization of soils and oxygen supply for underground roots, often found in anaerobic sediments. At a higher altitude and towards the interior of the mangroves, there is the white mangrove *Laguncularia racemosa*, which lacks aerial roots. However, when found in sediments that are poor in oxygen or remain flooded for long periods of time, they often develop peg roots.

Mangroves colonize protected areas along the coast such as deltas, estuaries, lagoons, and islands. The topographic and hydrological characteristics within each of these configurations define a series of different mangrove ecological types (Hoff et al, 2014). The most common ecological types include fringe mangroves, riverine mangroves, basin mangroves, flooded mangroves, and dwarf mangroves (Lugo and Snedekar, 1974; Twilley, 1998), as observed in Figure 9.

The mangrove strips border protected coastlines, channels and lagoons and are flooded by daily tides. Riverine forests flank river channel estuaries and are periodically flooded with nutrient-rich brackish and fresh water. The drainage depressions are located in the interior of the mangrove areas and are home of basin forests, characterized by stagnant or slow-flowing water. Overwash mangroves are frequently located in flooded islets, and dwarf or scrub forests grow in areas where hydrology is restricted, presenting conditions of high evaporation, high salinity or low nutrient status.

Figure 9. Ecological types of mangrove forests, from top to bottom: fringe mangroves, basin mangroves, riverine mangroves, overwash mangroves, and dwarf mangroves (Hoff et al, 2014).



Mangroves provide important environmental services, highlighting the improvement in the management of small-scale commercial fisheries (Hutchison, Spalding and Ermgassen, 2014; López-Angarita et al, 2018), protection against river flooding, stabilization of the coastline, water purification and wastewater treatment and protection against waves (Hamilton and Collins, 2013).

Mangrove forests contribute to the stabilization of the coastline as they represent sediment deposition sites; increased sedimentation can result in the expansion of mangrove habitats. Its framework of roots and stems improves sediment retention, which in turn promotes the growth and expansion of mangroves (Furukawa and Wolanski, 1996).

This accretion of mangroves is the result of increased friction and reduced speed of tidal currents (Woolanski et al, 1992). At the same time, roots and stems generate turbulence that keeps fine sediments in suspension to enter mangrove forests with tidal flooding (Shanbuding et al, 1999). As the tidal flow enters the mangroves, the current decreases, and in the period close to high tide, the current speed approaches zero and flocs are deposited (Furukawa *et al.*, 1997). Sedimentation and accretion processes can be rapid, with vertical accretion of 4 cm $year^{-1}$ recorded in some sites (Alongi *et al.*, 2005).

Mangroves surround coastal plains making up estuarine, and deltaic deposits, and other depositional formations, and are limited to a narrow altitude range within intertidal height (Mckee *et al.*, 2012). The areas of suitable intertidal habitats are called accommodation spaces that occur depending on the state or maturity of mangroves and the geomorphological complexity of larger depositional systems.

An assessment of sediment retention in mangroves in south-west Queensland showed that riverine mangroves had a more homogeneous sediment distribution in the intertidal zone than the tidal mangroves (overwash mangroves) where most of the sedimentation occurred in the marginal zone. The mangrove strip areas retained most of the sediments that entered during a tidal cycle with 0.90 ± 0.22 mg cm^{-2} syzygy $tide^{-1}$ representing $52 \pm 12.5\%$ of the total estimated sedimentation (Adame *et al.*, 2010).

Mangrove distribution on the coastline changes over time and involves a subtle balance between accretion and subsidence, erosion and vegetative stabilization, productivity and decay, tidal flooding, and drainage efficiency (Fitzgerald *et al.*, 2008). Observed and forecasted rates of sea level rise (SLR) could generate impacts on mangroves. This situation raises concern that these wetlands are vulnerable to drowning and coastal compression (Phan *et al.*, 2015). However, recorded rates of sediment accumulation under subtropical mangroves have shown rapid accretion, which in several cases would be faster than rates of sea level rise (Krauss *et al.*, 2014; Mackenzie *et al.*, 2016).

Sediment retention in mangroves protects other marine habitats and is associated with maintaining water quality by filtering sediments, minerals, pollutants, and nutrients from riverine and tidal waters. Mangroves have wide ranges of tolerance to salinity and levels of contamination. However, there are critical thresholds for salinity, the content of heavy metals, organic compounds containing chlorine and sediments, beyond which mangrove will become extinct (Snedekar and Brown, 1981).

Mangroves are complex ecosystems, with high primary productivity, efficient nutrient recycling, and permanent exchange between terrestrial and marine ecosystems as characteristic features (Jennerjahn and Ittekkot, 2002). Despite its high litterfall production and export rates, mangrove debris has been reported to be of little importance in maintaining marine food webs. The geographical distribution of organic matter (OM) derived from mangroves in marine sediments is restricted to its vicinity. Mangroves receive dissolved nutrients from the sea and land, but these inputs are not enough to maintain their high productivity, which can exceed 7,000 mg C m^{-2} per day (Alongi *et al.*, 1992, Bunt, 1992). Internal OM recycling is an important factor to satisfy this high nutrient demand (Holguin et al, 2001). Furthermore, mangrove leaves play a key role in this process as they contain up to 40% water-soluble components that can be converted into bacterial biomass in less than 8 hours after falling into the water (Benner *et al.*, 1986). Crabs recycle and bury mangrove leaves (Robertson and Daniels, 1989), and as a consequence, large amounts of macro detritus and dissolved substances can be exported to adjacent waters.

The increase in biodiversity is another ecosystem service associated with these plant formations. The framework of roots, pneumatophores and submerged branches of mangroves generate nurseries. These are a "habitat for a particular species that contributes proportionally with a greater number of individuals than the average of adult individuals per unit area generated by other habitats used by juveniles" and have ecological importance in the general maintenance of ecosystem functions (Dahlgren *et al.*, 2006).

Beck *et al.* (2001) hypothesized the abundance of food as the main causes of the high number of juvenile fish and shrimp in mangroves, lower predation pressure in shallow aquatic microhabitats with increased turbidity and reduced visibility relative to nearby unvegetated habitats and their complex physical structure. These factors would act synergistically to cause the nursery role of mangroves, increasing the density, growth and survival of juvenile fish and invertebrates.

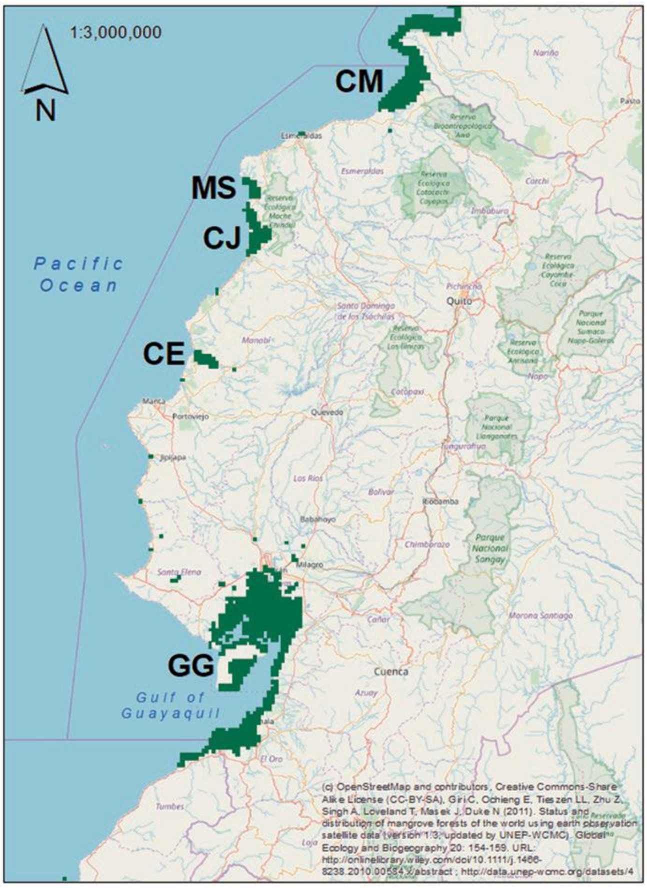
Hutchinson, Spalding and Ermgassen (2014) argue that the provision of food and refuges in mangroves improves fish production in general, i.e., its high primary productivity provides the basis for food chains that enhance the growth of fishing resources and, at the same time, the three-dimensional structures of channels, pools and complexity of submerged roots and branches provide protection against predation as well as shading and reduce water flows. Hamilton and Snedekar (1984) estimated that 80% of the fish caught in Florida's commercial and sport fishing activities were dependent on mangroves. Furthermore, Paw and Chaw (1991) determined that 72% of commercial fishing catches in the Philippines depended on mangroves. Mangrove fishing productivity has exceeded US$ 18,000 ha/year (De Groot *et al.*, 2014).

Mangroves are scarce and important in ecosystem terms. Their global coverage amounts to 154,085 km^2 (Hamilton and Casey, 2016), representing 1% of the total area of tropical forests, and 0.4% of the global forest coverage (FAO, 2007; Van Lavieren *et al.*, 2012; Sanderman *et al.*, 2018). Tropical forests are the richest in carbon per unit area, containing approximately 1023 Mg carbon*ha^{-1} (Donato *et al.*, 2011), and these forests sequester 3% of atmospheric carbon.

These forests are disappearing faster than internal forests and coral reefs (Duke et al, 2007). The decline is mainly caused by the development of activities in agriculture, aquaculture, tourism, urban development, and its own over-exploitation. In the last century, 50% of the planet's mangroves have been lost, and in the period 1980-2000, 35% of their global coverage would have been lost (Giri *et al.*, 2011).

In Ecuador, there are 161,835 ha of mangroves (MAE, 2017) that represent 8% of South American mangroves, which in turn are 11% of the world mangrove coverage (Giri *et al.*, 2011). Mangrove conservation has been controversial due to the excessive installation of shrimp farms in areas that were previously mangroves and the continuous demands of fishermen, shellfishers and social activists demanding mangrove recovery (Ocampo-Thomason, 2006; Veuthey and Gerber, 2012; Latorre, 2014).

Figure 10. Sectors in Ecuador that host mangroves include CM= Cayapas Mataje, MS= Muisne, CJ= Cojimíes, CE= Rio Chone, GG= Gulf of Guayaquil. (Hamilton, 2019)



According to the laws of Ecuador, mangroves are a public good and an object of conservation. The main policy for their conservation is to grant concession on mangrove areas to associations of fishermen, shellfishers and tourism entrepreneurs (Rodríguez, 2018). The former Subsecretaría de Gestión Marino Costera [Undersecretariat of Coastal Marine Management, or SGMC by its acronym in Spanish] was responsible for these processes called Agreements for Sustainable Use and Custody of Mangroves (AUSCM), which are based on the rights of ancestral use of fishing lands and a form of co-management that ensures access to communities dependent on fishing resources (Beitl, 2017).

The National Action Plan for the Conservation of Mangroves of Mainland Ecuador (Carvajal and Santillan, 2019) was established in 2019 and stated: *"In areas of influence (buffer) of the mangrove ecosystem, implement actions that promote the transition to sustainable production systems. By improving productivity and promoting the adoption of good agricultural, forestry and aquaculture practices."*

The installation of shrimp ponds in mangroves has been prohibited since 1978. However, mangrove clearing for this purpose has continued for 2 decades, and since 2011, Resolution 056 is in force, which involves a fine of US$ 89,273.01 for each hectare of affected mangroves. This value in considered loss of environmental goods and services and a cost of restoration. This instrument allowed the initiation of multiple legal processes and managed to stop the production of mangrove charcoal.

Hamilton (2019) deepens the changes that occurred in estuaries with mangroves on the Ecuadorian coast. The changes of the last century are shown in Figure 11.

Figure 11. Evolution of mangrove cover recorded in hectares in the period 1969-1999. Excerpted from Hamilton, 2019.

Table 1.3 Ecuadorian mangrove forest cover by year and province when available, 1969–1999

Year/Hectare	Esmeraldas	Manabí	Guayas	El Oro	Total	Author
1969	32,343	12,099	122,615	35,144	202,201	CLIRSEN (2007)
1979					203,700	Parks and Bonifaz (1994)
1980					203,000	UN FAO (2004)
1984					182,100	Parks and Bonifaz (1994)
1987	29,257	6401	116,065	23,403	175,126	CLIRSEN (1987)
1987					237,700[a]	Spalding et al. (1997)
1990					163,000	(UN FAO 2004)
1991					196,000	UN FAO (2004)
1991	23,969	6953	109,928	20,918	161,768	Bodero (1993)
1991					177,600	Harcourt and Sayer (1996)
1992			109,000		246,900[b]	Spalding et al. (1997)
1999	23,189	1797	104,586	18,911	148,483	CLIRSEN (2007)
1999					149,556	UN FAO (2007)

Figure 12 shows that the province of El Oro practically lost 50% of its mangrove cover in the period 1969-2020. Stuart Hamilton is one of the greatest researchers of mangrove loss in Ecuador and worldwide. Table 6 shows environmental services that would be obtained from mangroves worldwide according to Stuart Hamilton.

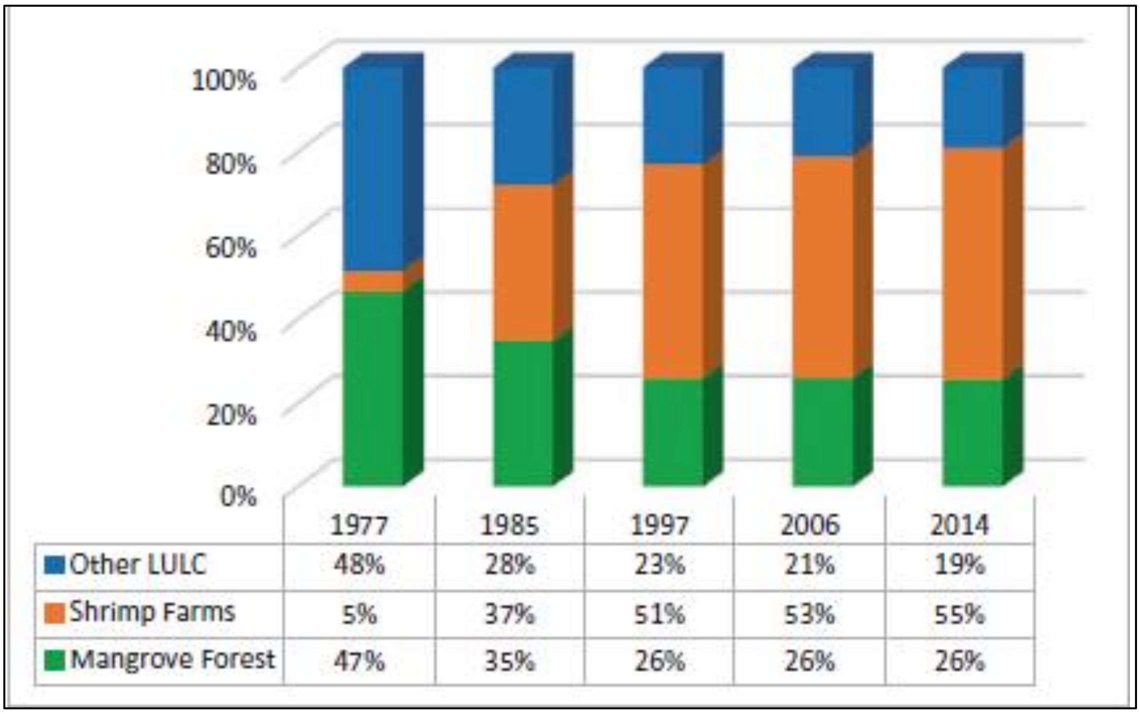
Table 7. Environmental services provided by mangroves according to Hamilton's classification.

Food	**Wood**	**Mitigation**	**Habitat**	**Others**
Wild shrimp	Coal	River flood control and protection	Diversity maintenance	Tourism
Fish	Firewood	Stabilization of the coastline	Fish farm	Recreation
Fish bait	Boats	Wind protection	Habitat for juveniles	Medicinal plants
Mollusks/clams	Posts	Water treatment	Migratory bird habitat	
Crabs	House construction	Waste treatment	Coral habitat support	
Traditional aquaculture products	Thatched roofs	Carbon sequestration	Pollinating bats and bees	
Shellfish	Smoked fish	Groundwater management		

Edible rinds		Treatment of pollutants from agriculture		
Edible plants		Storm surge and tsunami protection		
Pollinating species				
Sugar				
Honey				
Alcohol				

The province of El Oro has had a devastating loss of mangroves whose temporal evolution is shown in Figure 12.

Figure 12. Changes in land use from 1977 to 2014 in the province of El Oro. Please note that mangroves were practically reduced by half in 37 years (Hamilton, 2019).



The remaining mangroves have been granted in concessions to fishing-related civil society organizations, with a national total of 68,055.93 ha of mangroves granted in Agreements for Sustainable Use and Custody of Mangroves (AUCEMS) with 23 10-year concessions located in the province of El Oro.

Table 8. Mangrove area granted in concessions by the former Subsecretaría de Gestión Marino Costera [Undersecretary of Coastal Marine Management, or SGCM], update June 2019

Province	No. of Agreements	Hectares of mangroves granted in Custody	%
Guayas	24	52581,49	77.26%
Esmeraldas	5	826,82	1.21%
Manabí	2	61,8	0.09%
El Oro	23	14585,82	21.43%
Santa Elena	0	0	0.00%
Total	54	68055,93	

Based on these background, it is suggested to pay close attention to the management of mangroves in this Project. Some identified remaining mangroves could be affected by the expansion to the north of the current Dock 6.

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5. ANNEXES

ANNEX 1. Fishing record sheet sample

ENVIRONMENTAL AND SOCIAL ASSESSMENT, PROJECT PUERTO BOLIVAR – PHASE 1

– ASSESSMENT OF SENSITIVE HABITATS –

Prepared for:

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December 2020

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EXECUTIVE SUMMARY

This report presents an inventory and general description of the habitats found in the area of influence of the Puerto Bolivar Project, in order to categorize them as natural or modified areas, and to find critical habitats that require an action plan for their protection. The approach for determining the types of habitats is of a precautionary nature and responds to ecological, socio-cultural and economic criteria linked to the generation of ecosystem services. The different sites were identified and entered into maps.

The natural and modified habitats were geo-referenced after direct observation trajectories by approaching the coastal edge, describing the main activities carried out in their vicinity, as well as rapid ecological evaluations of strategic sectors for environmental assessments.

A description is made of the evolution of land use, in particular, the loss of mangroves to shrimp production, which has been occurring over the last five decades, and which has promoted the protection, by the Ecuadorian state, of the remaining mangrove remnants, mainly on the borders of shrimp farms.

It is estimated that the only critical habitat is the mangrove remnants located in the vicinity of the current Naval and Coast Guard School of the Navy of Ecuador, which are approximately 0.6 ha of mainly dwarf mangroves that could be affected by the expansion of the current pier 6, which in turn would generate a positive effect of increased subtidal biological fouling that would develop on its piles.

At a macro level, it is considered that the greatest risk faced by the area of influence is the unstoppable rise in sea level, a global effect that is not related to the Puerto Bolivar project and that postpones to a second level the potential and diminished effects that could result from activities related to the Puerto Bolivar project.

ASSESSMENT OF SENSITIVE HABITATS

1. Introduction

Performance Standard 1 specifies that all projects with environmental risk and potential impact are subject to a social and environmental assessment process. The types and significance of biodiversity are assessed and the potential impact of project-related activities is considered, taking into account the location and scale of the activities, the proximity of the project to areas of important biodiversity, and the type of technology to be employed. Assessing the significance of project impacts on the suite of biodiversity levels is an integral part of the Environmental and Social Assessment process. The main threats to biodiversity include habitat destruction and invasion of exotic species.

Performance Standard 6, Biodiversity Conservation and Sustainable Management of Natural Resources, describes the objectives of the Convention on Biological Diversity, promoting the use of renewable resources in a sustainable manner, and addresses how threats to biodiversity due to project activity can be avoided or mitigated.

Habitat destruction is recognized as the greatest threat to the preservation of biodiversity. Habitats can be:

- Natural: aquatic and terrestrial areas where the biological communities consist mostly of native plant and animal species and where human activity has not substantially modified the primary ecological functions of the area.
- Modified: areas altered by the introduction of foreign plant and animal species, as in agricultural areas.
- Critical: subset of both natural and modified habitats; determined by the presence of high biodiversity values, including endemic species, at risk of extinction, or habitat that is required for the survival of a species or particular behaviors of these.

In practice, natural and modified habitats exist in a diversity of manifestations. Both may have characteristics that, a priori, could belong to the other, and both are capable of supporting significant biodiversity at all levels, including endemic or threatened species. Thus, identifying an area as natural or modified habitat can be a complex process.

A project may involve a mosaic of habitats, where each will need to be addressed in a manner consistent with the requirements outlined in Performance Standard 6.

2. Habitat types and action plans

Performance Standard 6 recognizes the need to consider impacts on biodiversity of habitats, natural or modified, as modified habitats can have significant biodiversity value, and this is where the private sector develops its projects.

2.1 Modified habitats

Modified habitats may provide suitable living space for many plant and animal species, although the quantity and quality of ecosystems and their species, as well as the ecosystem services they could provide, have been diminished by changes to the original natural habitat.

In his presence, precautions should be taken to minimize any further transformation or deterioration and, depending on the nature and magnitude of the project, identify opportunities to enhance such habitats and protect and conserve biodiversity as part of its operations.

2.2 Natural habitats

In areas of natural habitats, the customer shall not significantly modify or deteriorate such habitats unless the following conditions are met:

- There are no other technically and financially viable alternatives;
- The overall benefits of the project outweigh the costs, including the costs to the environment and biodiversity;
- Any modification or deterioration is appropriately mitigated.

Mitigation measures will be designed to achieve no net loss of biodiversity, where possible, and may include a combination of actions, such as:

- Restoration of habitats after the operation
- Offsetting losses through the creation of a comparable area or areas to be managed for biodiversity purposes.
- Compensation for direct users of biodiversity

2.3 Critical habitats

Critical habitat is a subset of natural and modified habitats that deserves special attention. It meets at least one of the following characteristics:

i) a large number of endemic or restricted-range species are found only in one specific area

ii) the presence of species known to be extremely endangered or at risk of extinction

iii) habitat that is required for the survival of a particular migratory species or to support globally important single gatherings or numbers of individuals of congregatory species

(iv) unique assemblages of species that cannot be found elsewhere

v) areas that are of significant scientific value due to the presence of evolutionary or ecological attributes

vi) areas that include biodiversity that has social, cultural or economic significance of importance to the local communities

vii) areas recognized as being of paramount importance for the protection of ecosystem services (such as aquifer protection)

Projects should be carried out in critical habitat only if it can be demonstrated that they will not have a measurable adverse impact on the ability of the critical habitat to maintain the high biodiversity value. Populations of any species recognized as endangered or critically endangered (according to the IUCN Red List) must not be reduced.

2.4 Legally protected areas

In the event that the proposed project is located in a legally protected area, in addition to the requirements for critical habitats outlined above, it shall comply with the following requirements:

- Act in a manner consistent with the management plans of the defined protected areas.
- Consult on the proposed project with protected area managers or sponsors, local communities and other key stakeholders.
- Carry out other programs, as appropriate, to promote and enhance the conservation objectives of the protected area.

Ensure that project activities are consistent with any national land use or management criteria, resource uses and management criteria (including Protected Area Management Plans, National Biodiversity Action Plans or similar documents).

2.5 2.5 Invasive or Foreign Species

An foreign species is one that is introduced beyond its original range. Invasive foreign species are species that can become invasive or spread rapidly in competition with other native plants and animals when introduced into a new habitat that lacks their traditional controlling factors. Invasive foreign species are recognized as a major threat to biodiversity worldwide.

The intentional or accidental introduction of exotic or non-native species of flora and fauna into areas where they are not normally found can constitute a significant threat to biodiversity, as some foreign species can become invasive, spreading rapidly and overtaking native species.

The project shall ensure that it does not intentionally introduce new foreign species unless it does so in accordance with the existing regulatory framework for such introduction, if any, or undergoes risk assessment (as part of the project's Social and Environmental Assessment) to determine potential invasive behavior. Shall not intentionally introduce any alien species with a high risk of invasive behavior or any recognized invasive species, and shall use its best efforts to avoid any accidental or unintentional introductions.

3. Methodology

Yilport project Phase 1 is being developed in a coastal marine ecosystem. To diagnose the characteristics of the area's habitats and direct influence on this ecosystem, a bibliographic research of the historical changes in land use in the area of influence, with emphasis on the coastal marine edge, was carried out.

Then, an in situ identification was carried out by means of coastal navigation in a 7.5 m fiber boat propelled by two outboard motors (Yamaha 75 Hp and Suzuki 90 H), setting sail from the Puerto Bolivar coastal dock between October 30 and November 3 of this year, supported by a map of the main sectors that served as an initial reference.

In some sectors it was necessary to disembark to verify aspects that attracted attention, scanning the coasts while navigating parallel to it with the use of Buschnell Binoculars, to observe details of those sectors that could not be accessed due to low tide limitations or for safety reasons. UTM coordinates (WGS84) were taken at all sites with a Garmin Etrex 400 GPS and the coordinates that could not be taken in situ were taken in the body of water to be subsequently transferred to the coastal profile, when building the corrected map of sensitive sectors and infrastructure by a GIS specialist.

After the inventory, we proceeded to estimate the potential loss of habitats that could be attributed exclusively to the Puerto Bolivar project, estimating the potential affected area that should be observed during and after the construction phase of the expansion to the north of Pier 6.

For each habitat and sensitive site, general aspects of the site were recorded on cards with photographic support, which are attached to this report.

Table 1 shows the criteria for categorizing the identified sectors, sites and infrastructure.

Table 1. Categorization of sensitive areas, sites and infrastructure in the area of influence of the project.

Code	Description	Relevance
PAP	Pedestrian artisanal fishing	Ecosystem service of socioeconomic importance
PACM	Artisanal motorized coastal fishing	Ecosystem service of socioeconomic importance
PAF	Artisanal fishing with fixed gear	Ecosystem service of socioeconomic importance
DCC	Shrimp dams	Ecosystem service of socioeconomic importance
MGI	Internal mangroves	Ecological/ Socioeconomic
MGC	Coastal mangroves	Ecological/ Socioeconomic
BOC	Mouths or outlets of estuaries	Ecological
ESC	Breakwaters or protective rockfaces	Ecological/ Social
BAJ	sandy shallows, shells, muds that emerge at low tide	Ecological/ Social
WITH	Shells or empty shells aggregation beaches	Ecological/ Social
PAJ	Bird aggregation sites	Ecological
TUR	Sectors with tourist exploitation	Ecosystem service of socioeconomic importance

Prepared by: Ecosambito, 2020

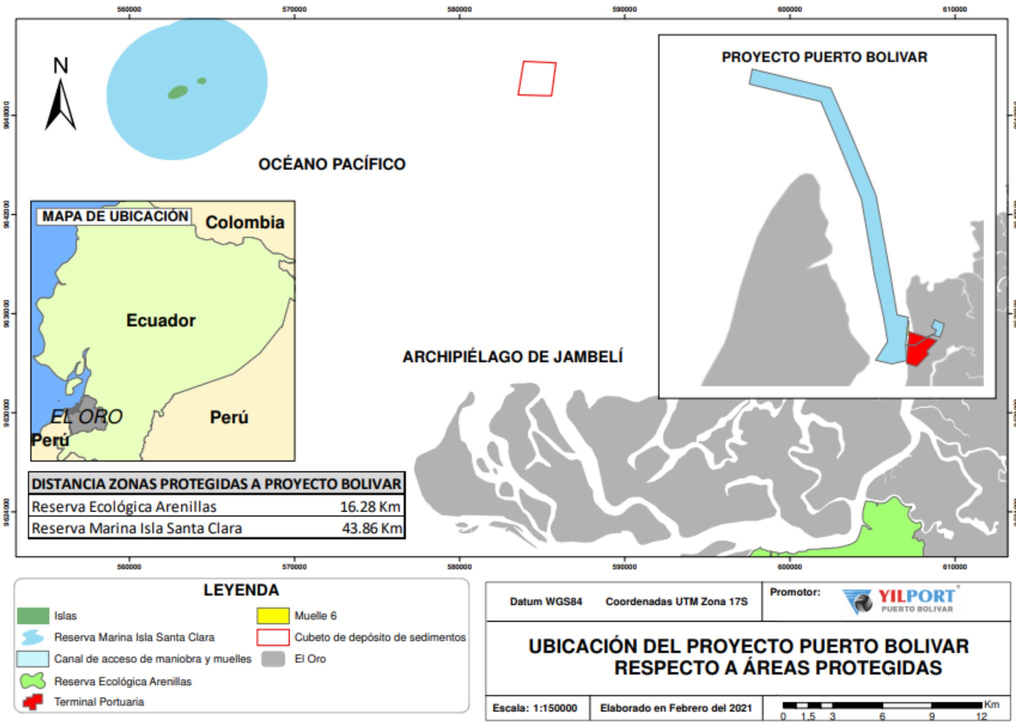
4. Results

4.1 Legally protected areas

The Certificate of Intersection of the project with the National System of Protected Areas (SNAP), State Forest Heritage (PFE) Forests and Protective Vegetation (BVP), showed that it DOES NOT INTERSECT with any category of areas protected by the Ecuadorian State.

The following map shows the relationship of the project's location with respect to the protected areas closest to the project.

Figure 11Protected areas in the vicinity of the project



Prepared by: Ecosambito, 2020

As can be seen in the image, the Santa Clara Island Marine Reserve is located 43.86 km from the dredging sediment dump area, while the Arenillas Ecological Reserve is located 16 km south of the Port Terminal. All port terminal activities are carried out towards the northern sector of the terminal, and there is no possibility of interaction with the Arenillas Reserve. Something similar happens with Santa Clara Island, since dredging activities are carried out to the east, while the island and its marine area are located to the west.

Santa Clara Island Marine Reserve. It is located at the entrance of the Gulf of Guayaquil, about 43 kilometers west of Puerto Bolivar, and about 25 kilometers southwest of Puná Island, belonging to the province of El Oro. It was declared a protected area on March 6, 1999, according to Ministerial Agreement A-83, through Official Register No. 219 of June 24, 1999. For the conservation of oceanic islands that are highly vulnerable to erosive anthropogenic activities and the protection of their species. The protected area includes Santa Clara Island, the surrounding islets and two nautical miles around it. Its ecosystem is made up of rocky reefs, wetlands, and a marine-coastal transitional ecosystem where the main currents and cold water masses converge. It has terrestrial-coastal, marine and aerial habitats. Among the endemic species are frigate birds, Fregata magnificens, brown pelicans, Pelecanus occidentali and blue-footed boobies, Sula nebouxii, among others.

Arenillas Ecological Reserve. It is located in southwestern Ecuador, in the province of El Oro, near the border with Peru, between the towns of Arenillas and Huaquillas. It covers more than 17,000 ha. The Arenillas Ecological Reserve was declared a protected area more than 60 years ago, but was officially recognized in 2001. It was declared a protected area for the conservation of its ecosystems and habitats of endangered species. The reserve has been included in Ecuador's National System of Protected Areas since June 2001. The reserve includes forest and dry scrub ecosystems of southwestern Ecuador, although commercial timber trees have already been extracted. It is dominated by lowland deciduous forest and tropical dry scrub. The vegetation becomes shrubbier as you get closer to the coast, where there are 2,800 ha of mangroves. There are about 153 bird species, 35% of which are endemic. The reserve contains the following endangered birds: Macareño parakeet (Brotogeris pyrrhoptera), Anambé Pizarra (Pachyramphus spodiurus) and Black-headed Curassow (Synallaxis tithys). Arenillas is an important site for Tumbesian endemic species. The mangrove areas are an important aggregation site for resident and migratory congregatory species.

4.1.1 National legal protection in favor of mangrove ecosystem.

Due to the accelerated expansion of shrimp farming and the dangerous decline of the mangrove ecosystem, Law No. 91, Official Registry No. 495 of August 7, 1990, incorporates mangrove forests into the State Forest Patrimony.

Article 769 of the Regulations to the Organic Environmental Code of Ecuador declares the mangrove swamp as an "Important Ecosystem".

> *"In the coastal area, mangroves and other coastal wetlands, as well as the natural remnants of dry forest found in watersheds with coastal frontage, will be considered as ecosystems of importance for the conservation and management of biodiversity."*

For its management and sustainable use, it states in Article 265 that "*The agreements for sustainable use and custody of the mangrove ecosystem constitute a mechanism for conservation, granted by the National Environmental Authority. These agreements may be granted and awarded to mangrove users who carry out traditional activities permitted within the mangrove".*

The possible modification of this ecosystem will be granted exceptionally by means of a motivated resolution (art. 278), and may include cutting or pruning the mangrove, as well as productive activities that require permanent maintenance for navigation, risk prevention, opening of transit easements, docks or port works.

Such resolution may be issued once the proponent has obtained the corresponding environmental administrative authorization, and shall contain:

a) The determination of the area of restoration and compensation of mangrove cover, depending on the type of project, in a mangrove ratio of 6 to 1 for each hectare cleared in the totality of the project, in the areas of restoration prioritization defined by the National Environmental Authority, who will approve the areas where the compensation of mangrove cover will be carried out; and,

b) Proof of payment for monetary compensation, equivalent to the total costs of restoration of the affected area.

4.2 Inventory of sites of interest and identification of main habitats

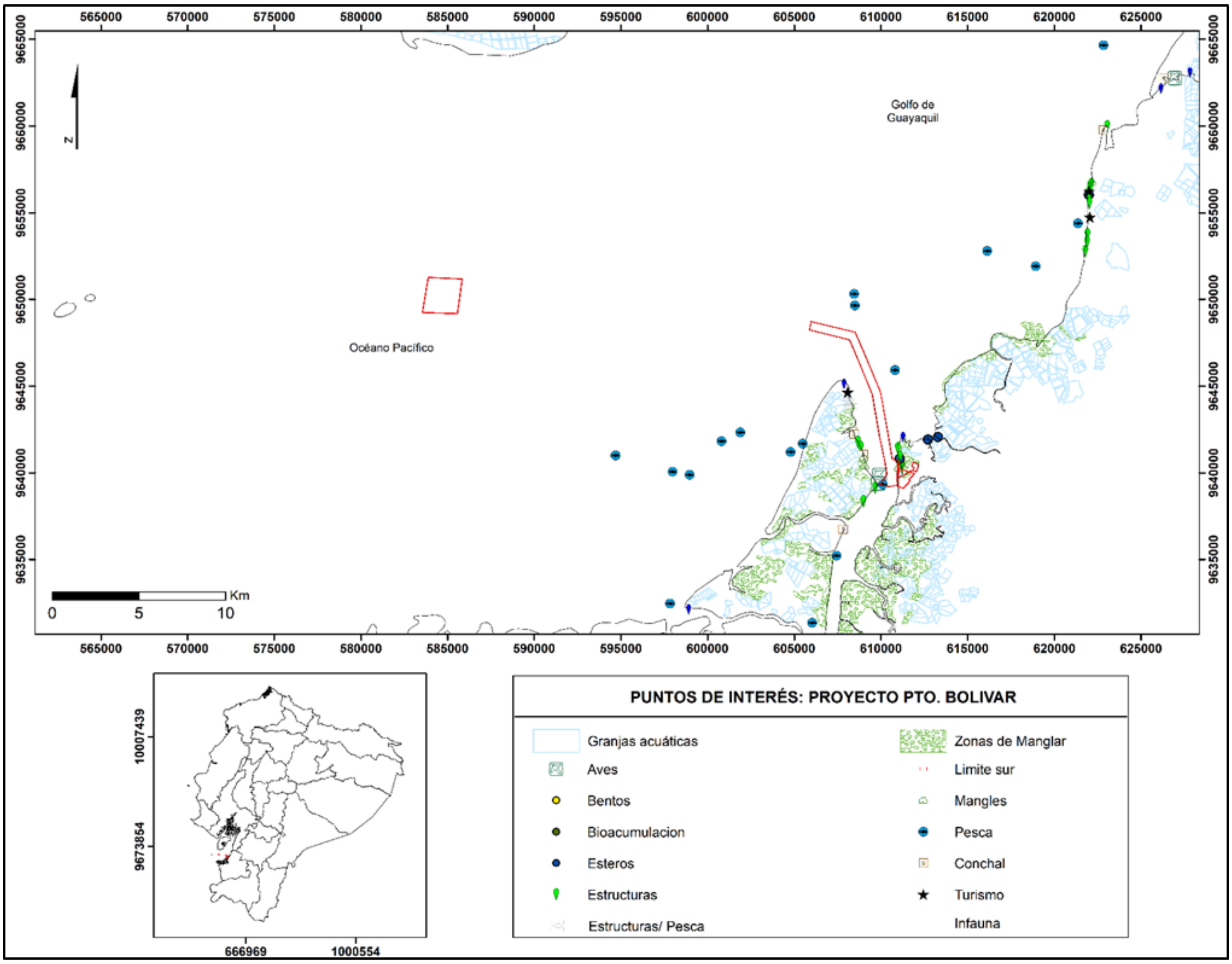
Table 2. Sites inventoried in routes parallel to the coastline

Type of record	Code	Site / legend	X	Y
Infauna	TUR1	Jambelí Beach	9645120	607858
Infauna	PAP1	Love Island Beach	9642172	610724
Fishing	PACM1	Shrimp fishing	9642332	601881
Fishing	PACM2	Shrimp fishing	9641826	600801
Fishing	PACM2	Shrimp fishing	9641010	594685
Fishing	PACM3	Shrimp fishing	9639886	598957
Fishing	PACM4	Shrimp fishing	9640066	597977
Fishing	PACM5	Shrimp fishing	9641202	604788
Fishing	PACM6	Shrimp fishing	9641688	605485
Mangrove	MGC1	Yilport 1	9640272	611029
Structures	ESC1	Heliport	9640374	611044
Structures	ESC2	Liceo Naval	9640424	611022
Mangrove	MGC2	Yilport2	9640510	611058
Mangrove	MGC3	Yilport3	9640624	611065
Structures	ESC3	Enrocado	9640624	611045
Mangrove	MGC 4	Yilport4	9640754	611044
Estero	BOC1/ESC5	The Dead	9640818	610988
Structures	ESC4	Shrimp wall 1a	9640904	610978
Structures	ESC4	Cam1b rockfill wall	9641424	610838
Estero	BOC2	Water Outlet Love Island Beach	9643268	610744
Estero	BOC3	Blind estuary	9644832	611507
Multipurpose	TUR2	Coco Beach		
Fishing	PAF2	Handbags 1	9652794	616128
Fishing	PAF2	Handbags 2	9664704	623081
Birds	PAJ1	Pajarada1	9664636	623194
Infauna	BAJ1 PAJ2	La Puntilla Islet	9663698	623495
Infauna	BAJ2 PAP2	La Puntilla	9662266	623542
Beach	TUR4	Playa de Arena home	9662868	622490
Structures	ESC 5	Beach Ruin	9660654	622619
Beach	TUR4	Sand beach end	9660180	622610
Mangrove	MGC5	Dead Mangrove	9656776	621926
Structures	ESC6	Breakwater #1	9656664	621910
Structures	ESC7	Breakwater #2	9656514	621895
Structures	ESC 8	Breakwater #3	9656368	621912
Tourism	TUR3	Balneario Bajo Alto	9656246	621944
Structures	ESC9	Breakwater #4	9656154	621966

Type of record	Code	Site / legend	X	Y
Esteros	BOC4	Estero Bajo Alto	9656036	621994
Structure	ESC10	Shrimp wall	9655846	622000
Structures	ESC11	Petroamazonas wall start	9655562	622023
Tourism	ESC11	Petroamazonas Wall End	9654726	621560
Fishing	PAF3	Handbags 3	9654392	621367
Structures	ESC12	Shrimp wall	9653796	620762
Structures	ESC13	Shrimp wall	9653346	620448
Structures	ESC14	Shrimp wall	9652886	620095
Fishing	PAF 4	Caletera network 1	9651916	618927
Fishing	PAF 5	Caletera network 2	9639978	609762
Tourism	TUR 4	La Playita Pier	9644642	608379
Structures/ Fishing	ESC 15	Shrimp and Tape Wall 3	9644204	608548
Structures/ Fishing	ESC15	Shrimp and Tape Wall 4	9643698	608674
Beach	CON1	Conchal #1	9642540	608990
Beach	CON2	Conchal #2	9642226	609065
Structures	ESC16	Shrimp wall	9641798	609219
Structure	ESC17	Shrimp wall	9641480	609345
Structures	CON3	Conchal #3	9641038	609517
Mangrove	MGC6	Dead mangrove / shrimp farm	9640832	609601
Mangrove	MGC7	Dead mangrove end / shrimp farm	9640388	609778
Birds	PAJ3	Pajarada2	9639866	609894
Birds	PAJ4	Nesting Frigates	9639380	609840
Structures	ESC 18	Shrimp wall	9639140	609710
Structures	ESC19	Shrimp wall	9638346	609160
Beach	CON4	Conchal 4	9636766	608015
Fishing	PACM7	Guajabal Cove	9635226	607428
South boundary		Pongal Estuary	9630994	606800
Fishing	PACM8	Mangrove fishing	9631356	606029
Infauna	BOC5	Pongalillo Beach	9632120	598897
Fishing	PACM 8	Fishing	9632466	597828
Fishing	PACM9	Shrimp fishing	9649650	608497
Fishing	PACM10	Shrimp fishing	9650320	608444
Fishing	PACM 11	Artisanal bowling	9645930	610805
Fishing	PACM12	Inland fishing	9639322	610102

Prepared by: Ecosambito, 2020

Figure 2. Identification of points of interest in the marine-coastal area, according to observation tours.



Prepared by: Ecosambito, 2020

From the above description, the following habitats are found along the coastal edge of the area of influence:

- mangroves
- sand and mud beaches
- aquaculture infrastructures, for fishing facilities and shoreline protection

Table 3. Identification of main habitats.

Ecosystem	Description	Habitats		
		Natural	Modified	Possibly Critic
Mangroves	Mangroves are a characteristic type of coastal wetland that develops in tropical and subtropical intertidal zones and are made up of facultative tree formations or dense halophytic plants (Ball and Farquhar, 1984). They have in common a wide variety of morphological, physiological and	X	X	X

Ecosystem	Description	Habitats		
		Natural	Modified	Possibly Critic
	reproductive adaptations that allow them to inhabit extreme environments with unstable substrate, high organic matter content, high temperatures, large salinity fluctuations and low oxygen concentrations (Tomlinsom 1986, Hutchings and Saenger, 1987). In Ecuador, all mangroves are considered, in its legislation, as State Forest Heritage, and their logging is totally prohibited, under penalty of significant economic fines and mandatory remediation. In addition, the state promotes the sustainable use of the fishery resources that grow under the shelter of this ecosystem through Sustainable Use and Mangrove Custody Agreements (AUSCM), which over the years have become an important source of socioeconomic development for the ancestral user communities of these resources.			
Sand/sludge/shell beaches	They are intertidal flooding sectors of low slope where the accumulation of sediments of mineral or biological origin and even human waste occurs, the length of these beaches is variable as they can be from less than 100 meters to kilometers long. Most of the sandy beaches present in the area of influence are considered dissipative based on their gentle slope and the presence of fine sands and muds, with wide intertidal ranges (Defeo,2018). The width of the intertidal fringe of exposed beaches of Jambelí Island is less than those observed in exposed beaches of the Jambelí channel and internal beaches of Estero Santa Rosa. The muddy beaches inside Estero Santa Rosa harbor important populations of infauna and particularly of bivalve mollusks, mainly two types of clams, mussels and zangaras, both for local consumption and for commercialization, as these fisheries are not regulated.	X	X	
Piers and artificial coastal structures	In this category you will find: - Port infrastructure of the Puerto Bolivar project - Minor docks mainly in the Huaylá estuary - Wooden jetties and various types of coastal protection known as breakwaters, which can be located directly on the coastal edge or, as in the case of two seaside resorts, parallel to the coastal edge but distanced from beaches, as well as perpendicular to beaches in order to reduce the movement of water and reduce the erosive effect of the sea on them. Solid infrastructures such as rockfill or concrete structures, in addition to stabilizing the coastal edge, generate a positive effect on the environment by providing solid substrates for the settlement and development of a greater number of marine invertebrates, whether encrusting or populations of other invertebrates and fish that find refuge among them, increasing the diversity of species with respect to soft-bottom sediments, In this way, a positive effect is expected with the extension of the current pier 6 of the Puerto Bolivar project, since it		X	

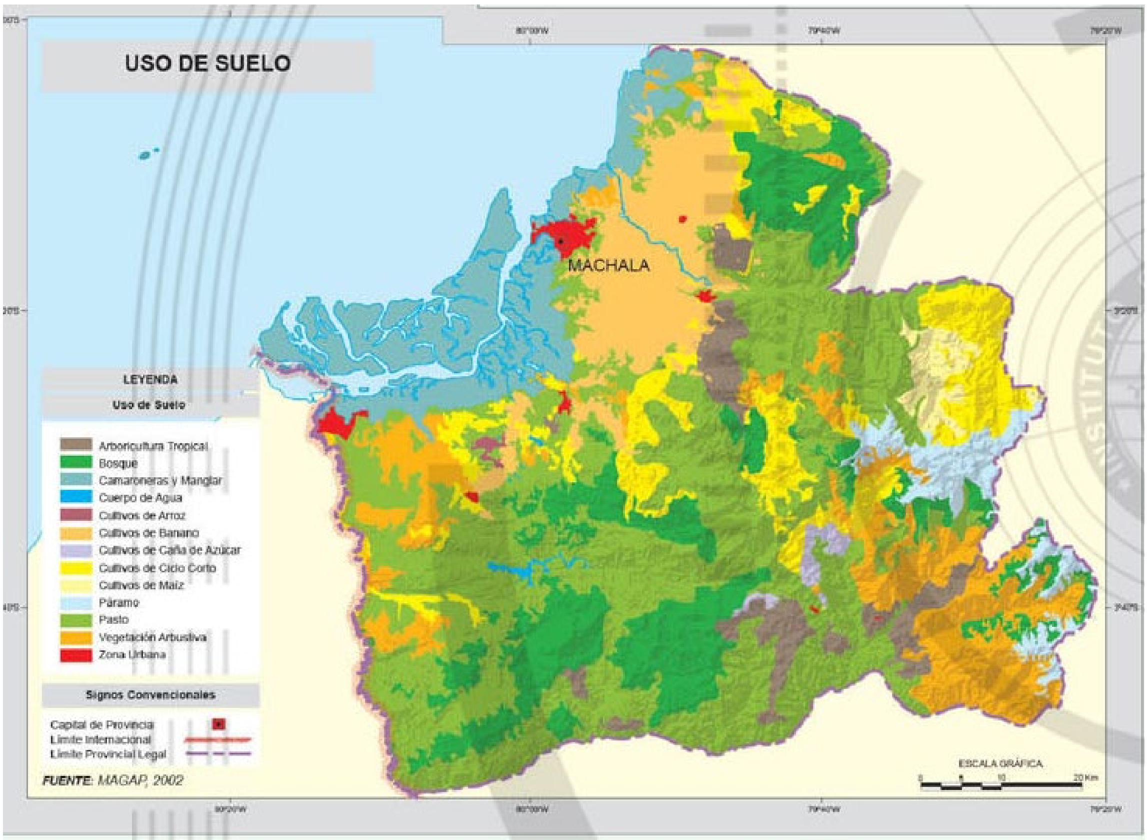
Ecosystem	Description	Habitats		
		Natural	Modified	Possibly Critic
	would increase populations of encrusting invertebrates and fish in the area, since these are sectors with restricted access where fishing activities are not practiced, serving as small local reserves.			
Shrimp farming facilities	This is a specific modification designed to contain water in extensive shallow pools to which water is pumped from the environment with high tides by suction pumps, the water contained in these pools is fertilized and shrimp larvae are added for production, which must be fed, in addition to requiring a daily partial water replacement to increase the natural food intake and decrease the accumulation of organic pollutants in the water column. Shrimp farm effluents or outflows are characterized by a high degree of organic enrichment and decrease planktonic and benthic diversity. These facilities are the majority in terms of coastal area used and are shown with light blue boxes as "aquatic farms" on the map in Figure 4.		X	

Prepared by: Ecosambito, 2020

4.3 Description and historical transformation of habitats in the project area.

The magnitude of land use change or degree of habitat transformation along El Oro's coastline is a controversial issue in the province, whose land use map is shown in Figure 3. The map does not distinguish between shrimp farms and mangroves, after which comes a strip of permanent crops and pastureland extending to the foothills of the mountains, and the main population centers are shown in red. Practically the entire coastal plain has been altered for decades.

Figure 3. Map of land use in the province of El Oro.

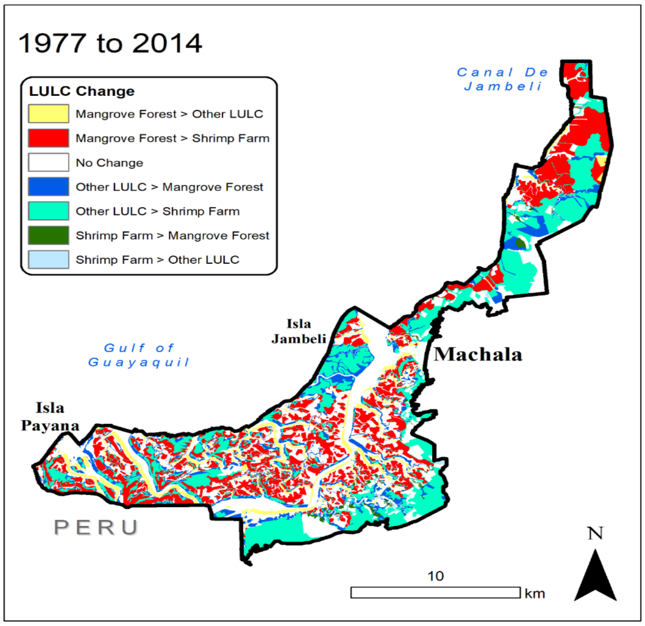


Source: Instituto Geográfico Militar del Ecuador, taken from www.geoportaligm.gob.ec

More than half of the territory shown as shrimp and mangrove farms was transformed from mangroves to shrimp farms in the last 43 years. Although no recent publicly available studies are available, the magnitude of this transformation is evident in the period 1977 to 2014 shown in Figure 4 and taken from Hamilton (2020).

As can be seen, the mangroves present in the area of influence of the project correspond to remnants of major forests cut down since the mid 1970s, leaving in most of the coastal sectors, small "patches" of mangrove forests that appear in blue, remnants bordering saturated sectors of shrimp ponds that appear in turquoise and red.

Figure 4. Change in land use in the province of El Oro



Source: Hamilton, 2019

In turn, these remnants show different conditions, including the loss of tall mangroves towards the northern coastal edge of the town of Bajo Alto, where the first strip of red mangroves of a few kilometers is already lost, and a forest of dead trunks can be observed. At the end of this strip of mangroves there is an extensive sandy beach with ruins of structures that have been devastated by the rising sea level.

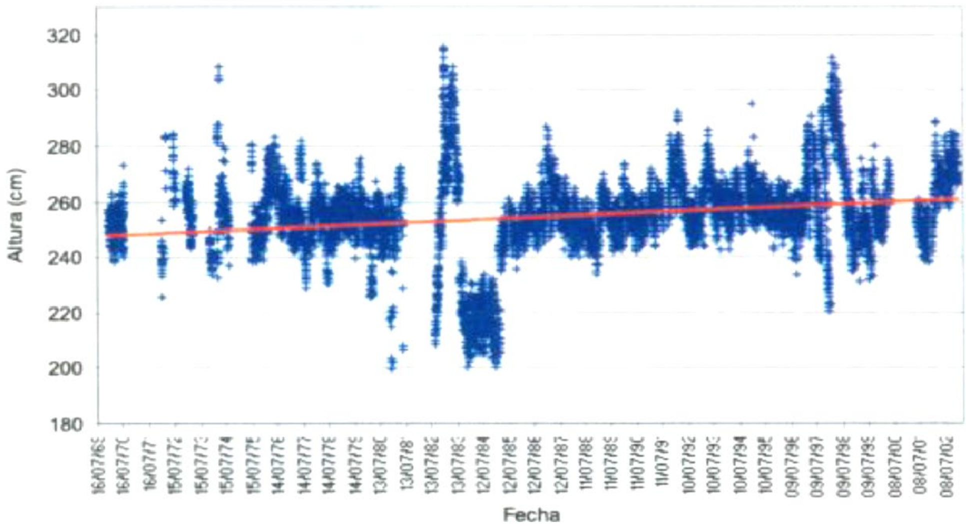
At this point, it is important to mention that the greatest agent of coastal transformation is the rise of the sea along the coastline of the province of El Oro, a situation that is evidenced by the construction of numerous rocky protections (breakwaters) that seek to protect certain sectors. These structures are common in shrimp farm walls in the Jambelí archipelago. Likewise, in places of tourist importance such as Bajo Alto and Playa Jambelí, where the state has had to invest millions of dollars to protect beaches.

In order to dimension this problem, a study on the evolution of sea level from 1970 to 2002 by Leonor Vera (2003), where corrected data from the mean sea level (MSL) of the Puerto Bolivar tide gauge station was analyzed, shows the rising trend shown in Figure 5. The author determined that in the study period (32 years), the sea level had risen 16 cm or 0.5 cm/year. Without adjusting any calculation and maintaining this trend, the sea level would have risen 8 cm more until today, surpassing the local sea level rise to the world average estimated between 21 to 24 cm from 1880 to 2009 (Lindsey, 2009).

To the south of Bajo Alto, reaching Playa Coco, the mangroves are of medium size and are interrupted by numerous reinforcement structures, mainly rockfill that serve as protection for shrimp pool walls and closer to the town of Bajo Alto, the protection structures of the gas pipeline from the Amistad Platform that connects to the Machala Power electricity generator.

Within the Santa Rosa estuary different mangrove conditions are observed, but in general terms larger trees are observed as you move away from Puerto Bolivar south to the Pongal estuary, however, in front of the seawall of Puerto Bolivar two sectors of significant seabird activity were identified: An aggregation of Frigatebirds and Cormorants, while to the north an important aggregation of wading birds was observed in the sector of La Puntilla; at this point the sectors called Bajeríos become important, which correspond to sectors of rest and feeding of birds with low tides forming an extensive strip of shallow depth between Bajo Alto to El Coco beach.

Figure 5. Sea Level Rise at Puerto Bolivar 1970-2002



Source: INOCAR, 2004.

The muddy and mixed-bottom beaches present in the Santa Rosa estuary are important for fishing and ecology, they concentrate an important infauna that is exploited by residents of Puerto Bolivar and Machala, and although when reviewing other beaches such as the internal sector of La Puntilla and Pongal beach where the presence of several edible species was evidenced, these are not exploited to the level observed in Isla del Amor and on the inner margin of Jambelí Island where daily exploitation of clams occurs.

Motorized coastal artisanal fishing is carried out practically throughout the entire area of direct and indirect influence of the Puerto Bolívar project[1], and if the observation routes had been extended to the southwestern margin of Puna Island, the northern continental margin passing the mouth of La Puntilla or southward through the Jambelí archipelago, or to the west, if they had sailed to Santa Clara Island, the same situation would have been observed. The entire coastline and inland waters are routinely fished.

During bimonthly monitoring conducted in the last two years in the dredge basin sector, in all samples, small vessels were observed fishing, as well as the transit of small and industrial vessels heading to Santa Clara.

Although all coastal water is exploited, according to the testimony of fishermen interviewed during fishing operations, they mentioned that fishing grounds vary according to the season and the change in natural supply in major sectors and that within major sectors there are

[1] The Ecosystem Services report elaborates on this activity by elaborating on the provision of goods

several sites (fishing grounds) that are systematically checked. Generally speaking, when a fisherman has a good catch in a specific fishing ground, that fishing ground is exploited for 2-3 days until its productivity declines and another fishing ground is tried. However, there is a sectorization with respect to distance from the coast: the shrimp fishery is coastal, in shallow sectors associated mainly with outlets of bodies of water or mouths that flow into the Jambelí Channel, and passive gear such as bags are installed in the vicinity of these.

Some fish have main fishing grounds with specific dates such as the bet to exploit large corvina, these, although they are captured in coastal and inland bodies of water, the largest pieces are achieved in the Jambelí channel taking advantage of their migration towards inland waters of the Guayas system. In deeper sectors and farther from the coast, larger fish are caught in riskier and more expensive operations.

4.4 Invasive species

One way in which marine transportation can impact the biodiversity of the area where it operates is the unintentional transfer of invasive species through ballast water that the ship takes on board in one port and then discharges in another to compensate for the loss or increase in weight due to the loading or unloading of goods. This water can bring marine species such as bacteria, viruses, protozoa, phytoplankton and some macroscopic species, and can include human pathogens. Another way of transporting invasive species can be through fouling on the hulls of ships.

The diversity of organisms that can survive in a new aquatic environment is limited. For a species transported in ballast water to be successful, the following factors play a role: water temperature range and time in which the temperature is favorable, tolerance to salinity, suitable ecological conditions (habitat, predators, food sources).

Although equatorial zones, are not classified as Potentially Hazardous Zones (Baro & Stotz, 2018), there are actions that can be executed to reduce the risk of invasion of alien species, such as: 1) Verification of Compliance with the Ballast Water Report, 2) Verification of the ballast water source zone, 3) quantify the risk associated with ballast water discharge and ballast water replacement check, in case risk factors are identified.

5. Critical habitats

Puerto Bolivar Phase 1 project will basically influence marine-coastal habitats, with practically no influence on terrestrial ecosystems, hence the fact that the Critical Habitats analysis focuses on these ecosystems.

Critical habitats are areas of high biodiversity value that include at least one or more of the five values specified in paragraph 16 of Performance Standard 6 or other recognized high biodiversity values. From the analysis in Critical Habitats, the following results are obtained.

Table 4. Results of the Critical Habitat analysis.

NO.	CRITERIA	RESULTS	COMPLIANCE WITH CRITERIA
1	Endangered (EN) or Critically Endangered (CR) Species	Although there are insufficient data to determine compliance with thresholds for these criteria, species with CR and EN status were determined: 3 species of birds, 16 of fish, 1 of invertebrates and 1 of reptiles, in marine-coastal ecosystems.	NO
	Endemic or geographically restricted species	The coastal marine ecosystems in the study area belong to the Tumbes-Chocó-Magdalena eco-region, which covers 1500 km of coastline (greater than 500 km of linear geographic extension considered as a threshold for coastal species).	NO
	Migratory species or species forming congregations	Migratory species: Mantas, sharks, and humpback whale Megaptera novangliae were identified. Congregations in mangroves: Because of their role as *nurseys* for aquatic species Congregations: Santa Clara Island involves the largest congregation of seabirds and pinnipeds in the area.	YES
	Highly threatened or unique ecosystems	The mangrove ecosystem and marine ecosystem, including Santa Clara Island, are identified as highly threatened ecosystems.	YES
5	Key evolutionary processes	The mangrove ecosystem presents evolutionary processes, due to its contribution to climate change adaptation, thanks to its capacity to achieve sedimentation and coastal stabilization.	NO

Prepared by: Ecosambito, 2020

Therefore, the presence of critical habitats is determined in the area of direct and indirect influence of the project, consisting of the mangrove and marine ecosystem, including the Santa Clara Island Marine Reserve.

6. Conclusions

The area where the Puerto Bolívar project is being developed is an area that has undergone major transformations in its ecosystems over the last five decades. Although most of the habitats in the vicinity of the project have been modified, they still retain ecological or socioeconomic importance.

Although there are critical habitats in the area of influence of the Puerto Bolívar Port Terminal, the area where the project is located has been in operation for 60 years, while the expansion area has been completely disturbed. The closest mangrove area is the Jambelí archipelago, on the other side of the Santa Rosa Channel, 2 km from the Port Terminal. Although this ecosystem will not be threatened by the expansion project, it is extremely important, due to its biodiversity value, that mechanisms be implemented to promote its conservation.

Regarding the marine area, the area around Santa Clara Island is located in the limits of the area of indirect influence, and could have interaction with maritime traffic; however, port traffic would not represent the greatest threat to this ecosystem, whose greatest pressure comes from fishing activities.

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8. Annexes

ANNEX 1. Sensitive Habitats Identification Sheets

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PUERTO BOLÍVAR PROJECT – STAGE 1

– CRITICAL HABITATS –

Prepared for:

[Yilport Puerto Bolívar logo composite mark]

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Prepared by:

[Sambito logo composite mark]

ECOSAMBITO C.LTDA.

December 2020

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ACRONYMS

AAEA	Ecologically Appropriate Area of Analysis
APPB	Puerto Bolívar Port Authority
CMS	Convention on the Conservation of Migratory Species
CR	Critically Endangered
DAC	Qualitative Environmental Diagnosis
DD	Data Deficient
DMU	Discrete management unit
EN	Endangered
ESIA	Environmental and Social Impact Assessment (EIAS by its Spanish acronym)
GN	Guidance Note (NO by its Spanish acronym)
ICF	Forestry Conservation Institute
IUCN	International Union for Conservation of Nature (UICN by its Spanish acronym)
IBAs	Important Bird and Biodiversity Areas
IBAT	Integrated Biodiversity Assessment Tool
KBA	Key Biodiversity Area
LC	Least Concern
MAAE	Ministry of Environment and Water of Ecuador
MLWS	Mean Low Water Springs
MIF	Multilateral Investment Fund
NE	Not Evaluated
NT	Near Threatened
RMISC	Isla Santa Clara Marine Reserve
RVS	Wildlife Refuge
SNAP	National System of Protected Areas
UNESCO	United Nations Educational, Scientific and Cultural Organization
VU	Vulnerable

EXECUTIVE SUMMARY

This report presents the Critical Habitat assessment within the area of influence of Puerto Bolívar project according to the definition of these types of habitats established in Performance Standard 6 of the International Finance Corporation (IFC) that regards them as “areas with high levels of biodiversity, such as i) habitats of major significance to the survival of endangered or critically endangered species; ii) habitats of major significance to the survival of endemic or restricted-range species; iii) habitats that sustain the survival of significant world concentrations of migratory or congregatory species; iv) unique or highly endangered ecosystems, or v) areas associated with key evolutionary processes”. This conceptualization is achieved through 5 assessment criteria with their corresponding selection thresholds, which have been used in the performed assessment.

In addition to the information gathered from biotic monitoring and tracking procedures conducted throughout two years in the project area of influence, supporting information has been used in the form of an Integrated Biodiversity Assessment Tool (IBAT) database report specifically on Puerto Bolívar project area; a sighting occurrence report from the *Global Biodiversity Information Facility* (GBIF), together with an extensive bibliographical research.

The analysis shows that Critical Habitats do exist in the area of influence according to 3 of the 5 criteria established by IFC, Criterion 2 (Endemic or restricted-range species), Criterion 3 (Migratory or congregatory species) and Criterion 4 (Unique or highly endangered ecosystems), namely: Archipiélago Jambelí due to its mangrove ecosystem and Isla Santa Clara Marine Reserve (RMISC).

Although there is no doubt that the Project activities will not directly affect these habitats, they may suffer from some indirect effect given their vulnerable condition. Therefore, in agreement with the provisions in IFC Guidance notes of Performance Standard (ND by its Spanish acronym) 6, a portfolio of initiatives has been designed which constitute the Critical Habitats Management Plan whose aim is to achieve tangible benefits associated with the aim of preserving of these habitats.

CRITICAL HABITATS

1. Introduction

Performance Standard 6 acknowledges that the protection and conservation of biodiversity, the maintenance of environmental services and the sustainable management of live natural resources are essential to sustainable development. The requirements laid down in this ND are based on the Convention on Biological Diversity that defines biodiversity as “the variability of live organisms from any source, including, but not limited to, land and marine ecosystems as well as other aquatic ecosystems and the ecological systems they are a part of; it includes diversity within each species, between species and of ecosystems.

The applicability of said Performance Standard is defined during the identification of environmental and social risks and impacts, whereas the fulfillment of the necessary actions in order to meet the requirements herein set forth is managed via the client’s social and environmental management system, whose elements are explained in Performance Standard 1.

The identification of environmental and social risks and impacts will take into consideration the endangerment of biodiversity and environmental services, while strongly emphasizing habitat destruction, decline and fragmentation, invasive exotic species, overexploitation, changes in hydrology and nutrient pollution and contamination. It will also consider the different values that affected communities and, where appropriate, other social actors ascribe to biodiversity and ecological services.

2. Methodology

Critical habitats are areas with high levels of biodiversity, such as habitats of major significance to the survival of endangered or critically endangered species; habitats of major significance to the survival of endemic or restricted-range species; habitats that sustain the survival of significant world concentrations of migratory or congregatory species; unique or highly endangered ecosystems, or areas associated with key evolutionary processes.

2.1 Criteria for defining critical habitats

Critical habitats are areas of high biodiversity levels. ND6 establishes 5 criteria on which any critical habitat assessment must be based:

- Criterion 1: Endangered (EN) or critically endangered (CR) species
- Criterion 2: Endemic or restricted-range species
- Criterion 3: Migratory or congregatory species
- Criterion 4: Unique or highly endangered ecosystems
- Criterion 5: Key evolutionary processes

Numerical thresholds are defined for the first four criteria for decision-making purposes, whose source is the IUCN, a global standard for identifying key biodiversity areas and red list categories and criteria. Thresholds are indicative and merely serve orientation purposes for decision-making. There is no standard formula for defining a critical habitat; the involvement of outside experts and the performance of project-specific assessments is highly important, particularly when data are limited.

There are no numerical thresholds for Criterion 5. Instead, the best scientific information available must be used, as well as expert opinions, in order to guide decision-making with regard to the critical importance of a habitat in these situations.

Table 1. Criterion and thresholds for defining Critical Habitats

	Criterion	Thresholds
1	Endangered (EN) or Critically Endangered (CR) species	a) areas that keep heavy world concentrations of a species appearing in IUCN Red List as CR or EN (≥ 0,5% of world population and ≥ 5 reproductive units of a CR or EN species)
		b) areas that keep heavy world concentrations of a species identified as Vulnerable (VU) in IUCN Red List, whose loss would lead to a change in the Red List species status to CR or EN and which would reach the thresholds of item NO72a);
		c) where appropriate, areas containing large concentrations of a species listed as CR or EN at a national or regional level.
2	Endemic or restricted-range species	a) areas that typically contain ≥ 10% of world population and ≥ 10 reproductive units of a species. • For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO of less than 50,000 km². • For marine systems, restricted-range species are provisionally being regarded as those with an EOO (extent of occurrence) of less than 100,000 km^2. • For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km wide at any point (for example, rivers), restricted-range species are defined as those having a global distribution of less than or equal to 500 km linear geographic span (i.e. the furthest distance between two occupied locations).
3	Migratory or congregatory species	a) areas that cyclically or regularly keep ≥ 1% of the world population of a migratory species or one that congregates at any point in the species life cycle;
		b) areas that predictably sustain ≥ 10% of a species world population during periods of environmental stress.
4	Unique or highly endangered ecosystems	a) areas representing ≥ 5% of the world expanse of a type of ecosystem that fulfills UICN CR or EN condition criteria;
		b) other areas still not assessed by IUCN but which are considered of high conservation priority in regional or national systematic conservation planning.

	Criterion	Thresholds
5	Evolutionary processes of key importance	There are no thresholds; assessment elements will depend on each case.

Prepared by: Ecosambito, 2020

Projects located within a nationally or internationally recognized area of high biodiversity value may require a critical habitat assessment, for example:

- areas that fulfill the criteria for UICN categories of protected areas I.a, I.b. and II;
- key biodiversity areas (KBAs), which include important bird conservation areas (IBAs).

In accordance with the mitigation and management requirements of Performance Standard 6, projects in some areas are not considered suitable for financing, with a few exceptions. This group includes the following areas:

- natural and mixed sites declared World Heritage by UNESCO;
- sites that fulfill the Alliance for Zero Extinction (AZE) designation criteria

2.2 Data collection

The assessment of critical habitats was aided by the collection of secondary information data which will be compared against the IBAT tool (www.ibat-alliance.org), whose report, with a 50 km buffer of Puerto Bolívar project, is shown in ANNEX 1. IBAT reports provide biodiversity database information (protected areas, essential for biodiversity and species) from global databases, hence they can store rather general information of the studied areas; therefore, monitored and/or spotted species within the area of influence are included in the species assessment as part of the regular bimonthly biotic monitoring procedures conducted between 2018 and 2020, in addition to the samplings carried out with the aim of complementing biodiversity and tracking analysis of traditional fisheries developed in November 2020; whose list is shown in Annex 11. List of identified species in Puerto Bolívar area of influence. Lastly, the IBAT database was checked against databases that are updated at a national level, such as BioWeb[1] from Pontificia Universidad Católica del Ecuador, the Ecuadorian university with the most outstanding professional background in biological research, and FishBase[2] which updates fish databases at a global level.

[1] www.bioweb.bio

[2] www.fishbase.de

3. Ecologically Appropriate Area of Analysis

According to Performance Standard 6 of the IFC, the analysis of Critical Habitats requires the definition of the Ecologically Appropriate Area of Analysis. For that purpose, the potential distribution of valued species or ecosystems must be taken into consideration, as well as the patterns, processes, characteristics and ecological functions necessary for their maintenance, whether it be within or beyond the project area of influence limits.

In order to define the Ecologically Appropriate Area of Analysis, it is required that the ecosystems developing in the project vicinity be identified. The term ecosystem (the integration of living beings, i.e. biocenosis, and the environment, i.e. biotope) is useful when related to the concept of Habitat which, according to the ND6 of the IFC at the section devoted to biodiversity protection and conservation, is defined as the terrestrial, riverine or marine geographical unit or airway that sustains the lives of groups of living organisms interacting with the non-living environment.

Puerto Bolívar Expansion Project Stage 1 is located at Puerto Bolívar parish in Cantón Machala, El Oro province, on the southern coast of Ecuador. El Oro is a province that harbors 18 types of different ecosystems throughout its surface of over 5,000 km^2 (GADPEO & INABIO, 2018). This ecosystem variety is largely influenced by its topography dominated by broad coastal plains, particularly characterized by mangroves, grasslands and lowland forests that are traversed to the south by the Andes mountain range with the Chilla and Tahuín formations, and which accommodate from moorland forests and grasslands to foothill, semi-deciduous and evergreen forests. The northeast region comprises the foothills that descend from Mollepungo mountain range until reaching the Gulf of Guayaquil (GADPEO & INABIO, 2018).

Basing the analysis on the project area of indirect influence, it is observed that this area is located at the oceanic coastal interface of Canal de Jambelí and Archipiélago de Jambelí, where important marine habitats develop, such as the mangrove ecosystem and marine habitats of high biodiversity such as Canal de Jambelí and Isla Santa Clara. Likewise, the continental coastal border and Isla Puná at its southern end show the presence of a mangrove ecosystem, interrupted throughout its entire distribution by shrimp farms. At the continental region, only modified habitats can be found, e.g. The Machala urban region, bordered almost entirely by banana monoculture plantations. The presence of these soils fully transformed for intensive production purposes significantly hinders the potential ecological connectivity with other natural habitats, which begin to reappear towards the east in the vicinity of Los Andes mountain range, and towards the south at the Arenillas region characterized by the presence of dry forests.

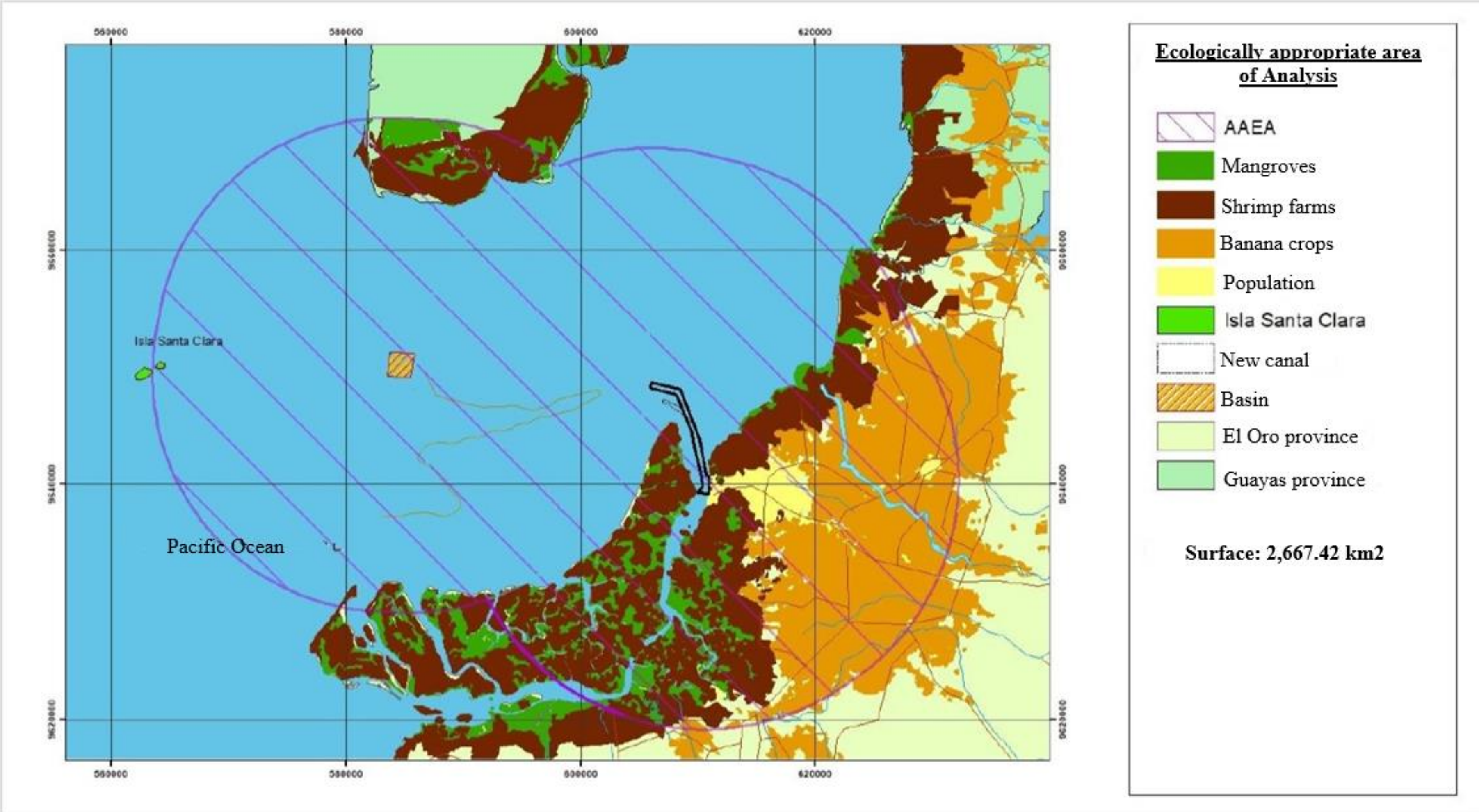
Table 2. Natural and modified habitats, and occupied surface within the AAEA.

Ecosystem/ Habitat	Type of Habitat	Surface area (km^2)
Isla Santa Clara and the marine reserve	Natural	43.00
Mangrove	Natural	145.85
Canal de Jambelí and oceanic area	Natural	1,300.00
Shrimp farms	Modified	563.42
Banana crops	Modified	462.36
Isla Puná	Natural Modified	60.00
Urban area	Modified	56.74

The area of indirect influence is deemed sufficiently representative to be used as the Ecologically Appropriate Area of Analysis (AAEA) for the study of critical habitats, given the presence of the main marine coastal ecosystems which are essential for the biodiversity of the region, and for their importance in providing the ecosystem services in Figure 1.

The AAEA has a surface area of 2,667 km^2, of which 2,169.36 km^2 pertain to the marine and marine coastal region.

Figure 1. Ecologically Appropriate Area of Analysis.



3.1 Description of the AAEA.

The southern region of the Gulf of Guayaquil shows distinctive hydrological and oceanic characteristics: it is the region that makes the most significant freshwater contribution to a marine system given its location south of Río Guayas river mouth, which entails a major supply of organic matter and continental nutrients that increase its primary productivity: on its oceanic side it receives a boost of oxygen, and a thermal regulation originating from the cold Humboldt Current, which entails an ecotone among coastal species of warmer inner currents and species from colder oceanic water bodies.

From a physical perspective, 3 main regions can be distinguished that will influence the habitat distribution of present resources and which will ease subsequent assessments, namely: Canal de Jambelí, Archipiélago de Jambelí and Isla Santa Clara.

Canal de Jambelí. Its source is at the mouth of Río Guayas, and continues along Archipiélago de Jambelí. It borders Isla Puná to the north and the Ecuadorian continental coast to the east; the approximate length of the canal is 70 km, with a width of 10 km at its initial section and of 30 km at its final end. It has the typical funnel shape ending in marine terraces as a result of tectonic uplifts (Rada, 1986).

Figure 2. Satellite image showing sediment entrainment in Canal de Jambelí

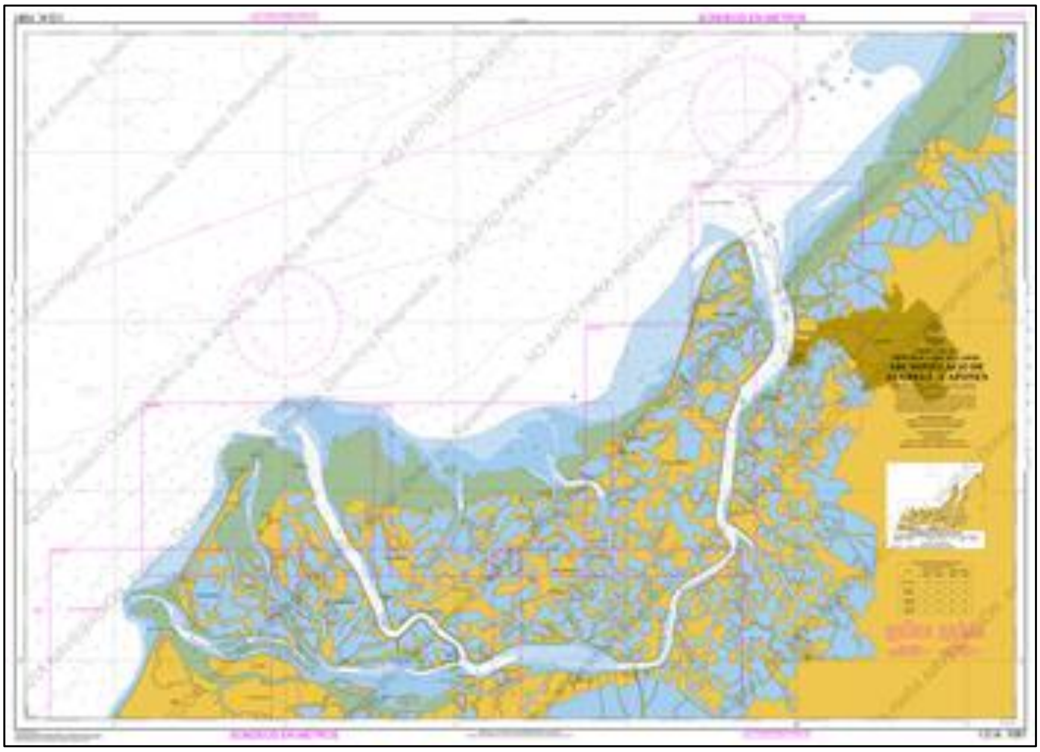
The maximum depth recorded at the mouth of Canal de Jambelí is 90 m, and its middle course oscillates between 50 m and 70 m; it is characterized by the sole presence of soft bottoms and ample intertidal spaces in the continental margin as illustrated in Figure 2 with green and light blue colors, where the access to coastal towns is restricted to high tides, thus its residents must install demarcation “handles” associated with water stream mouths to the canal which in turn enable routes that vary constantly so as to access or set sail in smaller vessels.

Mariana Jácome de Solórzano and Liliana Llanos studied the sediments at Canal de Jambelí in 1987, and pointed out that on the coastal border regions there was an abundance of silty clay sediments with 60% silt content, 35% clay and 5% sand; further away from the coastal border there was a predominance of silty sediments with 70% silt, 20% clay and 10% sand; in addition to sandy silt sediments with 35% silt content, 10% clay and 55% sand located towards the mouth sector, and finally sandy sediments covering small segments of the canal which have 20% silt, 10% clay and 70% sand.

Canal de Jambelí consists of a natural habitat of estuarine waters with soft bottoms, being high turbidity one of its main characteristics as can be appreciated in satellite images that show its major riverine influence, and therefore, it has significant drag and sediment dispersion, as shown in Figure 2. Canal de Jambelí is flanked on both sides by mangroves, which will be commented on later.

Archipiélago de Jambelí. The main isle is a sandy formation of medium grain size D50 equal to 0.48 mm, and is located approximately at 3 m above sea level. Tidal range oscillates between 2 m and 2.5 m. Erosion processes are abundant at Isla Jambelí, being waves and sea level changes the main sources of this issue, such that abnormal effects like El Niño or Pacific tropical storms cause serious damages in a few hours or days (Leonor Vera, 2007).

Figure 3. Archipiélago de Jambelí, chart 1081



Source: www.inocar.mil.ec

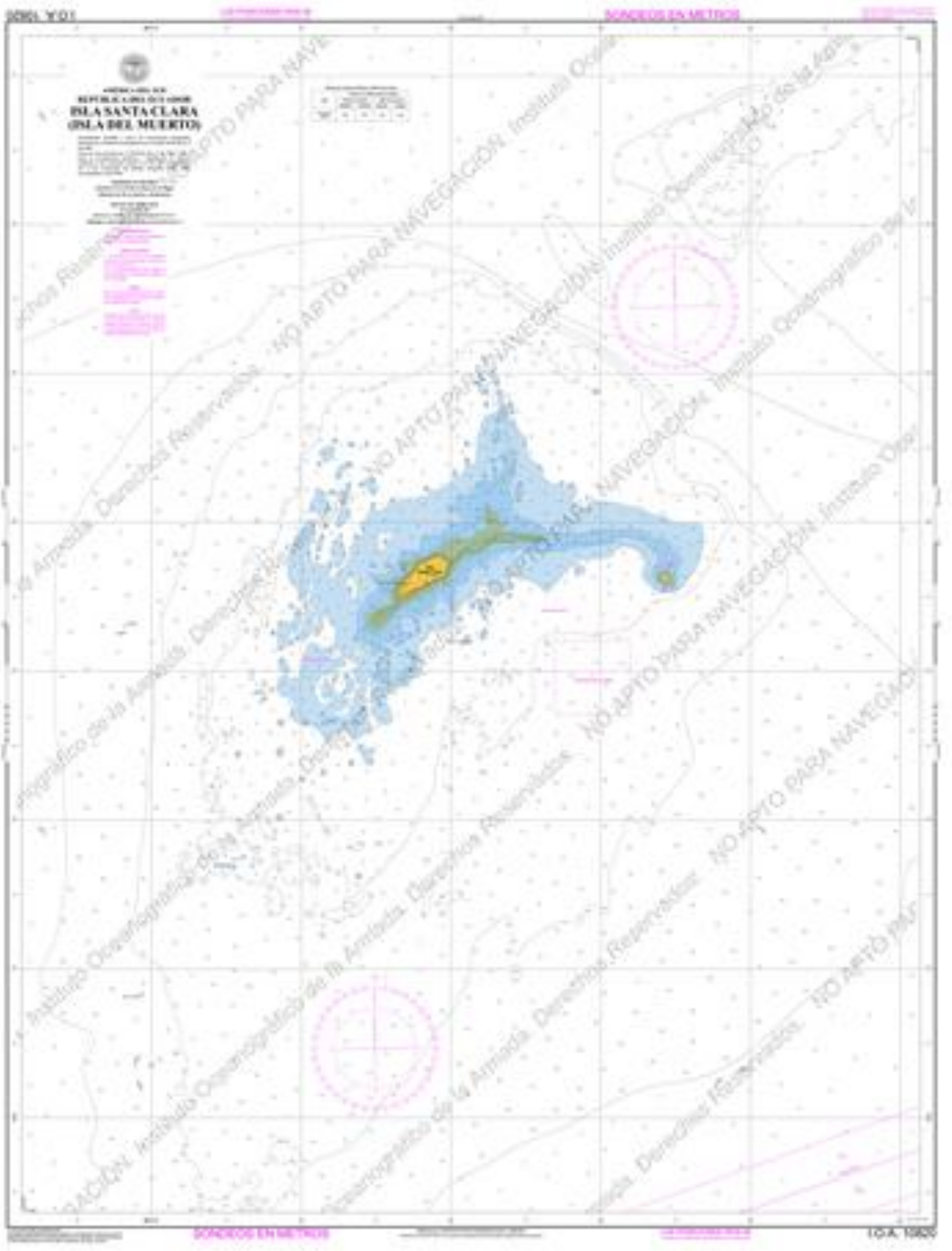
Figure 3 shows that Archipiélago de Jambelí has multiple inner water streams with mangrove presence dominated by the *Rhizophora mangle* species (Red Mangrove) and very few salt pans and highlands. Towards the segment under sea exposure, there are intertidal spaces several kilometers long with low tides, being coastal navigation restricted to smaller vessels. The heaviest soil use in the archipelago pertains to shrimp farms that have altered the ecosystem. The main intertidal regions correspond to natural habitats, critical habitats (mangrove remains) and modified habitats, shrimp farming and tourist structures.

Isla Santa Clara. Figure 4 Shows the nautical approach chart to Isla Santa Clara, which has several rocky islets that form Isla Santa Clara Wildlife Refuge. It is located 50 km west of Puerto Bolívar, 25 km off the south coast of Isla Puná and 125 km SSW in the direction of Guayaquil, its geographical position is 3° 10´13” S and 80° 26´11” W. (Position of the lighthouse belonging to INOCAR).

The part above sea level presents an enlarged shape towards the northeast and is constituted by several islets, of which the main one, considered the largest island, has a maximum width of 240 m between the cliffs’ feet and 400 m including the beach during low tide, and is 850 m long. The beach belt appearing during low tide connects the island with the islets, both to the northern and southern regions, and is 2,600 m long.

According to INOCAR bathymetric charts, the region corresponds to a rocky platform. At a regional scale, bathymetry continues to show a platform less than 30 m deep bordered by plains of 30-50 m to the east and bottoms of 100 m to the west. The platform less than 30 m deep measures 13 km by 11 km and is enlarged to the NE-SW direction. The shape of this platform highlights structural directions, mainly NE-SW, a line NNE-SSW, and a potential structural valley in the NW-SE direction, north of the island. (E. Santana and J.F. Dumont, 2000). Consequently, this marine region is being referred to as natural habitat of oceanic waters and hard bottoms; likewise, as will later be discussed, it has a high ecological significance, hence it is protected by the Ecuadorian government. It should be pointed out that it is located outside Puerto Bolívar project direct area of influence.

Figure 4. Approach chart 10820 to Santa Clara.



Source: www.inocar.mil.ec

4. Compliance with Critical Habitat requirements

4.1 Criterion 1: Critically endangered species or threatened with extinction.

According to Puerto Bolívar Expansion -Stage 1 IBAT Report (2021) (Annex 1), there are 1,804 biological resources within a 50 km range around the project which could potentially be found in the area.

As has already been mentioned, the AAEA pertains primarily to marine and marine coastal ecosystems, which is why the IBAT database was filtered towards marine beings while the search was limited to the following animal classes: *Actinopterygii*, Birds, *Bivalvia*, *Chondrichthyes*, Gastropods, *Holothuroidea, Malacostraca, Mammalia*, *Myxini* and *Reptillia*, ruling out terrestrial and freshwater species. The plant search was narrowed down to mangrove-related herbaceous families.

Flora: No resources in the CR or EN categories were reported within the herbaceous species of the mangrove ecosystem, there being records for the area of influence from which database 17 herbaceous resources were filtered and identified by Red List as being related to mangroves, all of them categorized as LC, OR, LR/LC (Least concern) and a single resource given the NT (Near threatened) category. Herbaceous species considered by Red List appear in the Annex 2 document.

Marine invertebrates: Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) informs the presence of the Holothurian *Isostichopus fuscus* (sea cucumber) which has been spotted by team members at Santa Clara intertidal rocky outcrops.

Photographic record 1. Isostichopus fuscus (EN) at Isla Santa Clara

Among other invertebrates related to fishery resources recorded during monitoring procedures, a unique specimen of green spiny lobster *Panulirus gracilis*, a species in the DD category, was captured and later returned to its environment unharmed. A permanent prohibition is in force on the extraction of green lobsters in the Ecuadorian jurisdiction, since the efforts that went into controlling their illegal capture have failed and their populations are markedly declining.

Marine birds: Marine birds in the CR and EN categories could be found in the entire coastal border and do not tend to gather, unlike marine birds in the least concern category whose presence corresponds to wandering individuals mainly related to Isla Santa Clara, among which the following fall into the CR and EN categories:

- *Pterodroma pheaopygia* or Galapagos petrel (CR)
- *Phoebastria irrorata* or Galapagos albatross (CR)
- *Sternula lorata* or Peruvian tern (EN)

The first two species have not been reported in local inventories, whereas the Peruvian tern has been observed at offshore platforms south of Isla Santa Clara during the 2013 to 2015 period.

Fish: Upon filtering the database towards bony fish (*Actinopterygii*) within a 50 km radius from Puerto Bolívar (Annex 4b), a list of 596 species was compiled (an extensive record given that continental Ecuador would have nearly 780 species of marine fish). No bony fish was found in the CR and EN categories.

The outcome is different upon filtering the database towards *Chondrichthyes* or cartilaginous fish (rays and sharks or batoidea), where the IBAT PB database showed 7 species in the CR category and 9 in the EN category.

None of the species listed by IBAT in the EN and CR categories were observed during the bimonthly fishery productivity monitoring procedures conducted on a standardized sampling effort during the 2018 to 2020 period or in the traditional fishery tracking procedure of November 2020, although the whale shark *Rhincodon typus* (EN) and large rays *Mobula birostris* (EN) have been observed in the vicinity of Isla Santa Clara, where diving encounters with *Squatina armata* (CR) or angelshark have taken place. A brief description of these appears in Annex 7. CR/EN/VU species reported by IBAT in the project area of influence.

It is worth pointing out that during the fishery productivity monitoring procedures conducted at the dredged sediment disposal site, it was requested by MAAE that the fishery productivity analysis near Isla Santa Clara be included where, on one occasion, the pygmy devil ray *Mobula munkiana* categorized as vulnerable (VU) was captured, and in another, the whale shark *Rhyncodon typus was observed, in addition to freeing the below species from catches performed within the dredged sediment disposal site:*

- Whitesnout guitarfish *Pseudobatos leucorhynchus* (VU)
- Longnose eagle ray *Myliobatis longirostris* (VU)
- Sarten picuda *Urotrygon rogersii* (NT)
- Whiptail stingray *Dasyatis brevis* (not in the Red List)

- Equatorial rays *Rostroraja equatorialis and Raja sp* (VU)

During the monitoring of fish in Estero Santa Rosa, at regions closer to Puerto Bolívar, a unique capture of two giant seahorses *Hippocampus ingens* (VU) and several Equatorial rays were released unharmed.

Mammals: As regards mammals, Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) provided 9 mammal records; 6 of them were marine ones. 5 dolphin species were mentioned, all of them oceanic and in the least concern category, mainly approaching Canal de Jambelí in seasonal transition periods, time during which *Stenella coeroleualba* individuals were observed on several occasions at the dredged sediment disposal site area, in addition to an outstanding report of a beaked whale *Mesoplodon peruvianus*, also categorized as least concern, although no reports were submitted on the presence of migratory whales such as *Megaptera novanglieae*, also in the least concern category, or of common bottlenose dolphins *Tursiops truncatus* whose population at Canal de Jambelí and Estero Salado worries national researchers due to constant reports of its decline. Marine mammals and reptiles filtered from Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) are listed in the Annex 6 document. Among otariids, South American sea lions, southern sea lions *Otaria flavescens (Shaw, 1800),* marine sea lions, referred to as *Otaria byronia* in the Red List, are in the LC category and will be commented on in the third criterion.

Marine reptiles: Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) yielded only 6 records of marine reptiles:

Chelonia mydas or green sea turtle (EN): Out of 3 encounters with this sea turtle in the 2018-2020 period, only one pertained to a live individual, while the other two were floating carcasses which presumably died as a result of interactions with fishermen using longline fishing techniques.

Crocodilus acutus, listed as VU in the Red List and CR in the national list (Carrillo et al, 2005): Their most frequent habitats in Ecuador are located in the Guayas province. They are rarely seen at the Jambelí canal and archipelago, which makes their sightings attention-grabbing events. The last capture event of a specimen larger than two meters in the area of influence was performed in November 2020 by fishermen in Estero Pilo south of Puerto Bolívar.

According to Carvajal, Savedra and Alva, 2005, an average of 0.27 to 0.63 individuals per km (0.48 on average) would exist in El Salado reserve, Guayas province, at regions near Guayaquil surrounding urban area. The highest number of individuals was found at Estero Palo Seco which, according to the research, corresponds to the species ideal microhabitat: those where low and deep regions alternate and which possess an adequate area of land for nesting and basking. The population density of Tumbes mangroves in Peru is the lowest (0.18 indv. /km); there, the registered population throughout 122 km is close to 22 individuals (Escobedo & Mejía 2003). It is quite possible for gene flow to occur between the Ecuador and Peru populations, specifically in individuals that would still be present at mangroves bordering

Peru; however, the existence of the species in Archipiélago de Jambelí, Ecuador, would need to be verified (Escobedo, 2004).

4.1.1 Criterion 1 result

According to Puerto Bolívar Expansion - Stage 1 IBAT Report (2021), there would be 22 species in the CR and EN categories which could potentially be found within a 50 km range around the project. Upon comparing it with two-year monitoring procedures in the site and other assessments conducted in the region, only 5 species in the EN category and one species in the CR category have been observed in the project area of influence, and they basically consist of sightings and encounters.

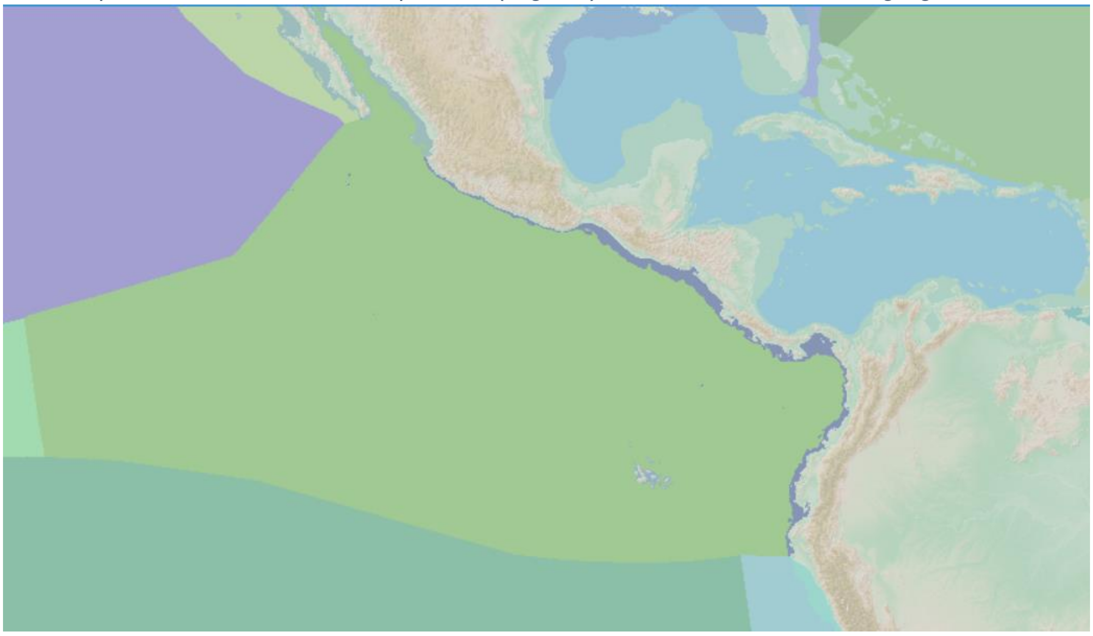
As regards the Vulnerable species, IBAT indicates that 36 species in this conservation category would be found in the AAEA, 8 of which have been captured and released or otherwise observed during biotic monitoring procedures and diversity assessments conducted in November 2020 (see Annex 7).

In search of additional data, a list of occurrence for species in the AAEA was downloaded from GBIF.org (14 May 2021). None of the species registered in this list coincides with the above list of VU, EN or CR species.

After analyzing the bibliographical and primary information, it was concluded that the AAEA cannot be considered a region of significant concentrations of endangered species at the global, national or regional level.

4.2 Criterion 2: Endemic and/or restricted-range species

Figure 5. Tropical eastern Pacific marine province (in green) and its continental shelf highlighted in dark violet.



Source: https://data.unep-wcmc.org/datasets/38

Endemism is a difficult condition in Puerto Bolívar since it belongs to a large marine ecoregion or pelagic provinces of the world known as tropical eastern Pacific province (Spalding et al, 2012), which extends from northern Peru until Baja California and covers a surface of 3,700,000 km^2, being provinces defined as extensive epipelagic ocean zones determined by large-scale oceanographic processes on a spatial and temporal scope (or with recurring seasonal patterns) where assemblies of species that share a coevolutionary history live. Taxonomic refinement can typically be driven by a staged isolation of the ocean borders and hemispheres.

Most marine and bird species in the AAEA[3] can also be considered endemic to the “Tumbes-Choco-Magdalena” ecoregion, one of the 36 biodiversity hotspots[4] identified worldwide, which comprise 1,500 km of coast from Panama until northern Peru, harboring 2,750 plant species and 364 animals ones (Weller et al., 2017). It also preserves 6,200 km^2 of mangrove forests which correspond to the region’s main coastal biome.

Almost all the observed resources in the project area of influence during the monitoring of fish, marine mammals, reptiles and marine invertebrates, as well as the resources identified in bibliographical searches (birds) are also reported in other mangrove coastal regions north of the country, despite direct connectivity interruptions since mangroves practically disappear from Santa Elena and Manabi coastal borders to reappear as of northern latitude 0°, which belongs to the border of Manabí and Esmeraldas provinces; the hydrologic connectivity of local currents on the continental shelf is evidenced by the similarities among fish and marine invertebrates. Mangroves in northern Ecuador are connected with Chocó mangroves in Colombia and are deemed to be better preserved. Some emblematic species such as shells in the Anadara genus, of major social importance in the project area of influence, can be found from Central America and Baja California to northern Peru.

The *Living National Treasures*[5], an organization specialized in recording endemic species, reports the following as being the most important endemic species in the country: The Galapagos sea lion *Zallopus wollebaeki*, the Galapagos fur seal *Arctocephalus galapagoensis*, the eastern caenolestid *Caenolestes sangay*, the South American shrew *Cryptotis niausa*, the Sacha guinea pig *Cavia patzelti*, the wandering Oldfield mouse *Thomasomys erro,* the Galapagos rice rat *Aegialomys galapagoensis*, the Santiago Galapagos mouse *Nesoryzomys swarthi*, the Ecuadorian grass mouse *Neomicroxus latebricola*, the Hammond's rice rat *Myndomys hammondi*, the Ahuaca mountain viscacha *Lagidium ahuacaense*, the equatorial dog-faced bat *Cabreramops aequatorianus*, the Gualea red brocket *Mazama gualea* and the Simons’ dwarf squirrel *Microsciurus simons*i.

[3] BirdLife International (2021) Country profile: Ecuador. Available from http://www.birdlife.org/datazone/country/ecuador. Checked: 4/24/2021

[4] Biodiversity hotspots cover only 2.3% of the land surface and harbor 50% of known life forms.

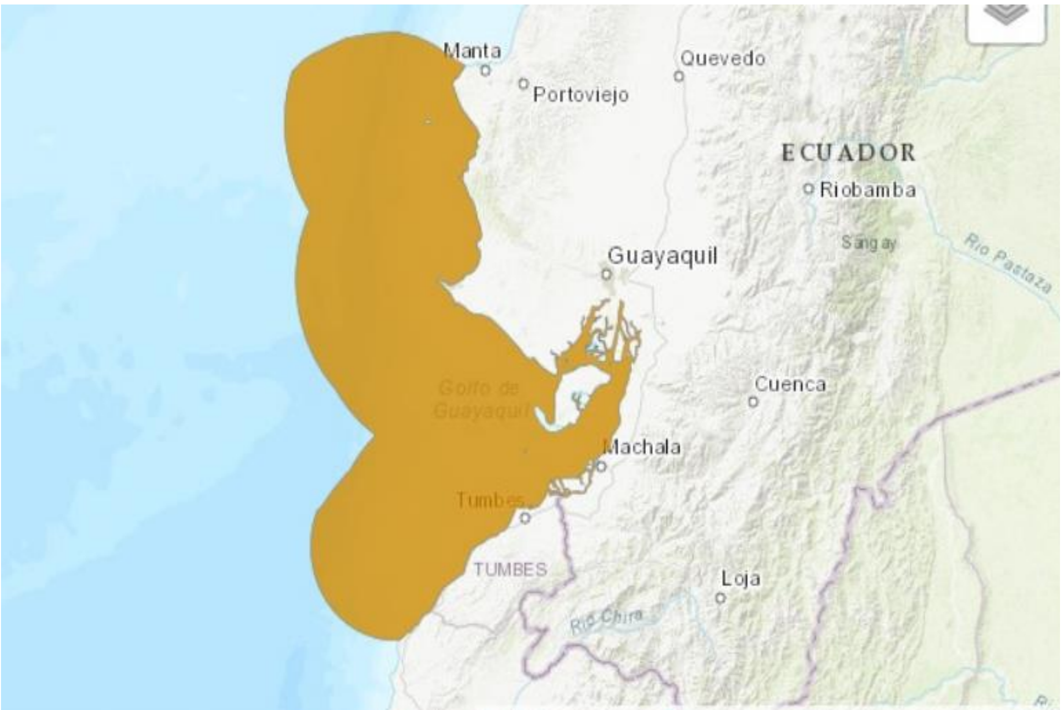
[5] http://lntreasures.com/index.html

According to *Living National Treasures*, there are 39 species of endemic marine fish in Ecuador, all of which are found in Archipiélago de Colón and the Galapagos Islands located 1,000 km from the AAEA.

As to restricted-range species based on their distribution or extent of occurrence (less than 100,000 km^2), two fish are listed in the Red List, both in the VU category, and none under any national category:

- **The wrasse *Paraclinus fehlmanni* or "Trombollito de Fehlmann"**: unique to intertidal ponds at the Ecuadorian-Peruvian border. Its distribution reaches approximately 20,000 km^2

Figure 6. Paraclinus fehlmanni EOO



Source: https://www.iucnredlist.org

Specimens have been captured during intertidal samplings that may belong to said species and which were released. The samplings were focused on the infauna of muddy beaches in Archipiélago de Jambelí and of intertidal ones in Isla Santa Clara.
Due to the lack of population estimates, the marine coastal area of the AAEA was compared to the species total area of occurrence to determine the estimated significance of the habitat to the species survival. This was done despite the absence of a constant population distribution or known regions of higher or lower occurrence throughout the distribution. It will be estimated that a percentage above 10% could sustain a population above the 10% estimate for critical habitats in criterion 2.

As for this species, it is calculated that the area of the AAEA represents 13.33% of the total area of occurrence.

Photographic record 2. Pond wrasses, left Isla Santa Clara, right Archipiélago de Jambelí

- The ***Urobatis tumbesensis*****,** an endemic ray that occurs from northern Peru until Colombia. With an extent of occurrence less than 20,000 km^2, it is estimated that AAEA represents 13.33% of the species area of occurrence.
  This species has not been observed in the monitoring procedures conducted in the AAEA.

Figure 7. Urobatis tumbesensis EOO

Source: https://www.iucnredlist.org

4.2.1 Criterion 2 result

According to NO74, two fish species in the AAEA are endemic or restricted-range: *Paraclinus fehlmanni* and *Urobatis tumbesensis*. In the absence of population estimates and since the criterion compliance has not been established, its presence was estimated based on the percentage of the studied area of AAEA compared to the total area of occurrence; in both cases, the obtained value was 13.33%, which qualifies this region as a critical habitat according to criterion 2.

4.3 Criterion 3: Migratory and/or congregatory species

Migratory species

In agreement with Ecuador's CMS[6] country profile, 63 migratory species from South American, Central American and Caribbean regions have been entered in the country's records, most of which conform to UICN Red List; in addition, after being filtered towards marine species, the list was reduced to 43 species which are detailed in the Annex 9 document.

Cartilaginous fish such as rays and sharks stand out among the migratory species observed in the project area of indirect influence (within waters near Isla Santa Clara) in addition to marine mammals, the most emblematic of which is undoubtedly the humpback whale *Megaptera novaeangliae* that migrates each year from Antarctica to the tropical waters of Ecuador and Colombia for mating and copulation that take place from early May until mid or late October each year, and which has turned into a tourist attraction for local visitors that embark from Puerto Bolívar Cabotage Pier towards Isla Santa Clara. This species is estimated to have a population of 50,000 individuals (Branch, 2007), with the unlikely presence of 500 whales in the vicinity of Isla Santa Clara and the area of influence of Puerto Bolívar project, given the water turbidity conditions associated with Canal de Jambelí.

With regard to pelagic sharks, they are not as abundant in this region as they are in other coastal regions of Ecuador such as Esmeraldas and Manabí. No specimen has been captured after 2 years of monitoring procedures, neither do they show at fishery terminals.

Congregatory species

Figure 8. Protected areas and KBAs in Puerto Bolívar project region shows, in a weave of vertical lines, the sites regarded as bird gathering spots. Table 3 classifies as IBA *A4* such areas that are significant for the conservation of birds regarded as congregatory which "are known or believed to harbor congregations of ≥1% of the world population of one or more species in a regular or predictable manner"; namely:

- Jambelí and the mangroves of Guayaquil

[6] Convention on Migratory Species

- Isla Santa Clara and Wildlife Refuge

Jambelí and the mangroves of Guayaquil: Mangroves play a highly important role in bird congregation and bioaquatic species migration: root entanglement, pneumatophores and submerged mangrove branches create nursery habitats, which are defined as "habitats for a particular species that proportionally contribute with a higher number of individuals than the average of adult individuals per unit area generated by other habitats used by their juveniles", and which are of ecological significance to the general maintenance of ecosystem functions (Dahlgren et al., 2006).

Most aquatic birds identified in the country settle in mangroves. According to Agreda (2017), the Gulf of Guayaquil, Archipiélago de Jambelí and Río Chone estuary are the main congregation habitats, where 24 Nearctic beach migratory species were recorded. The most abundant of these are *Calidris pusilla* (semipalmated sandpiper), *Calidris mauri* (western sandpiper), *Numenius phaeopus* (Eurasian whimbrel) and *Charadrius semipalmatus* (semipalmated plover).

At the southern mangrove area of Guayaquil, it was discovered that the largest groups pertained to the following families: sandpipers (*Scolopacidae*) with nine species and 212,795 individuals, terns (*Sternidae*) with three species and 17,954 individuals, plovers (*Charadriidae*) with three species and 9,430 individuals and herons (*Ardeidae*) with nine recorded species and a total of 8,999 individuals. (Agreda, 2019).

Canal de Jambelí comprises >10% of the biogeographic population of the semipalmated sandpiper *(Calidris pusilla)*, at least 9% of the Eurasian whimbrel *(Numenius phaeopus),* 7% of the semipalmated plover population *(Charadrius semipalmatus)* and 3% of the American oystercatcher *(Haematopus palliatus),* (available from https://avesconservacion.org).

Bird gathering at Isla Santa Clara: Isla Santa Clara has, without a doubt, the largest congregation of marine birds and pinnipeds from the southern coast of Ecuador, which is why it is protected by the Ecuadorian government. Here, the populations of blue-footed boobies *Sula nebouxi*, in the least concern category with no estimated population according to Red List, frigatebirds *Fregatas magnificens*, as well as brown pelicans *Pelecanus occidentalis* and Peruvian pelicans *Pelacanus thagus* are estimated by the thousands. Among marine mammals, the best-known inhabitant showing significant population fluctuations is the sea lion *Otaria flavescens*, whose main colony consisted of over 150 individuals in April 2021, this species was reported as *Otaria byronia* which, according to Red List, would have a population of 222,500 individuals; in northern Chile alone, a population close to 69,000 sea lions was estimated in 2012 (Contreras Von Meyer, 2012); also, this species is considered native to Brazil, Uruguay, Argentina, Chile and Peru, as well as present and wandering in Ecuador and Colombia; in more abundant years, the estimated number of sea lions at Isla Santa Clara has reached near 750.

Photographic record 3. Sea lions Otaria flavescens, center blue-footed boobies Sula nebouxi and bottom abundance of birds at Isla Santa Clara, 10 April 2021

4.3.1 Criterion 3 result

Mangroves (Jambelí and Guayaquil) and Santa Clara are important areas for the congregation of aquatic bird species, and of South American sea lions within the context of Ecuador. As to the semipalmated sandpiper (*Calidris pusilla*), the consulted bibliography indicates that the Gulf of Guayaquil region will fulfill criterion 3a.

This is confirmed via the IBA classification, which regards both ecosystems as "sites that harbor congregations of ≥1% of the world population of one or more species in a regular or predictable manner", thereby fulfilling criterion 3b.

4.4 Criterion 4: Unique and highly endangered ecosystems:

Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) has compiled a list of 5 Protected Areas (a list of Peru included) and 4 Key Biodiversity Areas (with the exception of two Protected Areas that are listed here again).

Protected Areas are natural regions that ensure the coverage and connectivity of key terrestrial, marine and marine coastal ecosystems, their cultural resources and main water sources. These are part of the National System of Protected Areas (SNAP).

Key Biodiversity Areas (KBAs) are sites that substantially contribute to the preservation of biodiversity in terrestrial, freshwater and marine ecosystems. The sites are classified as global KBAs if they fulfill one or more of the 11 criteria, which are grouped into five categories: threatened biodiversity; restricted-range biodiversity; ecological integrity; biological processes; and irreplaceability. KBAs comprise a "general" group of priority biodiversity sites with international recognition, which include Important Bird and Biodiversity Areas (IBAs); and *Alliance for Zero Extinction* (AZE) sites.

Protected Areas.

According to Puerto Bolívar Expansion - Stage 1 IBAT Report (2021), within a 50 km radius from Puerto Bolivar project location, the following areas can be found which belong to the National System of Protected Areas of Ecuador. As has already been stated, this list includes a protected Area located at northern Peru, bordering Ecuador.

Arenillas Ecological Reserve, founded on 16 May 2001. It is located in El Oro province, between cantons Arenillas and Huaquillas, and has an expanse of 13,170 hectares. Climate is warm and dry with a temperature that exceeds 24 °C, the type of vegetation is mangrove, deciduous and semi-deciduous lowland forest, dry scrubland and coastal cactus. Flora is typical of the area and fauna is made up of 60-80 mammal species and 153 registered bird and amphibian species (Aguirre, 2014). The ecosystem is characterized by high levels of flora and fauna endemism that can only be found in the Ecuadorian dry forest at southern Ecuador and northern Peru (Ministry of Environment, 2015).

Wildlife Refuge and Isla Santa Clara Marine Reserve. Founded via Ministerial Resolution A-83 on 6 March 1999. It is located at the Gulf of Guayaquil entrance, 43 km west form Puerto Bolívar in El Oro province. It covers 7 hectares of land and 2 nautical miles around the isle and islets. Flora is dominated by scarce herbaceous coverage of the dry scrubland type, and fauna consists of 4 mammal species, 29 birds, 4 reptiles and 37 invertebrates (Aguirre, 2014). The high marine productivity and the abundance of nutrients in waters has enabled the convergence of several species. Thousands of marine birds, such as frigatebirds, blue-footed boobies and pelicans make up one of the largest colonies of these species in the entire country, which is why in 2002 it received an international acknowledgment and was cataloged as a Ramsar site (Ministry of Environment, 2015).

La Tembladera. La Tembladera wetland is located in El Oro province, 17.5 km from Cantón Santa Rosa. It consists of a permanent lagoon and its flooded surrounding areas located at the Tumbes Endemic Birds Area, and is home to at least 24 endemic bird species, such as the Ecuadorian ground dove (*Columbina buckleyi*) and the Pacific parrotlet (*Forpus coelestis*), endangered and vulnerable species in the Red List such as the gray-cheeked parakeet (*Brotogeris pyrrhoptera*) and the rufous-headed cachalaca (*Ortalis erythroptera*). The lagoon supplies water to the irrigation systems for agriculture and livestock activities in the surrounding area and supports small-scale fishery. Threats to the site include habitat pollution and destruction due to the growth of agricultural and livestock activities operating in the wetland.

Manglares de Tumbes. Santuario Nacional los Manglares de Tumbes is located northwest of Peru in the Zarumilla district (Tumbes), and has an expanse of 2,972 ha. It was declared protected area in March 1988. The ecosystem is typical of a tropical region and is named after the vast mangrove expanse. Among the typical species in the region are the mangrove crab, prawns and the pustulose ark. Besides the rich biodiversity, it offers a significant contribution to the nearby towns by means of the hydrobiological products obtained from the ecosystem (SERNANP, s.f.).

Key Biodiversity Areas (KBAs)

Archipiélago de Jambelí. Is located in front of El Oro province coasts, south of the Gulf of Guayaquil and 2 km from Puerto Bolívar. It has a 293 km expanse. The archipelago consisting of 5 isles was one of the areas referred to as Special Management Zones (SMZs) established in 1989 as part of the Fishery Resources Management Program implementation. Currently, the archipelago is no longer under any state control or monitoring mechanism. As is the case with any marine coastal ecosystem in the region, it has been highly intervened throughout the years, particularly by the shrimp farming industry which decimated its mangrove forests, thus leaving patchy remains of undeniable ecological value that are currently being watched over by self-supporting fishery associations. As of 2016, the mangrove surface of Archipiélago de Jambelí was 8,468.94 hectares (Flores et al, 2020), making up 5% of the total mangrove surface in Ecuador, which was calculated at 161,820 ha for that year.

The archipelago also has beaches which constitute the province’s main tourist destination.

Daucay. It consists of a foothill tropical rainforest located between El Oro and Azuay provinces. The region in surrounded by agricultural and pasture areas. The humidity is explained by the distance to the coastal line and its location at the Andes foothills. According to N. Krabbe in his 1993 visit, 135 species were recorded, among which are the *Pyrrhura orcesi*, a globally endangered endemic species in Ecuador, and the also endangered *scytalopus robbinsi* (BirdLife International, 2021).

Manglares del golfo de Guayaquil. The region referred to as Manglares del golfo de Guayaquil is located in cantons Guayaquil, Naranjal and Balao, as well as in Isla Puná. It is regarded as a highly significant region for congregatory species. This area contains Reserva de Producción Faunística Manglares de El Salado, the mangroves within the city of Guayaquil and the mangrove area run by the Cerrito de los Morreños community. Information on fauna is limited, although it is certain that there are aquatic and marine species that nest in and visit the region. Of special note is the presence of a large population of frigatebirds, the migration of sea lions and the diversity of commercially important fish (BirdLife International, 2021).

Buenaventura Reserve. Buenaventura Reserve is a region of tropical cloud forests belonging to Fundación Jocotoco since 1999, located at Cantón Piñas in El Oro province. With an expanse of 1,500 ha, it harbors a rich diversity of wild flora and fauna, mostly endemic and some endangered. It is one of the country sites which allows for an accessible ornithology. It is inhabited by approximately 320 bird species, 30 of which are endemic and 12 are endangered. National and foreign tourists visit it for birdwatching and to carry out ecotourism activities (AME, 2020).

Considering that the threshold for this criterion regards as critical the regions cataloged as: i) areas that fulfill the criteria for UICN categories of protected areas I.a, I.b. and II; ii) key biodiversity areas (KBAs) including areas important for bird conservation (IBA), iii) areas representing ≥ 5% of the world expanse of a type of ecosystem that fulfills UICN CR or EN condition criteria, the details on these characteristics for the assessed regions is shown in Table 3.

Merely on the basis of sub-criteria i and ii, it is concluded that Arenillas, Santa Clara, Jambelí, Gulf of Guayaquil, Buenaventura and Daucay would fulfill Criterion 3 (see the green-shaded cells in Table 3). However, a connection must be established as to the physical proximity to or the project's potential interaction with these habitats.

Table 3. Assessment of protected Areas and KBAs of the project

Area	Ecosystem/ Habitat	National/ International Protection Category	UICN Red List	National equivalent*/ other criterion	IBA**/ AZE	Surface (km^2)	Global surface (km^2)	% of world expanse
Arenillas	Ecuadorian dry forest (Tumbes region)	Ecological Reserve		IA, IB or II	A1, A2, A3, A4i	131.78	55,000[7]	0.23%
Isla Santa Clara and Wildlife Refuge	Wetland	Marine Reserve, Wildlife Refuge, Ramsar		IV	A1, A4i, A4ii, A4iii	3.35	12,500,000[8]	0.000026%
La Tembladera	Wetland	Ramsar		---	---	14.71	12,500,000	0.00011%
Manglares de Tumbes	Mangrove forest	Santuario Natural (Peru)	III	III	---	29.72	154,085[9]	0.02%
Archipiélago de Jambelí	Mangrove forest	Special Management Zone (SMZ)	---	Section 119 of the Environmental Organic Code. Mangrove is declared of National Priority for management and conservation.	A4iii	79.48[10]	154,085	0.2%
Manglares del golfo de Guayaquil	Mangrove forest	Reserva de Producción Faunística Manglares de El Salado	---	Section 119 of the Environmental Organic Code. Mangrove is declared of National Priority for management and conservation	A4iii	21.71[11]	154,085	0.014%
Buenaventura	Tropical cloud forest	Private reserve.	---	---	A1, A2	3.45	539,263[12]	0.0022%

[7] Espinoza et al, 2021
[8] Ramsar Convention Secretariat, 2018
[9] Hamilton and Casey, 2016
[10] Flores-Aguilar, D. et al., 2020.
[11] Key Biodiversity Areas Partnership, 2020
[12] Bubb et al, 2002

Area	Ecosystem/ Habitat	National/ International Protection Category	UICN Red List	National equivalent*/ other criterion	IBA**/ AZE	Surface (km^2)	Global surface (km^2)	% of world expanse
Daucay	Tropical rainforest	Tropical rainforest	---	---	A1	13.21	10,900,000[13]	0.00012%

*MAE (2004). Policies and Strategic Plan of Ecuador's National System of Protected Areas 2007-2016

** IBA classification details: A1. Globally threatened species; A2. Restricted-range species; A3. Biome-restricted species; A4. Congregation; B1: Species of conservation concern.

[13] Ofosu-Asiedu, A. (s.f.).

Figure 8. Protected areas and KBAs in Puerto Bolívar project region

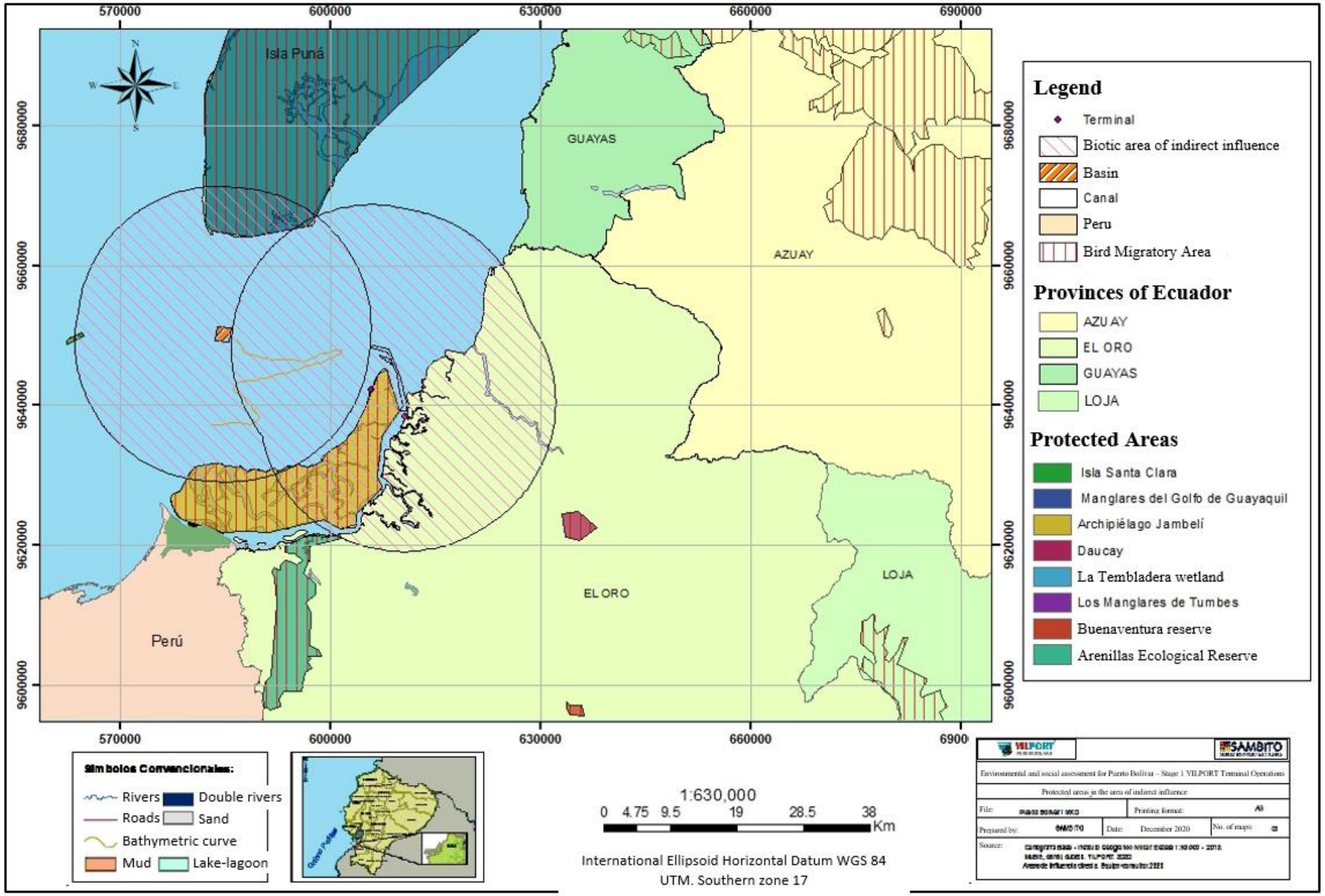


Figure 8 shows the location of protected areas and KBAs in relation to the AAEA. It can be observed that it essentially has the potential of interacting with or influencing marine coastal protected areas and KBAs, in addition to being mutually interrelated. On the other hand, La Tembladera, Buenaventura and Daucay located southeast of the Port are far from the project, have different characteristics and are relatively isolated from one another.

4.4.1 Criterion 4 result

As can be seen from the above analysis, **mangrove forests**, particularly those located in Archipiélago de Jambelí, are undoubtedly the most important ones for this assessment due to the following reasons:

- It is the marine coastal habitat which could interact the most with the project given its nature and proximity.
- They provide ecosystem services and are bird nesting sites
- They constitute a significant area compared to other habitats, and do not reach the thresholds laid down for critical habitats in relation to worldwide coverage.
- They are protected by the Ramsar convention on wetlands[14] of which Ecuador is signatory since 1991 with 19 protected sites, 4 of which are mangroves.
- Despite the legal instruments for their protection, they are threatened by the growth of agriculture, aquaculture, urban development and their very exploitation. In the last century, 50% of the world's mangroves were lost, and during the 1980-2000 period, 35% of the global coverage would have been lost (Giri et al., 2011); moreover, Ecuador lost 43% of the national mangrove coverage between 1969 and 1999

On the other hand, Isla Santa Clara is regarded as a unique ecosystem to the south coast of Ecuador which, though distant from the project area of influence, its marine environment may also be deemed threatened given its proximity to Puerto Bolívar access navigation route, and although the Ecuadorian government has given it the status of protected area, it presents severe logistic difficulties for its care. Additionally, precisely due to their ichthyological richness, they receive considerable pressure by traditional and semi-industrial fisheries.

4.5 Criterion 5: Key evolutionary processes:

Within a specific region, structural characteristics such as its topography, geology, soil, temperature and vegetation, and the combination of these variables, can influence the evolutionary processes that lead to the regional configurations of species and ecological properties. In some cases, unique and specific characteristics of a landscape have been associated with genetically singular species populations (IFC, 2019). Some attributes associated with evolutionary processes are: high spatial heterogeneity, environmental gradients, edaphic interfaces, habitat connectivity and proven significance for climate change adaptation.

[14] www.ramsar.org

4.5.1 Criterion 5 result

Pursuant to NO83 of ND6 in relation to this criterion, in most cases “it will be applied in previously researched regions which are known or assumed to be associated with singular evolutionary processes”.

As to the ecosystems and crucial biodiversity regions noted in this assessment, they do not meet the indicated characteristics to be regarded as ecosystems that sustain key evolutionary processes, which is why they do not fulfill criterion 5 for critical habitats.

5. Critical Habitat assessment results

Critical habitats are areas of high biodiversity levels that include at least one or more of the five values laid down in paragraph 16 of Performance Standard 6 or other recognized high biodiversity values; also, no criterion is less important than another when designating critical habitats, thus:

Table 4. Critical Habitat assessment results.

No.	Criterion	Results	Criteria fulfillment
1	Endangered (EN) or critically endangered (CR) species	5 species in the EN category and one species in the CR category have been observed at the AAEA, although their sightings are rare and generally of isolated individuals from limited captures. No population data on these species is available at the AAEA; therefore, there are no solid grounds to declare it a critical habitat.	No
2	Endemic or restricted-range species	Two endemic species of fish are located in the AAEA, both in the VU category: *Paraclinus fehlmanni* and *Urobatis tumbesensis*. Both species are deemed to fulfill this criterion since the AAEA, where they are located, represents over 10% of the total EOO.	Yes
3	Migratory or congregatory species	Mangroves (Jambelí and Guayaquil) and Santa Clara are important areas for aquatic bird species congregation. As to the semipalmated sandpiper (*Calidris pusilla*), the consulted bibliography indicates that the Gulf of Guayaquil region fulfills criterion 3.	Yes
4	Unique or highly endangered ecosystems	The mangrove and marine ecosystems, including Isla Santa Clara, are identified as highly endangered ecosystems.	Yes
5	Key evolutionary processes	The mangrove ecosystem shows evolutionary processes on the basis of its contribution to climate change adaptation due to its ability to achieve sedimentation in [sic] and coastal stabilization.	No

Prepared by: Ecosambito, 2020

Therefore, the above assessment determined the presence of Critical Habitats in the project area of direct and indirect influence, consisting of mangrove and marine ecosystems, including the RMISC.

5.1 Project relation to critical habitats

Although the area of influence of Puerto Bolívar Port Terminal contains critical habitats, the project establishment area has been operating for 60 years, whereas the expansion area is completely intervened. The closest mangrove area is Archipiélago de Jambelí, on the opposite side of Canal Santa Rosa, 2 km from the Port Terminal. Although this ecosystem will not be threatened by the expansion project, it is essential that conservation mechanisms be implemented given its biodiversity value.

As far as the marine area is concerned, the region surrounding Isla Santa Clara is located at the boundaries of the area of indirect influence, and may interact with maritime traffic; nevertheless, port traffic does not pose the main threat to this ecosystem, whose main pressure derives from the fishery activity.

6. Compliance with project requirements in critical habitats

According to paragraph 17 in the ND6 of the IFC, the following aspects and commitments must be proven so that the project can develop and operate in critical habitats:

a. there are no other viable alternatives within the region for the project to develop in natural or modified habitats which are not critical.

b. the project does not produce adverse quantifiable impacts on biodiversity values by virtue of which the critical habitat was designated or on the ecological processes that support said biodiversity values.

c. The project will not cause a net reduction in world or national/regional population of any endangered or critically endangered species for a reasonable period.

d. A long-term, well-designed, solid biodiversity tracking and assessment program will be integrated in the client management plan.

6.1 Lack of viable alternatives in the region

In 2016, by means of Administrative Ruling No. 31 -2016 of Puerto Bolívar Port Authority, YILPORT TERMINAL OPERATIONS is granted management license to the Port Terminal. Yet the ownership of Puerto Bolívar Port Terminal still belongs to APPB, and YILPORTECU assumes the operating and management functions of the Terminal, where it must realize its Expansion Project Stage 1. It must be remembered that Puerto Bolívar began in the late 18th century as a port enclave whose first settlement was Puerto Pilo, later referred to as Puerto Machala (between 1783 and 1860), Puerto de Huaylá (1861) facing Isla de Jambelí; and as of 1970, Puerto Bolívar Port Authority–APPB–was founded, which is responsible for managing the international maritime port. Nevertheless, the site was already a logistic enclave among former residents, who traveled to and from the current territories of Guayaquil and Puná, which were considered productive and commercial centers (Tapia, 2017).

On the other hand, the sediment disposal site was chosen based on its location characteristics, dominant currents and depth; and according to the provisions in the London Convention[15], which regulates waste material discharges in the sea and the adoption of all possible measures to prevent marine pollution. The site is located 13.75 miles from the sea buoy (25 km), and has depths between -27 and -36 MLWS, with predominant currents towards the northwest, thus sending disposed of sediments in that direction; moreover, as per the results of the sediment dispersion modeling provided, it was concluded that the area required for the sedimentation of fine materials under extreme and conservative tidal conditions will not interfere with the activities associated with the use of the water resource at a distance of 1.48 km and 1.84 (at surface level and below, respectively) during ebb tide; and up to 6.02 km during flood tide.

6.2 Absence of adverse quantifiable impacts on biodiversity values

According to the “final report of the research project bearing Authorization No. 002-2019-IC-FLORA/FAUNA-DPAEO-MAE: wildlife species specimen collection for conducting environmental assessments and other instruments for environmental regularization” (Annex 10), from where the results of biotic monitoring procedures carried out between 2018 and 2020 were obtained, the following conclusions have been drawn regarding the biological richness, abundance and diversity at the offshore sediment basin area in the outer limit of the RMISC and the port pier apron:

The benthic community at the offshore sediment basin receives most of the impacts since the extracted sediments accumulate in the existing community, whose richness and abundance is adversely affected and decreases considerably; this impact is nevertheless temporary during dredging maneuvers, and a meaningful recovery begins to show after two months. A greater richness of benthic resources is observed at Santa Clara station, mainly due to the presence of mixed seabeds which provide more habitats and thus enable the settlement of a larger number of species, whereas the stations at the dredged sediment disposal basin are silty, muddy and of fine sand, which makes it reasonable to find less variety of life-forms in a much more homogeneous environment.

[15] See more at https://www.imo.org/es/OurWork/Environment/Pages/London-Convention-Protocol.aspx#:~:text=El%20Convenio%20sobre%20la%20prevenci%C3%B3n,est%C3%A1%20en%20vigor%20desde%201975.

As regards fish, the area seemingly has productive cycles associated with the winter-summer seasonal change, and no fishery reduction has been observed in the dredged sediment disposal basin. No escape of fishery species took place during the dredging maneuvers period; in fact, out of 32 captures, the sampling on 17 April 2019 at the disposal basin station was the fourth most diverse catch in the studied period, and the captures with the smallest number of captured resources occurred on 5 December 2019, 6 months after the dredging maneuvers. With respect to local fishery productivity, the results of a two-year bimonthly systematic tracking procedure with offshore and inner-water standardized captures did not show any significant reduction that could be attributed to dredging maneuvers.

As regards critical species within the AAEA: *Paraclinus fehlmanni* growths its habitat in intertidal zones, i.e. far from the dredged area and the Port Terminal, which will also direct its expansion towards already modified habitats; whereas the *Urobatis tumbesensis* develops in inner canals towards the open sea area of Archipiélago de Jambelí, and its biggest threat is incidental catch. For both species, as well as for the bird *Calidris pusilla*, no adverse impacts are estimated due to the project presence or expansion.

Within the phytoplankton community, there is no evidence whatsoever that could link dredging maneuvers to effects on the community; a noticeable difference in abundance is observed in Estero Santa Rosa samples compared with the offshore samples, yet the differences lessen among the main regions in relation to species richness.

The zooplankton community with fractions larger than 300 and 500 micrometers did not show a clearly defined pattern. Though with regard to the fraction larger than 500 micrometers, a greater abundance was observed in winter, which decreased at the sampling pertaining to the performance of dredging maneuvers, yet showed a new abundance peak after two months in the vicinity of Isla Santa Clara, as well as in Estero Santa Rosa, with the likelihood that the sampling coincided at the dredged sediment basin with tidal changes; the least zooplankton abundances were recorded between August and October, period which corresponds to the summer season of the coast of Ecuador. There is no sufficient evidence to relate said reduction to the dredging maneuvers.

As regards mangrove productivity, bivalves and red crab extraction was measured with standard pedestrian fishing (1 hour). This monitoring procedure showed that the sampling pertaining to the performance of dredging maneuvers would have achieved more abundant collections than in other samplings, thus evidencing that no effect in terms of bivalve abundance can be attributed to these maneuvers. As to the red crab, it would not have been affected by dredging maneuvers. The size (mean shell diameter) of exploited resources is another indicator that allows for determining the absence of effects on resources exploited in a pedestrian manner at regions adjacent to Estero Santa Rosa dredging site; should there be any effects, smaller mean sizes should appear in subsequent samplings, which was not the case.

As regards marine mammals, several encounters with sea lions *Otaria flavescens* have been recorded in the area near Santa Clara. During the offshore monitoring procedure on 7 August 2019, two distant interactions with protected marine beings were witnessed: the first one pertained to a humpback whale *Megaptera novangliae* sighting, a female adult and a calf; the second one, to a pod of 20-30 dolphin individuals *Stenella coeruleoalba* heading northeast through vertex No. 2 of the dredged sediment disposal site towards Isla Puná. During the offshore monitoring procedure on 2 August 2019, whales were observed at a distance from the navigation route heading towards Santa Clara station; a later observation revealed a specimen doing jumps and tail splashes between Santa Clara sampling station and Isla Santa Clara.

6.3 Absence of net reduction in CR and EN species populations

No official quantitative information is available in relation to the historic evolution of endangered or critically endangered resource populations, although on the basis of the analyzed information, and in agreement with the foregoing paragraph, species *Paraclinus fehlmanni, Urobatis tumbesensis* and *Calidris pusilla* will not experience a net population reduction due to the project operations

6.4 Biodiversity monitoring and assessment program

The Environmental and Social Management Plan prepared in the Environmental and Social Impact Assessment of Puerto Bolivar Project Stage 1 includes a monitoring program of marine coastal resources that is broader than the current one and which has been carried out since 2018. Said program includes:

- Invasive species management plan
- Monitoring plan:

  Water quality
  Hydrology
  Sediment quality
  Biotic samplings: Phytoplankton, zooplankton, benthos, Ichthyofauna,
  Marine mammals,
  Samplings in mangrove resources, bioaccumulation in bivalves,

- Stranding management plan

Prevention plan for collisions with whales and other marine mammals. Since there are two species identified as critical for the project, the following practices are proposed within Ichthyofauna monitoring procedures.

Urobatis tumbesensis.

As is the case with all batoidea, such as guitarfish and rays, other fish and invertebrates regarded as vulnerable or protected by the Ecuadorian legislation, every captured specimen, in addition to being recorded, must be measured with an ichthyometer and photographed in detail in order for their identifications to become less common so as to have more data on these species.

A new fishing spot in Estero Santa Rosa should be integrated so as to demonstrate the presence of these beings in the port vicinity.

Paraclinus felhmanni

It lives in intertidal river pools and shallow waters, which requires the inclusion of at least 3 sampling points at intertidal sites: Pongal, Chupadores, Bajo Hediondo and Bajo Gregorio; as well as the review of sectors with ponds in order to confirm the presence of these species and other infauna invertebrates from sandy beaches.

Calidris pusilla

The same site where the monitoring of *Paraclinus felhmanni* is proposed will be subject to the monitoring of birds at resting spots or flocks (while focusing on the presence of *Calidris pusilla* and other birds). Binoculars and high-definition cameras are required for appropriately conducting documentation endeavors.

7. Critical Habitats management plan

7.1 Quantifying gains and losses

As has already been stated throughout this document, the mangrove ecosystem, due to its ecosystem importance and proximity to the Project, is regarded as a Critical Habitat.

The coastal line of project Stage 1 expansion area is populated by small dwarf mangrove patches[16] *Rhizophora mangle,* which have grown in the rockfill walls that protect the coast, and for that reason they lack the conditions for an appropriate development. It was estimated that the surface covering these mangroves is 0.6 hectares. It should be pointed out that since they are isolated, low-vitality trees, they are not subject to exploitation of fishery resources of any kind, and are different from natural formations in that they lack soft sediments.

Even though these mangroves will not be directly affected during Stage 1 since they are left out of the intervention zone, they may be indirectly affected by the change of tidal flow and sediments throughout the operational period.

7.2 Invasive species control

One way in which maritime transport can impact the biodiversity of the area in which it operates is the unintentional transfer of invasive species through water and ballast sediments that vessels load in a sector and then release from another to compensate for weight loss or gain due to the loading and unloading of goods.

[16] Dwarf mangroves are a kind of mangrove formation that develops in regions with inappropriate substrates or a deficient hydrological regime; they are named dwarf since they do not grow as tall as other mangrove species

Ballast water can contain marine species such as bacteria, viruses, protozoa, phytoplankton and some macroscopic species, generally zooplankton as well as human pathogens. Another way of transporting invasive species can be through vessel hull incrustations.

The range of organisms that can survive in a new aquatic environment is narrow. The following factors determine the success of a species transported in ballast water: water temperature range and time frame in which said temperature is favorable, salt tolerance, adequate ecological conditions (habitat, predators, food sources).

Even though Equatorial regions are not classified as Potentially Dangerous Areas (Baro & Stotz, 2018), there are practices that can be followed in order to reduce the risk of exotic species invasion, such as: 1) Verification of compliance with the Ballast Water Report, 2) Verification of ballast water area of origin, 3) Quantify the risk associated with ballast water discharge and check ballast water replacement, all of these procedures are laid down in the International Convention for the Control and Management of Ships' Ballast Water and Sediments of 13 February 2004 (BWM, 2004) promoted by IMO, GEF and UNDP, which is known as the GloBallast Program[17] and was ratified by Ecuador on 8 September 2017.

This convention specifies in several policies the control and monitoring mechanisms for vessel responsibility, as well as for port facilities receiving ballast water during vessel assistance which may be requested by competent authorities, in this case, by the local Jurisdiction Port captain (Grau Avila, 2018)

It should be pointed out that although control mechanisms can be simplified by using sensors, these involve the sampling of vessels' ballast tanks, the power of which is granted exclusively to the local authorities and not to licensees of port infrastructures; besides, verification analysis for phytoplankton and bacterial culture require at least 48 hours to complete, which is why these analyses are limited to the national jurisdiction and may slow down the flow of goods.

7.3 Measures for the Biodiversity Action Plan.

As has already been established in this assessment, the Project and its area of influence are defined within regions identified as Critical Habitats based on their definition in Performance Standard 6 of the IFC. Although it is emphasized that the Project will not produce direct impacts on these habitats, its realization at a specific location must bring tangible benefits associated with its conservation aims via the implementation of a Biodiversity Action Plan. Therefore, a portfolio of supportive initiatives is being contemplated to address the management of AUSCM, RMISC and, in general, the encouragement of conservation management capabilities both in public institutions with subject matter jurisdiction (MAAE and RMISC park rangers) and in social organizations of ancient inhabitants and traditional mangrove users.

[17] http://archive.iwlearn.net/globallast.imo.org/index.html

In order for these initiatives to be successfully applied, other institutions and social organizations, except for No. 1, need to get involved, sign letters of mutual commitment, and agree to work jointly in matters deemed of pressing nature by the parties; therefore, the selection of initiatives to be finally implemented will be performed based on an assessment of feasibility achieved during the initial approaches. Likewise, the estimated cost provided is for reference purposes only, whereas the real value to be conveyed will depend on the definition of issues and aims.

Said initiatives are shown in Table 5.

Table 5 Measures for the Critical Habitats management plan

No.	Initiative	Beneficiaries	Aim	End goal	Duration (years)	Total Cost (USD)	Verification means	Responsible party
1	During biotic, marine and mangrove resource monitoring procedures, demonstration on a differentiated basis of sighting occurrences of critically endangered species within the AAEA: *Paraclinus fehlmanni*, *Urobatis tumbesensis*. *Calidris pusilla.*	--	Knowledge contribution on CR, EN and VU species	Identification of population occurrences of critical species for the project in the AAEA.	Validity of relevant PMA	No additional costs	Monitoring report and photographic record	HSE
2	Raise awareness among YILPORT personnel of Critical Habitats in the Project Area of Indirect Influence (AID) (biannual)	YILPORTECU personnel Aso. Turística San Antonio	Raising personnel awareness	Raising personnel awareness of Critical Habitats	6	15,000.0	Photographic record and visit schedule	HR-HSE
3	Patrolling support and equipment at RMISC (biannual)	MAAE	Strengthening of RMISC safekeeping capabilities	Approximately 13 square miles	6	22,500.0	YILPORT-MAAE cooperation agreement, annual assessment report	Direction
4	Recovery of natural mangrove zonation (reforestation) at Isla del Amor region	Community organization of traditional mangrove users	Increase in mangrove coverage	10 ha	6	47,747.0	Technical specifications and process publications	HSE
5	Financing of the Socio Manglar program for AUSCM in the AID	Community organization of traditional mangrove users	Strengthening of mangrove safekeeping capabilities	467 ha	3	49,211.0	YILPORT-MAAE cooperation agreement - Social Organizations	Direction

No.	Initiative	Beneficiaries	Aim	End goal	Duration (years)	Total Cost (USD)	Verification means	Responsible party
6	Financing of the research project: - Carbon capture in mangroves within the AID -	Grant recipient - University or Research Institute	Strengthening of RMISC safekeeping capabilities	Approximately 13 square miles (7 hectares of land and 2 nautical miles around the isle and islets)	4	48,400.0	YILPORT-MAAE cooperation agreement - transfer certificates, results report	Direction
7	Support institutions with an expertise in marine coastal regions for the determination and tracking (on a five-year basis) of the Mangrove Forest Trend and Condition (ICTBM) within the area of direct influence	Grant recipient - University or Research Institute	Determine and monitor mangrove conditions in the area of direct influence	2,000 ha in the area of direct influence	10	75,000.0	Cooperation agreement YILPORT - institutions, academic journals, technical specifications and/or reports	Direction
8	Support the integration of a “Community Scientific Station” for mangrove monitoring and assessment (biannual): mangrove structure and coverage, carbon stock, species identification	University - Organizations of ancient inhabitants and traditional mangrove users	Mangrove structure monitoring	Up to 4 organizations with AUSCM in the safekeeping area	10	72,000.0	Cooperation agreement YILPORT - institutions, academic journals, technical specifications and/or reports	Direction

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9. Annexes

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Annex 3. Puerto Bolívar Expansion - Stage 1 IBAT Report (2021) on marine birds

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Annex 11. Species identified in monitoring procedures at Puerto Bolívar

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PUERTO BOLIVAR PROJECT PHASE 1

– SOCIAL BASELINE–

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Elaborated by:

ECOSAMBITO C. LTDA.

December 2020

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EXECUTIVE SUMMARY

In order to understand social actors in the influence area of the Project, a primary and secondary information survey was performed by applying tools such as enquiries to inhabitants and union representatives, semi-structured interviews to union leaders, and analysis and synthesis of secondary information.

According to IFC development standards, knowing community perception and participation regarding activities performed as part of the project is an important aspect. Specifically, ND1 that considers much more developed aspects regarding community relations and other social actors establishing more solid and profound relationships. Therefore, acknowledging current situation in order to complement measures and programs proposed by the Environmental and Social Management Plan (ESMP, PGAS in Spanish) into their reality is a way to guarantee their compliance.

This document presents a social baseline that establishes the conditions of education, health, housing, and basic services of the population closest to the project, as well as their productive activities, perceptions, and expectations regarding the construction and operation of the project.

Stakeholders have been identified and mapped in order to define communication and outreach strategies in the short, medium and long term.

Finally, an assessment of the potential risks and impacts of project activities on the health and safety of the community has been carried out.

SOCIAL BASELINE

1. Introduction

Consultancy retained for “SOCIAL AND EVIRONMENTAL ASSESSMENT FOR PUERTO BOLIVAR PORT TERMINAL PHASE 1 - YILPORT TERMINAL OPERATIONS” Project includes a diagnostic study about socio-economical characteristics and a socio-economic survey that should contain indicators such as population ethnic characteristics, gender and socioeconomic status, utilities, and infrastructure in compliance with valid national standards and International Finance Corporation (IFC) performance standards

2. Justification

Due to COVID 19 pandemic, performing personal or direct survey was limited. However, this type of survey was implemented by taking into account biosafety protocols and physical and social distancing.

3. Methodology

In order to collect and analyze data for “ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR PUERTO BOLIVAR PORT TERMINAL PHASE 1 - YILPORT TERMINAL OPERATIONS - YILPORTECU S.A.” Project, a deductive methodology in El Oro Province (macro level) and Machala Canton (micro level) was used, since Puerto Bolivar District is specifically considered as a urban district in Machala Canton.

A primary information survey through closed enquiries including multiple choice and single selection questions was performed. This tool will provide results with rough data representing an actual and updated social diagnosis.

Methodological tools were:

- A first-level analysis involved literature review (publications, reports, audits and previous environmental impact studies, Machala Canton 2018 Development and Land Use Plan (PDOT in Spanish) for the study area.
- A second level involves primary information by implementing physical enquiries.

3.1. Enquiry Implementation Procedure

Face-to-face enquiries were performed in Puerto Bolivar urban district. The form used in these enquiries is presented in Appendix 1.

Sample Selection

Object population in this enquiry is obtained from 2020 Election Registry prepared by National Election Council, which states that Puerto Bolivar District has 23,062 electors. This number was considered as total universe to obtain an enquiry sample.

Figure 1 Number of electors in Machala Canton and Puerto Bolívar District

CANTÓN PARROQUIA	ÁREA*	ELECTORES	SEXO		TIPO DE VOTO		PERSONAS CON DISCAPACIDAD	JUNTAS	RECINTOS ELECTORALES
			HOMBRES	MUJERES	OBLIGATORIO	FACULTATIVO			
HUALTACO	U	915	438	477	761	154	23	4	1
HUAQUILLAS	U	32.745	16.549	16.196	26.692	6.053	798	99	6
MILTON REYES	U	873	447	426	714	159	24	4	1
UNIÓN LOJANA	U	2.118	1.002	1.116	1.782	336	60	7	1
LAS LAJAS		**4.987**	**2.691**	**2.296**	**3.702**	**1.285**	**261**	**21**	**7**
EL PARAÍSO	R	589	309	280	466	123	32	4	2
LA LIBERTAD	R	685	371	314	517	168	34	4	2
LA VICTORIA/LAS LAJAS	U	2.774	1.517	1.257	2.041	733	143	9	1
PLATANILLOS	U	433	214	219	301	132	26	2	1
SAN ISIDRO	R	506	280	226	377	129	26	2	1
MACHALA		**213.650**	**107.741**	**105.909**	**174.299**	**39.351**	**6.014**	**663**	**52**
9 DE MAYO	U	4.987	2.342	2.645	4.046	941	171	19	3
EL CAMBIO	U	7.063	3.655	3.408	5.654	1.409	193	23	3
EL RETIRO	R	1.947	1.031	916	1.639	308	53	10	3
JAMBELÍ	U	4.364	1.955	2.409	3.616	748	177	14	2
JUBONES	U	1.726	772	954	1.425	301	86	6	1
LA PROVIDENCIA	U	71.756	36.278	35.478	61.764	9.992	2.088	219	19
MACHALA	U	98.745	49.914	48.831	77.379	21.366	2.575	302	16
PUERTO BOLÍVAR	U	23.062	11.794	11.268	18.776	4.286	671	70	5
MARCABELÍ		**5.409**	**2.845**	**2.564**	**4.138**	**1.271**	**199**	**18**	**2**
EL INGENIO	R	301	170	131	225	76	5	2	1
MARCABELÍ	U	5.108	2.675	2.433	3.913	1.195	194	16	1
PASAJE		**66.170**	**33.929**	**32.241**	**52.607**	**13.563**	**2.030**	**218**	**25**
BOLIVAR	U	684	311	373	611	73	18	2	1
BUENAVISTA	R	4.992	2.672	2.320	3.963	1.029	164	15	1

*U= ÁREA URBANA I R= ÁREA RURAL

SIGUIENTE ▶

Canton, Parish, Sex, Men, Women, Vote Type, Compulsory, Optional, Disabled person, Committees, Electoral premises, Urban Area, Rural Area

A formula proposed by Murray & Larry (2005) was used:

$$n=\frac{Z^2\sigma^2 N}{e^2(N-1)+Z^2\sigma^2}$$

Where:

n = is the size of the sample to be obtained.

N = is the size of the Universe. (in this case, 23,062 people registered as electors in Puerto Bolivar urban district)

σ = represents population standard deviation. In case this data is ignored, a constant value equivalent to 0.5 is commonly used.

Z = is the value obtained through levels of reliability. Its value is a constant; generally two values are available, depending on reliability degree required, being 99% the highest value (this value is equivalent to 2.58) and 95% (1.96) the minimum value accepted to consider this investigation as reliable (in this case, 1.96 is the value used).

e = represents the minimum acceptable sampling error, generally from 1% (0.01) to 10%

(0.10), being 5% (0.05) the standard value used during investigations (in this case, 0.10 is used)

Once proper values are established, value substitution and formula implementation to obtain the size of population sample consistent with determined finite universe are performed.

A sample of 96 cases that represents the number of enquiries to be performed in Puerto Bolivia urban district was obtained.

Training to Interviewers

Training to interviewers was performed by explaining in detail the way to fill in the enquiry forms and the biosafety protocols to follow. For this purpose, corresponding PPE (Personal Protection Equipment), biosafety equipment and credentials were delivered.

Material

The following material was used:

- Identification Credential of the Interviewer
- Biosafety Protocol and Physical and Social Distancing
- PPE - Personal Protection Equipment
- Designed and printed enquiry to be applied in a face-to-face manner
- Registry Log of enquiries performed

Biosafety Protocol for field survey approved by National Emergency Operative Center (COE in Spanish)

Personnel for information collection (field survey) will follow biosafety protocols and consider the following:

- Using the following Personal Protection Equipment (PPE): protective suit, hat, and face masks during the whole process, as well as facial protection, glasses and others according to risk exposure for the interviewer.

  Wearing jewelry such as rings, earrings, necklaces or bracelets is prohibited. Carrying personal cleaning kit: alcohol or sanitizer for personal use, and washing and disinfecting hands at least every 3 hours must be performed.
- People having long hair (longer than shoulders) should keep it tied back; finger nails must be kept short.
- When using cellphone, clean it periodically with alcohol applied with a napkin or cloth.
- Physical greeting is prohibited.
- Documentation will be collected at the door of every home/industry/store keeping a 2-meter distancing.
- Disinfecting tools to be used for survey after every enquiry.
- Maximum time per enquiry: 20 minutes.
- Once enquiry is finished, personnel will use sanitizer to disinfect their hands.

Safety during Mobilization

- Using face mask all the time is compulsory.
- A single person per row in small vehicles and keeping distance among passengers.
- In case of vehicles with greater capacity (bus, van) units must apply disinfection process, as established in Cleaning and Disinfection Protocol for Public Transportation Units issued by National Traffic Agency.
- Hand cleaning and disinfection before and after using means of transportation is compulsory.

Adverse Conditions for Enquiry

- People who show symptoms (cough, fever, hard time breathing) that could be related to COVID 19.
- People who are part of a Prioritized Assistance Group: handicapped, old aged, pregnant or having had previous or catastrophic medical conditions such as artery hypertension, heart disease, diabetes, chronic lung disease or immunosuppression, among others.

4. Demography

4.1. Population

According to 2010 Census, El Oro Province has a total population of 600,659 inhabitants: 304,362 men and 296,297 are women.

Population in cantons of El Oro Province is distributed the following manner:

Table 1. Population of cantons in El Oro Province

CANTON NAME	INHABITANT NUMBER
MACHALA	245,972
ARENILLAS	26,844
ATAHUALPA	5,833
BALSAS	6,861
CHILLA	2,484
EL GUABO	50,009
HUAQUILLAS	48,285
MARCABELI	5,450
PASAJE	72,806
PINAS	25,988
PORTOVELO	12,200
SANTA ROSA	69,036
ZARUMA	24,097
LAS LAJAS	4,794

Source: INEC, 2010 Population and Housing Census

Prepared by: *Ecosambito, 2020*.

The canton with the largest number of inhabitants is Machala, taking into account that it is the provincial capital and has highly populated urban districts. It has 245,972 inhabitants: 122,948 women and 123,024 men.

This is, 50.02% of Machala population is comprised by men and 49.98% are women. A minimal difference of 0.04%, corresponds to 76 men more than women[1].

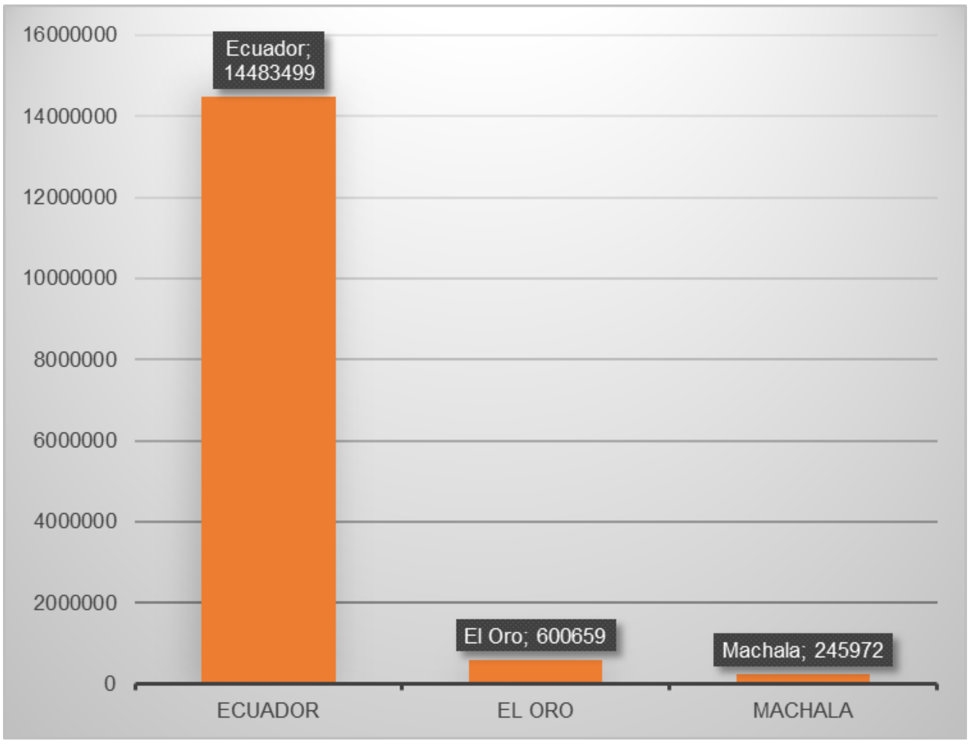
Table 2. Population by Gender according to Canton, Province and Country

CANTON/ PROVINCE/COUNTRY	POPULATION	MEN (%)	WOMEN (%)
MACHALA CANTON	245,972	50.02	**49.98**
PROVINCE	600,659	50.67	**49.33**
COUNTRY	**14,483,499**	**49.56**	**50.4**

Source: INEC, Population & Housing Census 2010.

Elaborated by: Ecosambito, 2020.

Figure 2. *Population in territorial jurisdictions*



Elaborated by: Ecosambito, 2020.

Population in Puerto Bolivar District includes 6,174 people: 3,235 men and 2,939 women according to 2010 Census.

[1] National Statistics and Census Institute (INEC), 2010 Population and Housing Census

In El Oro Province, according to five-year age groups, 10.51% people are less than 14 years old, which determines that majority of population are young and no significant differences between men and women are present.

From 15 years old, individuals are present in the pyramid, most of all between 25 and 30 years of age. This phenomenon could be justified because this group leaves the province for study, work and other purposes.

According to large age groups, Machala Canton population is distributed as follows:

- 72,219 inhabitants between 0 and 14 years of age
- 160,321 inhabitants in Machala are in ages between 15 and 64 years old
- 13,432 are 65 years of age or older

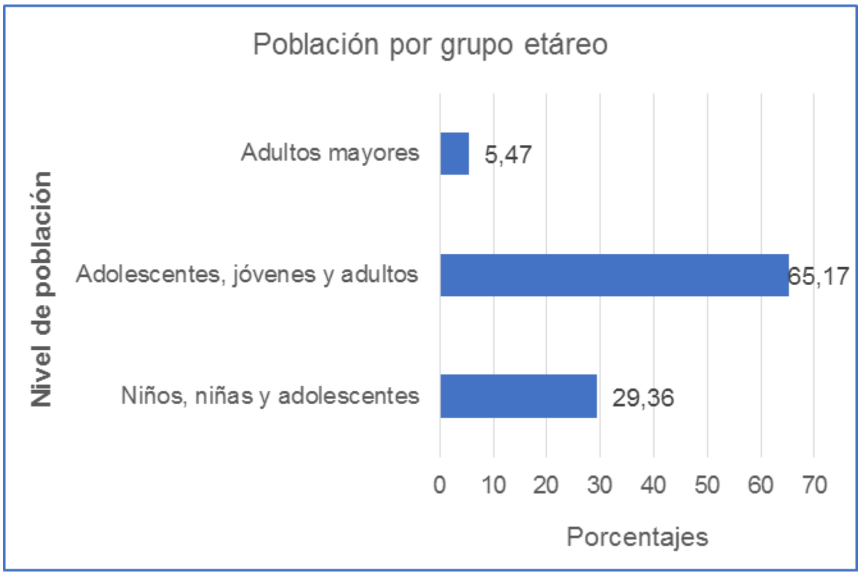
Table 3. *Population by Gender and large age groups in Machala Canton*

Age Groups	Total	%
Children (0/14 years old)	72,219	29.36
Adolescents (12/17 years old), Youngsters (18/28 years old), Adults (29/64 years old)	160,312	65.17
Older Adults (65 and older)	13,432	5.47
TOTAL	**245,972**	**100**

Source: INEC, 2010 Population and Housing Census

Elaborated by: Ecosambito, 2020.

Figure 3. *Population by Age Group*



Age group population, Population level, Senior citizens, Adolescents, youngster, male children, female children and adolescents

Elaborated by: Ecosambito, 2020.

4.1.1. 2010-2020 Population Growth Index

Population projection estimated in Machala Canton refers to demographic data and methodology developed in the study by National Planning and Development Secretariat[2]. In this regard, population estimation refers to:

> […] the number of people estimated an area has or had in a specific moment in time, either globally or by a more reduced category. Such volume is not produced by direct measurement, but in order to obtain this, some information about population has been taken into account […][3]

Population estimation provides a projection:

> […] resulting from a set of demographic, mathematical or any other kind of estimation, by which more plausible trends for determining variables in population dynamics are sought to be established and therefore derivation of population volumes […].[4]

According to methodology established by INEC (2012), a basic principle is to break down population growth into fundamental demographic components. This model enables inferences on a regional, provincial and cantonal basis.

According to this methodology and data provided by INEC, the following figures are presented on a scale related to Machala Canton:

Table 4. *Population Projection for 2010-2020 Period – Machala Canton.*

Projection Year	Population
2010	245,972
2011	255,012
2012	258,490
2013	261,905
2014	265,254
2015	268,537
2016	271,758
2017	274,919
2018	278,013
2019	281,041
2020	284,009

Source: INEC 2012 Projections; Census 2010

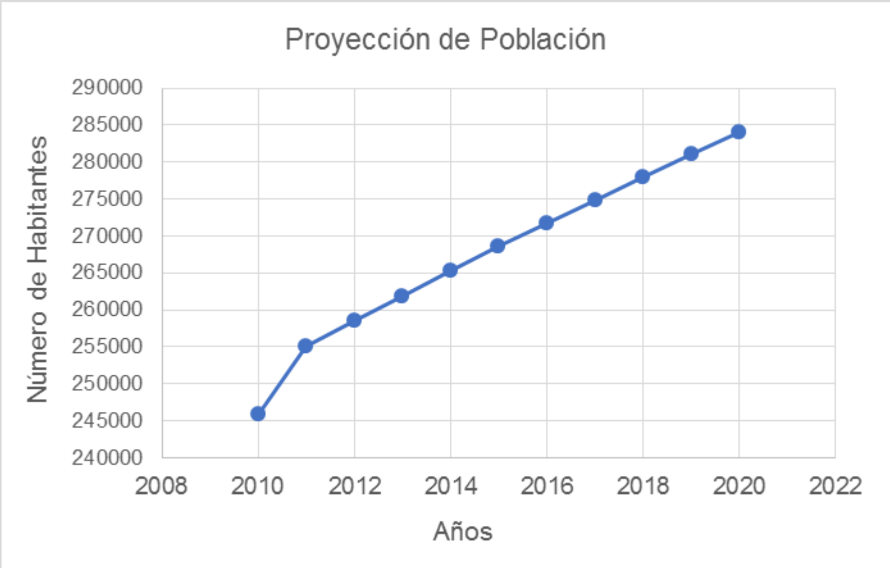
Elaborated by: Ecosambito, 2020.

[2] INEC (2012) - 2010-2050 Projections for Population in the Republic of Ecuador, SENPLADES Department of Standards and Methodologies, Quito

[3] INEC (2012) *Op. Cit.*

[4] INEC (2012) 2010-2050 Projections for Population in the Republic of Ecuador, SENPLADES Department of Standards and Methodologies, Quito

Figure 4. *Projection for Machala Canton Population*



Elaborated by: Ecosambito, 2020.

4.1.2. Population Density

INEC provides population census data and area of each jurisdiction, in an official manner. This information is used to estimate population density for Machala Canton (including Puerto Bolivar urban district).

Table 5. *Cantonal Population Density*

Districts	Population	Square Km	Population Density
Machala Canton	245,972	33,018	**7.44**

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

5. Ethnic Self-identification

Resulting data from 2010 Population & Housing Census revealed that El Oro Province citizens identified themselves as mestizo (81,78%), being majority, whereas minority, 7,81%, consider themselves as white. A total of 4,81% consider themselves Afro-Ecuadorian, 2,81% Montubio, 2,11% mulatto and only 0,68% indigenous, as shown in the following table:

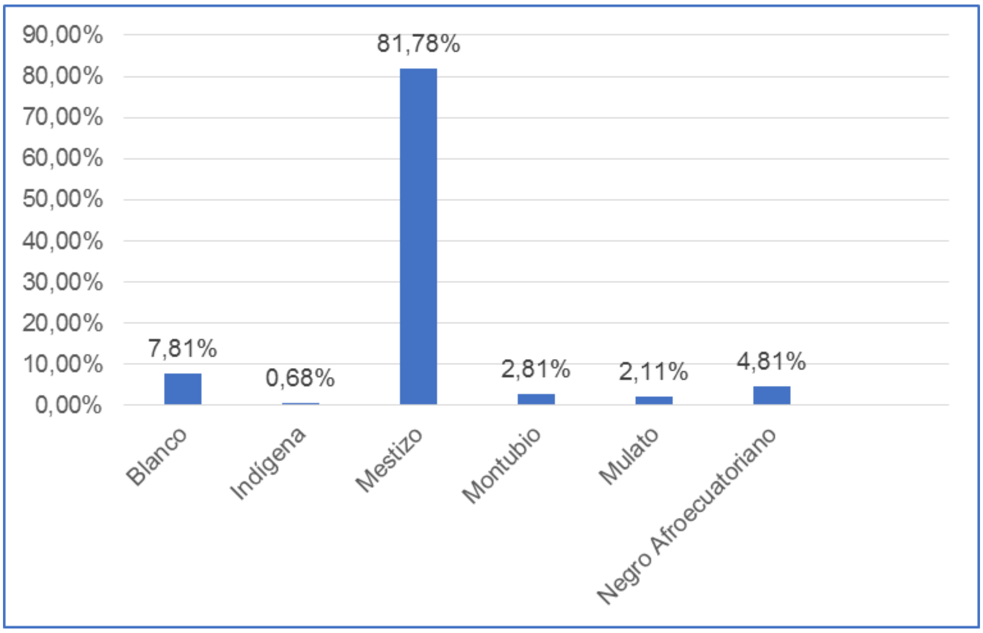
Table 6. *Ethnic Self-identification in El Oro Province*

Indicator	Population	Percentage
White	46,801	7.81
Indigenous	4,060	0.68
Mestizo	489,843	81.78
Montubio	16,858	2.81
Mulatto	12,613	2.11
Afro-Ecuadorian	28,828	4.81
TOTAL	**599,003**	**100.00%**

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

Figure 5. *Ethnic Self-identification in El Oro Province*



Elaborated by: Ecosambito, 2020

According to the seventh population census, mestizo race prevails in Machala Canton, according to people's self-identification, 79% of mestizo people are predominant while 9% of Machala population consider themselves as white, 5% Afro-Ecuadorian; 3% mulatto, 3% Montubio and only 1% state being be indigenous.

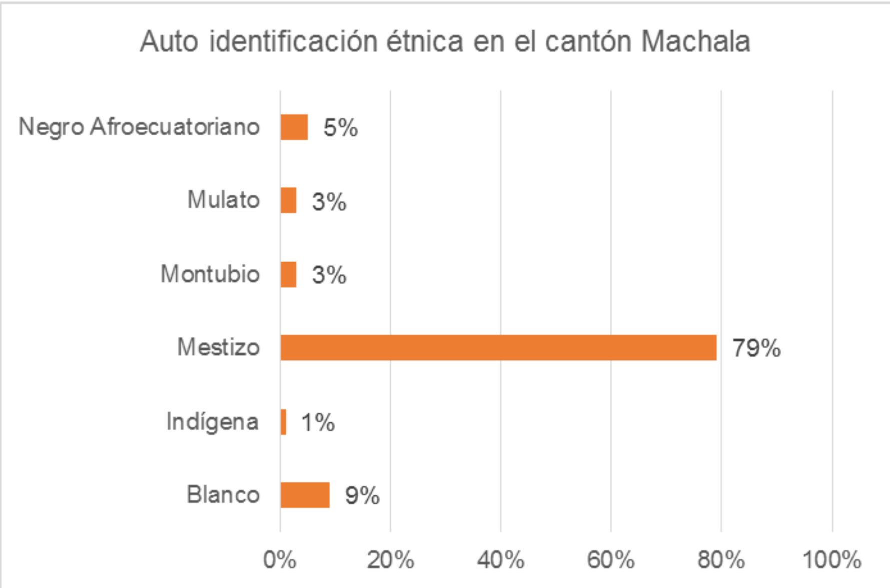
Table 7. *Ethnic Self-Identification in Machala Canton*

Self-Identification	**Percentage**
Indigenous	1%
Afro-Ecuadorian	5%
Montubio	3%
Mulatto	3%
Mestizo	79%
White	9%
Total	100%

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

Figure 6. *Ethnic Self-Identifcation in Machala Canton*



Elaborated by: Ecosambito, 2020.

6. Economic Activities

6.1. Economic Activity in El Oro Province

In 2010, agriculture, livestock, forestry and fishing sector represented an employment source for 61,592 people living in the province; this is more than one fourth of the economically active population (PEA in Spanish).

This sector is still characterized by a very relevant masculinization since 9 out of 10 active people are men. On the other hand, almost half of active population, 65 years or older, in the Province (46%), belong to such sector.

In El Oro Province, a total of 15,061 economically active people (6%) are concentrated in the secondary sector of provincial PEA. In this province, 4,062 men and 1274 women between 15 and 29 years of age are concentrated in the secondary economic sector and represent 7% of PEA regarding economically active provincial population from 15 to 29 years of age.

In El Oro, 144,516 economically active people located in 2010 service section were registered. In commercial sector 35%, construction 11% and “transportation and storage” 9% sectors are registered”[5].

In El Oro Province, 48% of men and 69% of women between 15 and 29 years of age are concentrated in the tertiary economic sector regarding economically active population ranging 15 and 29 years of age.

Trading activities, including 50,792 people, have increased twice regarding active population in only two decades; it groups 20% of El Oro population. Furthermore, trading sector plays an important role in women incorporation to labor in this province.

Public Administration and Security sector includes 10,981 people from which 8,058 are men and 2,923 are women. It is evident that men are still leading in this sector; however women stand out in teaching activities that gather 7.2% of active people in this sector where 7,890 are women and y 4,401 are men. Likewise, in human healthcare sector, 3,318 are women and 1,409 are men, another sector where female active population exceeds male active population. Then, Public Administration and Security is clearly masculine while Teaching and Healthcare is significantly feminine.

In 2010, Construction sector reached a record figure of 15,781 people. The most masculine sector in the province is characterized by youngsters.

Manufacturing Industry sector, including 15,061 active people in the province, shows an evident standstill and even a light setback regarding significance for active population compared to the other economic sectors.

Three subsectors concentrate approximately two thirds of active population in this sector: (i) food and drinks production industry (ii) textiles, leather and dressmaking industry, and (iii) furniture and timber industry.

Food Production Industry is an activity source for 1 of every 5 workers in the industrial

[5] Development and Land Use Plan, Machala Canton – 2018

sector and comprises 1.5% of PEA in this province. This indicates a low capability of agri-food sector in total to generate added value and take advantage of its great economic potential. For each active person in the agricultural sector, 0.06 - 0.08 active people in agri-food industry are present. This industry is also characterized for a low presence of active female population: 1 for every 4 women.

Textiles, leather and dressmaking industry is characterized by high female active population; 2 to 3 women.

Furniture manufacturing only represents 16% of active population in the industrial sector with a higher level of masculinization than agri-food sector[6].

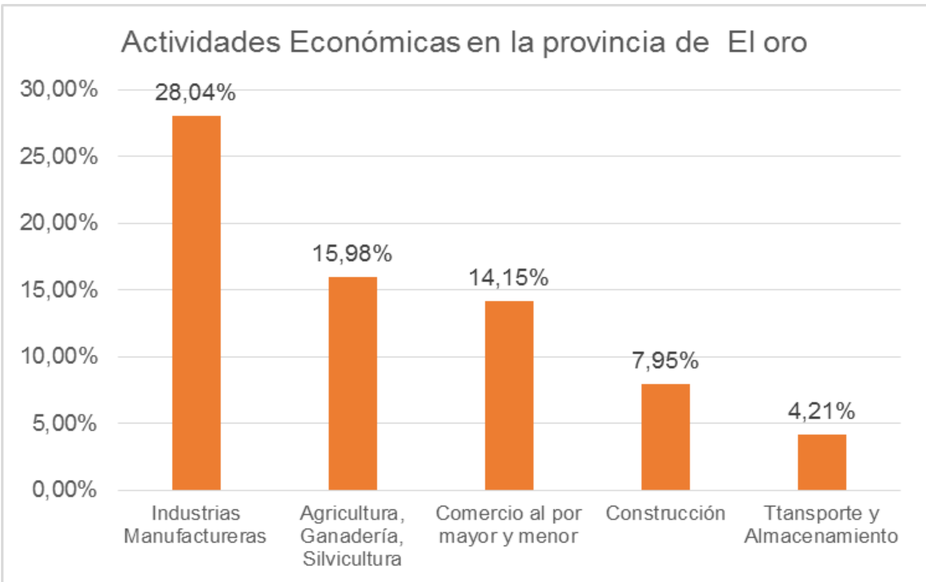
Table 8. *Economic Activities in El Oro Province*

Gender	Manufacturing Industry	Agriculture, Livestock, Forestry	Wholesale & Retail Trading	Construction	Transportation & Storage	Total
Men	2,495	2,312	1,314	1,480	765	10,980
%	22.72	21.06	11.97	13.48	6.97	
Women	2,826	720	1,371	29	34	7,994
%	35.35	9.01	17.15	0.36	0.43	
Total	5,321	3,032	2,685	1,509	799	18,974
Total %	28.04	15.98	14.15	7.95	4.21	

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

Figure 7. *Economic Activities in El Oro Province*



Manufacturing industries, Agriculture, Livestock, Forestry, Wholesale and retail trade, Construction, Transportation and Storage

Elaborated by: Ecosambito, 2020.

[6] Development and Land Use Plan, Machala Canton – 2018

6.2. Economic Activity in Machala Canton

Population in Machala Canton work in 21 activities considered the most important in the area. Among these, three are the most important with greater participation percentage[7]:

- Wholesale and Retail trading, including 27,192 inhabitants in Machala Canton that represent 25%.
- Secondly, Agriculture, Livestock, Forestry and Fishing including 14,244 inhabitants and representing 13%.
- Manufacturing Industry including 7,670 inhabitants and representing 7%.
- Construction sector also represents 7% including 7,593 inhabitants.
- Undeclared workers represent 7% and Transportation and Storage workers represent 6%.
- Education sector represents 5% and includes 5,312 economically active inhabitants.
- It is important to mention Public Administration representing 5% corresponding to 5,215 inhabitants, and Hosting and Food Service including 5,089 also representing 5%.
- Public Administration and Security, also considered an activity, represents 5% of Machala Canton population, including 5,215 inhabitants.
- New workers include 4,868 inhabitants that represent 4%.
- Remaining percentage between 0% and 3% represent other activities.

Table 9. *Activities in Machala Canton*

Activity	Population
Agriculture, Livestock, Forestry & Fishing	14,244
Mining and Quarrying	639
Manufacturing Industries	7,670
Electricity, gas, steam & air conditioning provision	473
Water supply, Sewage and Waste Management	487
Construction	7,593
Wholesale and Retail Trading	27,192
Transportation & Storage	6,579
Hosting and Food Service Activities	5,089
Information & Communication	1,301
Financing and Insurance Activities	362
Real Estate Activities	129
Professional, Scientific & Technical Activities	1,615
Administrative and Support Service Activities	2,384

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Activity	Population
Public Administration & Security	5,215
Education	5,312
Human Healthcare Activities	2.768
Arts, Entertainment & Recreational Activities	640
Other Service Activities	2,962
Domestic Employee Activities	3,557
Extraterritorial Organizations and Entities	5
Non-Declared	7,150
New Workers	4,868
TOTAL	**108,234**

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

6.3. Economic Activity in Puerto Bolívar

Puerto Bolívar is the main urban district in Machala Canton, where one of the most important export ports in the country is located. Approximately 85% of banana total production obtained in Ecuador is traded through Puerto Bolivar marine port.

However, other activities such as production and export of cacao, coffee, shrimp, tropical fruits, timber, seafood and minerals are present. Artisan fishing is also developed in Jambeli Archipelago estuaries and canals, where community has a limited area for fishing. Among communities, types of fish varies but the most common are: European bass, corvina, snapper, liza, grunt, anchovy, catfish, shorefish, moonfish, pompano, *cachema*, threadfish, leatherjacket fish, Raphael catfish, ray, sawfish, guitarfish, puffer, sole, and sea shrimp during May and April.

7. Education

Ministry of Education is in charge of observing, regulating, controlling and managing educational service, while on a cantonal level, it supervises infrastructure adaptation.

7.1. Illiteracy

In El Oro Province, illiteracy is 4.12% representing the lowest rate when compared with other provinces.

In Machala Canton, illiteracy is 3.10%, which represents 96.90% is literate[8].

7.2. School Dropout Rate

In El Oro Province, school dropout rate is 7.25%. According to 2010 Population and

[8] National Statistics and Census Institute (INEC), 2010 Population and Housing Census

Housing Census results, 9% of population older than 15 years of age who regularly attends educational centers have not finished basic education (school dropout), while in Machala Canton school dropout rate is 5%.

Table 10. *School Dropout Rate on a cantonal Basis*

Canton	Number of Students dropping out School System	Register Total	Dropout Rate
Arenillas	40	1,188	3.4
Atahualpa	40	548	7.3
Balsas	19	349	5.4
Chilla			
El Guabo	304	4,759	6.4
Huaquillas			
Las Lajas	3	354	0.8
Machala	40	796	5.0
Marcabeli	2	46	4.3
Pasaje	101	3,568	2.8
Piñas	35	1,537	2.3
Portovelo	6	449	1.3
Santa Rosa	132	3,174	4.2
Portovelo	118	2,780	4.3

Source: INEC, 2010 Population & Housing Census

Elaborated by: Ecosambito, 2020.

7.3. Educational Levels

According to 2010 Census undertaken by INEC, a total of 79,994 regular educational facilities are available in Machala Canton.

From that total, 57,956 are managed by the State and 20,821 are private institutions, representing 72% and 26%, respectively. A total of 802 educational centers are public-religious (*fiscomisionales)* and 415 are municipal schools.

According to this data, it can be concluded that Public Education system covers 74% (considering state, public/religious and municipal schools).

According to INEC 2010 Census, in Machala Canton, 68,681 inhabitants state their highest educational level is primary school. A total of 58,079 declared having secondary school and 36,790 inhabitants achieved university education.

Results show that only 2,218 inhabitants have post-degree education.

A total of 2,630 inhabitants are in preschool level and 17,958 access primary school, while 21,738 go to secondary school and 3,125 achieve post-graduate education.

8. Health

Ministry of Public Health in Ecuador is the competent body within the health system. Operational Units (UO in Spanish) are related to the National Health System and qualified according to their assistance type and level, determined by patient medical history and the demands for medical assistance.[9] SNS places Imbabura Province in Zone 7, along with Loja and Zamora Chinchipe Provinces.[10]

SNS is intended to improve systematically and progressively life and health levels of Ecuador inhabitants, and improve their life conditions. This system focuses on implementing health rights to every individual guaranteed by the Constitution of the Republic. SNS includes private, public, autonomous and communal health institutions and intends to fulfill the following objectives:[11]

1. Assure equal and universal access to integrated health assistance through a service network including decentralized management.
2. Integrally protect people from risks and damage to their health and environment from its deterioration or impact.
3. Generate healthy life environment, style and conditions.
4. Promote institutional coordination, complementation and development in health sector.
5. Incorporate citizen participation in planning and surveillance at every action level and condition regarding SNS.

Health service coverage in El Oro Province is highly significant in cantons with high concentration of population such as Machala, Pasaje and Santa Rosa.

Machala Canton has 68 health centers, both public and private. A total of 99% is distributed within urban area, which practically covers the whole population.

Machala Health District has achieved to organize Intercultural Health, Alternative Medical System for Allopathic Medicine Health Service, Health Zone Cadastral Registry N1 and 2 for year 2013 according to Integral Health Location Analysis, Health District 07d02, Machala-El Oro, 2014- 2015 Document that registers every healthcare center.

[9] Ministry Agreement No. 00005212, Alternative Typology to ratify Healthcare Facilities according to assistance levels and supporting services for National Health System. – Supplement – Official Registry No. 428, Quito – Friday, January 30, 2015.
[10] Ministry Agreement No. 00004521, Guidelines to organize healthcare facilities of Ministry of Public Health in Areas and Districts, November 14, 2013.
[11] Law No. 2002-80. Organic Law for National Health System, Official Registry No. 670, Quito: September 25, 2002.

Table 11. *Types of Health Centers on a Cantonal Level*

Center Type	Public	Private
Municipal Healthcare Center	9	0
Municipal Mobile Clinics	5	0
Private Healthcare Centers	0	22
Clinics	0	27
National Police Healthcare Center	1	0
Army Force Healthcare Center	2	0
Municipal Hemodialysis Center	1	0
Private Hemodialysis Center	0	1
Esperanza Hospital (Machala Curia)	0	1
SOLCA Hospital - Machala	1	0
Machala Social Security Hospital	1	0
Dr. Pomerio Cabrera Municipal Hospital	1	
General Hospital	1	0
Total	**22**	**51**

Source, Machala Health District, 2013

Elaborated by: Ecosambito, 2020.

The Ministry of Public Health has three facilities in the parish of Puerto Bolivar:

1. Puerto Bolivar Health Center 2.
2. Amazonas Health Center
3. Puerto Bolivar Epidemiological Surveillance Post.

Regarding physicians/inhabitants, the main canton area registers 884 physicians, an average of 33.5 professionals for every 10 thousand inhabitants.

This Canton registers 245,972 inhabitants, but the number of beds for health assistance is only 693; this is 25.9 beds for every 10 thousand inhabitants. Reportedly, Machala Canton has a deficit of 4.1 beds for every 10 thousand inhabitants to provide the whole population. This deficit is determined by Ministry of Public Health standards that relate 3 beds per every 1,000 inhabitants for an appropriate provision to population.

8.1. Mortality

Mortality rate is one of the main variables in demographic dynamics of a population. In this regards, evaluation is required since it is inversely related to life quality of inhabitants. During the last 20 years, Diabetes and Hypertension are the main causes of mortality on a provincial and cantonal level.

The main health problem in 2020 is COVID-19 pandemic that has impacted the whole world. Therefore, in Ecuador it became a “State of Health Emergency” on March 12, 2020 according to Agreement No. 00126-2020, thus impacting Ecuadorians severely since health system was already collapsed and no vaccine is available to date.

Coronavirus 2019 (COVID-19) is a respiratory disease caused by SARS-CoV2 virus. It has spread to a great number of countries around the world, thus impacting each one on mortality and morbidity levels and responsiveness of healthcare services. Furthermore, everyday life aspects like economic and social activities, including traveling, trading, tourism, food supply and financial markets, among others could be impacted.

Based on the foregoing, Presidency and Vice-presidency of the Republic, Ministry of Health (MSP), Ministry of Labor (MT) and Ministry of Government (MG) have issued general guidelines to direct population on measures required to mitigate virus transmission, which must be adopted in different activities and sector in order to reinforce a response during virus mitigation phase.

To November 16, 2020, 7073 cases of COVID-19 have been confirmed and 518 casualties were reported in El Oro Province, while 3507 transmission cases have been confirmed in Machala Canton[12].

8.2. Morbidity

In the GeoSalud portal, information is available for two of the three health facilities (Centro de Saludo Puerto Bolivar and Amazonas) registered. The available official data given by the Ministry of Public Health (MSP) is from 2016.

Table 12. Morbidity in the parish of Puerto Bolivar1

MAIN CAUSES	TOTALS			PERCENTAGE		
	MAN	WOMAN	TOTAL	MAN	WOMAN	TOTAL
Urinary tract infection unspecified site		827	920	1,96%	7,91%	6,05%
Acute rhinopharyngitis [common cold].	351	432	783	7,38%	4,13%	5,15%
Intestinal parasitosis not otherwise specified	335	440	775	7,05%	4,21%	5,09%
Unspecified acute pharyngitis	254	355	609	5,34%	3,39%	4,00%
Inflammatory cervical disease	0	568	568	0	5,43%	3,73%
Diarrhea and gastroenteritis of presumed infectious origin	259	281		5,45%	2,69%	3,55%
Streptococcal tonsillitis	243	217	460	5,11%	2,07%	3,02%
Unspecified acute tonsillitis		237	434	4,14%	2,27%	2,85%
Candidiasis of the vulva and vagina	0	324	324	0	3,10%	2,13%
Acute cystitis		252	285	0,69%	2,41%	1,87%
Essential (primary) hypertension				2,00%	1,53%	1,68%
Unspecified acute bronchitis	86		186	1,81%	0,96%	1,22%
Unspecified atopic dermatitis		101		1,41%	0,97%	1,10%
Iron deficiency anemia not otherwise specified				1,35%	0,92%	1,05%
Unspecified obesity	45	110		0,95%	1,05%	1,02%
Genital infection in pregnancy	0				1,37%	0,94%
Mild protein-calorie malnutrition				1,28%	0,77%	0,93%
Unspecified amebiasis				1,05%	0,80%	0,88%
Dyspepsia				0,82%	0,85%	0,84%
Headache		91		0,63%	0,87%	0,80%
Obesity due to excess of calories				0,93%	0,68%	0,76%
Acute vaginitis	0			0	1,03%	0,71%
Strep throat				0,82%	0,54%	0,62%
Mixed hyperlipidemia				0,61%	0,57%	0,58%
Superficial mycosis without other specification				0,44%	0,63%	0,57%
Impetigo [any anatomical site] [any organism].				1,01%	0,34%	0,55%
Unspecified fever				0,74%	0,47%	0,55%
Unspecified gastritis				0,44%	0,53%	0,50%
Unspecified allergic rhinitis				0,78%	0,34%	0,48%
Unspecified low back pain				0,46%	0,49%	0,48%

[12] Ministry of Health, Ecuador, 2020.

MAIN CAUSES	TOTALS			PERCENTAGE		
	MAN	WOMAN	TOTAL	MAN	WOMAN	TOTAL
Unspecified back pain	28	42		0,59%	0,40%	0,46%
Localized upper abdominal pain				0,42%	0,38%	0,39%
Joint pain			58	0,25%	0,44%	0,38%
Non-insulin-dependent diabetes mellitus without mention of complication				0,29%	0,38%	0,35%
Constipation				0,50%	0,29%	0,35%
Unspecified allergy			45	0,32%	0,29%	0,30%
Pterygium				0,36%	0,26%	0,29%
Unspecified urinary tract infection in pregnancy	0			0	0,35%	0,24%
Secondary amenorrhea	0			0	0,30%	0,20%
Unspecified neuralgia and neuritis	5			0,11%	0,23%	0,19%
Allergic contact dermatitis of unspecified cause				0,25%	0,14%	0,18%
Lumbago with sciatica				0,13%	0,12%	0,12%
Pelvic and perineal pain	0			0	0,17%	0,12%
Pure hypercholesterolemia				0,04%	0,11%	0,09%
Other acute gastritis				0,06%	0,07%	0,07%
Tension headache		5		0,04%	0,05%	0,05%
Other iron deficiency anemias	1			0,02%	0,02%	0,02%
Myalgia	0			0	0,03%	0,02%
Acute upper respiratory tract infection, unspecified	1	1		0,02%	0,01%	0,01%
Grand total	4.753	10.461	15.214	100%	100%	100%

Source: Ministry of Health, 2016

As can be seen, the main medical care in the parish is related to urinary tract infection, acute rhinopharyngitis [common cold], intestinal parasitosis without further specification, unspecified acute pharyngitis, inflammatory disease of the uterine cervix, diarrhea and gastroenteritis of presumed infectious origin, streptococcal tonsillitis, among others.

9. Housing

In 2010, 159,016 homes were available in El Oro Province. Currently, there are 75,479 on a cantonal basis; this means (in absolute figure) 3.4 people live per home, as a median average. Additionally, 72.69% homes are house/villa type, so it can be deduced that approximately 186,000 people live in this kind of home, which demonstrate a housing culture among inhabitants[13].

Percentages about the type of home also demonstrate that practically the whole canton has a horizontal growth for their human settlements since only 9.99% live in apartments.

10. Utility Services

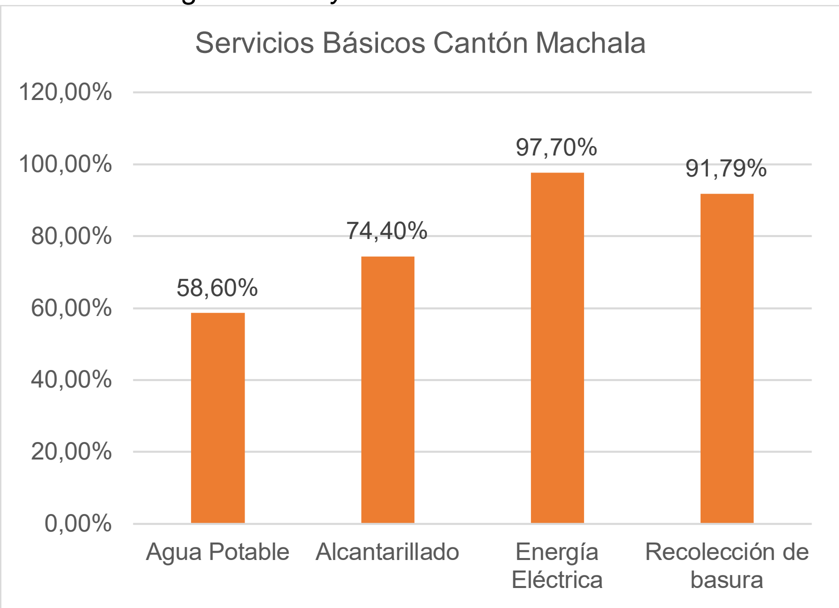
Utility services are infrastructure works that improve life quality of a population resulting in reduction of diseases and therefore saving resources. Besides, they enable access to information and communication. Utility services considered are: electricity, water for consumption, waste management and sewage system.

In El Oro Province, from 159,016 homes registered, 97% include electricity, 56% drinking

[13] Development and Land Use Plan, Machala Canton – 2018.

water, 86% waste management and 64% sewage system.

Figure 8. *Utility Services in Machala Canton*



Elaborated by: Ecosambito, 2020.

Previous figure shows that electricity is the most covered service in the whole canton, followed by waste management, sewage system and the least covered service is drinking water.

In Machala Canton, 28.73% of the population has local telephone in their homes; therefore 71.27% do not count on this service.

According to INEC data, 84.20% of homes in Machala Canton have mobile telephone service and 15.80% lack of this service.

In Machala Canton, 16.73% of homes have internet service.

Since the state of emergency and a year later the Humanitarian Support Law have been established increasing costs, fees or tariffs to utility service and telecommunications is prohibited. This means that fees may not be increased until September 15, 2021. Every company providing utility and telecommunication services should not apply any outage for default of payment as long as the state of emergency is valid and after two months it is terminated. This means prohibition for service outage is valid until November 15, 2021. Companies may start charging accumulated payment dividing them into twelve equal installments without any interests, fines or surcharges.[14]

Regarding utility services, during the State of Emergency due to COVID-19, population must not be left without any service. Therefore, it was resolved that electricity over 500 kilowatts for companies and homes will be charged at 10 cents per kilowatt/hour.

[14] This content has been originally published by **EL COMERCIO Journal in the followinglink:**https://www.elcomercio.com/actualidad/prohibicion-corte-servicios-basicos-pago.html.

11. Road Management

In El Oro Province, the State Road Network covers 400.94 kilometers, while Provincial Road Network extends 2,652.58 kilometers, from which 1,145.01 kilometers belong to Strategic Axes and 1,507.57 kilometers are Country Roads, not including bridleways.

State Road Network comprises a set of primary and secondary roads including the greatest vehicle traffic, interconnect province capitals, main towns in cantons, international border ports with our without customs office, and big and medium economic activity centers managed by the Ministry of Transport and Public Works.

11.1. Provincial and Cantonal Road Network

El Oro Provincial Road Network is a set of roads managed by provincial government according to 2014-2025 Road Management Plan. This network comprises tertiary roads divided in accordance with significance into four strategic axes and country roads.

Tertiary roads connect main districts and production areas to National Road Network roads and country roads with low traffic.

A total of 18% (488.90 km) belongs to the main provincial strategic axis, 14% (375.32 km) to secondary provincial roads, 8% (209.74 km) to main cantonal roads, 3% (71.05 km) to secondary cantonal roads, and 57% (1,507.57 km) to country roads.

Table 13. *Vial Road Network Conditions*

Provincial Road Network	Very Good	Good	Regular	Poor	Very Poor	Total in Km
Main Provincial Strategic Axis	57.40	166.59	125.36	69.95	69,90	488.90
Secondary Provincial Strategic Axis	66.80	91.16	119.46	79.20	18,70	375.32
Main Cantonal Strategic Axis	21.35	44.09	12.18	121.98	10,14	209.74
Secondary Cantonal Strategic Axis	3.76	10.92	22.90	26.87	6,60	71.05
Country Roads	5.04	101.40	189.62	1,033.35	178,16	1,507.57
Provincial Road Network	**154.35**	**414.16**	**469.52**	**1,033.35**	**283.20**	**2,652.58**
Percentage %	**6%**	**16%**	**18%**	**50%**	**11%**	**100%**

Source: El Oro Province Development Plan - 2015.

Elaborated by: Ecosambito, 2020.

Regarding Type of Wearing Courses, from a total of 2,652.58 (excluding bridleways); 19% are paved roads; only 0,1% are cobbled roads, 43% are ballast roads and 38% are dirt roads (natural soil); therefore, 81% are ballast and dirt roads.

Table 14. *Characteristics of Road Networks*

Provincial Road Network	**Paved**		**Cobbled**	**Ballast**	**Dirt (natural soil)**	**Total Km**
	DTSB	**Asphalt Layer**				
Main Provincial Strategic Axis	161.25	18.0		240.11	69.54	488.90
Secondary Provincial Strategic Axis	69.56	97.75		162.01	46.00	375.32
Main Cantonal Strategic Axis	13.12	33.85	1.46	107.69	53.62	209.74
Secondary Cantonal Strategic Axis	14.20	14.68		42.17		71.05
Country Roads	40.19	45.62		593.20	829.56	1,507.57
Provincial Road Network	**298.32**	**209.90**	**1.46**	**1,145.18**	**997.72**	**2,652.58**
Percentage %	**19%**		**0.1%**	**43%**	**38%**	**100%**

Source: El Oro Province Development Plan - 2015.

Elaborated by: Ecosambito, 2020.

11.2. Transportation Network

Main transportation system is by land. A total of 18 cooperatives with 644 vehicles including buses and vans for interprovincial and inter-cantonal transport are present. Heavy transport is performed by 7 cooperatives including 110 trucks and light-load transport is performed 12 cooperatives including 236 pick-up trucks and light trucks. Besides 23 taxi cooperatives including 608 vehicles are present.[15]

Maritime transport is mainly performed from Puerto Bolivar, located in the northwestern part of the province, under jurisdiction of Puerto Bolivar urban district in Machala Canton. This part is also located south of Guayaquil Gulf, at the entrance of Santa Rosa Canal, protected by Jambeli Archipelago. On a national basis, Puerto Bolivar is the second most important port in the country due to load volume that it is transported this way. Eighty percent of national banana production is exported by this port. This is a terminal apt to hold any type of vessel and load: ships for banana cargo, refrigerated paddles and containers, dry containers, vehicles, machines, coils and others.

12. Migration

In 2002, a total of 2,880 people migrated from El Oro Province, while in 2010, only 570 people left this province. This means a greater development in provincial production was present.

[15] Development and Land Use Plan, Machala Canton – 2018.

Total canton population registered in 2010, showed that 6,541 people migrated; 51% men and 49% women. From this total, 5,734 range between 15 and 64 years of age. Main causes for migration are in order of priority: work, family reunion and education.

Table 15. *Main Reasons for Migration*

Migrant Gender	Work	Education	Family Reunion	Others	Total
Men	2,352	287	542	155	3,336
Women	2,130	270	664	141	3,205
Total	**4,482**	**557**	**1,206**	**296**	**6,541**

Source: Development and Land Use Plan – Machala Canton, 2018.

Elaborated by: Ecosambito, 2020.

Main receptor countries for all 6,541 migrants, 2,6% of total canton population, are: United States of America, 9.3%, Chile 2.05% and Argentina 0.96% of migrating population.

According to a study prepared by both Ministry of Defense and IEE (Institute of Ecuadorian Studies) in 2013, 2,659 people arrived to the canton from other countries; 65.06% from Latin America, 26.14% from Europe, 8,5% from Asia and 0.3% from Africa, according to 2010 Census. In global percentage, they only represent 1.08% from total of inhabitants.[16]

13. Touristic and Cultural Activities

A Table by Ministry of Tourism illustrates tourist arrivals in El Oro Province per month. This is a reference about Machala Canton since an estimated 40% of tourists visit Machala Province capital. According to Ministry of Tourism data, in 2011 approximately 14, 772 visitors, mostly for paperwork activities performed in the provincial capital were registered.

Regarding foreign tourists moving in Machala Canton, 60% corresponding to 22,159 visitors, come from other cantons in El Oro mainly for gastronomical reasons and visit to cultural sites. January and February are the months of greatest tourist flow.

Labor in touristic activities involves 3,664 people, from which 60% to 40% are women, being an important unpaid segment in this activity. This situation is more evident in accommodation and food service activities than in arts, entertainment or recreation. This is presumed to happen because food service activities are mostly family undertakings where a female owner is head of household and does not work under employment regime.

The most attractive touristic sightseeing within the project area[17] are:

<u>Puerto Bolívar</u>

Named to honor Liberator Simon Bolivar, this port connects El Oro Province with other ports in the world, since it holds 85% of national banana production. In Puerto Bolivar,

[16] Technical Summary, Machala Canton, Geo-information Generation for land management at national level, Scale 1: 25000, Socio-economic Project, December 2013, Ministry of National Security, IEE *et al*.

[17] Development and Land Use Plan, Machala Canton – 2018.

marine breeze, landscape, beautiful sunsets and delicious dishes made with seafood, especially the best *ceviche* in the world can be enjoyed. On the other hand, Puerto Bolivar is the starting point to visit Jambeli Island, *Isla del Amor* (Love Island) and Santa Clara or *Isla del Muerto* (Island of the Dead)

Old Cabotage Wharf in Puerto Bolivar

It was built by Gaston Thoret, construction engineer, and opened on May 9, 1902. From this site cabotage ships transporting passengers and cargo from and to Guayaquil and Santa Rosa (currently Pital Port) departed. Many vessels such as Jambelí, Bolívar, Colón, Dayse Edith, Quito, etc. offered such service until 1973, when Oro-Guayas road was finished. Currently, after being remodeled, it has become an interesting place including a marine museum owned by the Cultural Center and an elegant restaurant named *El Viejo Muelle*.

Jambelí Island

Machala is the starting point towards this friendly island located 35 minutes away from Puerto Bolivar by ferryboat. It is worth mentioning the island does not belong to this canton; however, boats to go to the archipelago are taken from Puerto Bolivar in Machala. The ride becomes an exciting adventure by looking at an attractive scenery, variety of birds and a mangrove in the area. Jambeli is the largest open sea beach in the archipelago and also the most populated one. There are many restaurants, accommodation, recreation and sport places including Geo Mer Marine Museum.

Towards the eastern part of the island and bordering Santa Rosa estuary, shrimp industry, which restrains touristic and residential expansion possibilities, is located.

Currently, the mangrove area has been reduced due to its indiscriminate development by shrimp production.

Among touristic activities undertaken by the district, especially in Isla Costa Rica community, a facility to provide accommodation to visitors has been implemented during the last few years.

In Costa Rica, Bellavista and Las Huacas, facilities to provide with drinks and food to locals and foreigners, with great success especially on holidays or special events have also been implemented.

Isla del Amor (Love Island)

Located five minutes away from Puerto Bolivar by ferryboat, this island is a great experience for nature lovers and ornithologists, since this where a great variety of birds develop, and that is why it has that name; it’s a place where birds nest and reproduce.

Santa Clara Island

Located 90 minutes away from Puerto Bolivar, this island is a temple for ancient indigenous cultures where remains of an Inca sanctuary. Also known as the Island of the Dead because from the distance it looks like a man lying dead, Santa Clara is similar to Galapagos Islands in its volcanic structure and fauna, since it is habited by birds, sea lions, iguanas, blue-footed boobies, frigatebirds, etc. From July to September, whale watch, one of the most expected attractions to foreign tourists takes place.

Machala City

Although new on a canton basis, touristic activity has increased since the last six years, as demonstrated by increasing touristic facilities within the city and the province in general.

Machala has 183 touristic facilities (qualified by Ministry of Tourism and provided with a Touristic Operation License) and accommodation infrastructure including 60 lodging facilities with an average of 3,180 rooms.

14. Political-administrative Aspects

The Ecuadorian government is organized in territories, regions, provinces, cantons and districts, each territory has a decentralized autonomous government (*GAD-Gobierno Autónomo Descentralizado)* for development management by exercising powers. This government will be composed of democratically elected citizens who will exercise their political representation. Decentralized autonomous governments include: a) regional governments, b) provincial governments, c) cantonal or metropolitan district governments, and d) rural districts.

In provinces, cantons and rural districts, Indigenous, Afro-Ecuadorian and Montubio territorial constituencies may be formed.

Decentralized autonomous governments (GAD in Spanish) main roles are framed on: a) legislation, standards and supervision, b) execution and administration, c) public participation and social control.

In El Oro Province, a Decentralized Autonomous Government (GAD) or Prefecture is a law person of public right, with political, administrative, financial and publicly elected autonomy and its highest authority is the Prefect.

Machala Canton is represented by the Municipal Decentralized Autonomous Government of Machala or Municipality, a law person with public rights, political, administrative, financial and publicly elected autonomy, and its highest authority is the Mayor and both urban and rural Councillors.

Regarding districts (*parroquias)* as a result of 1998 Constitution reforms and their ratifications by 2008 Constitution, Decentralized Autonomous District (*Parroquial*) Governments (GADP) also called Rural District Board (*Junta Parroquial Rural*) is the government body in the rural district and is composed of chairpeople elected by popular vote, and whoever is most voted will be its president.

In El Oro Province, the state representative on a provincial basis is the Governorate. On a cantonal basis, the representative of Ministry of Government is the Political Chief of Machala Canton.

On a local basis, presidents of communities, quarters and sectors are valid authorities.

15. Enquiry Systematization

15.1. Systematization

15.1.1. Enquiry Coverage

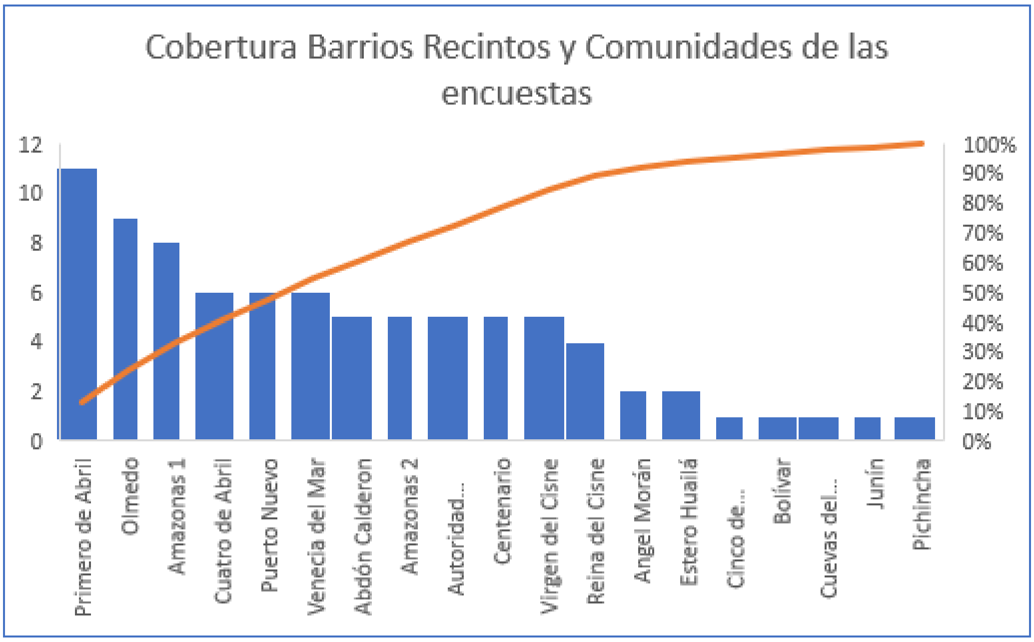
This enquiry was performed taking into account Quarters, Premises and Communities located in Puerto Bolivar Urban District, Machala Canton in order to cover influence area of the project:

Table 16. *Areas covered by Enquiries*

Quarters/Premises/Communities	No. of Enquirers
Cinco de diciembre	1
Abdón Calderón	5
Amazonas 1	8
Amazonas 2	5
Port Authority	5
Bolívar	1
Centenario	5
Angel Morán	2
Cuatro de Abril	6
Cuevas del Huayco	1
Estero Huailá	2
Junín	1
Olmedo	9
Pichincha	1
Primero de Abril	11
Puerto Nuevo	6
Reina del Cisne	4
Venecia del Mar	6
Virgen del Cisne	5
TOTAL	**84**

Original Source: Ecosambito, 2020.

Figure 9. *Areas covered by Enquiries*

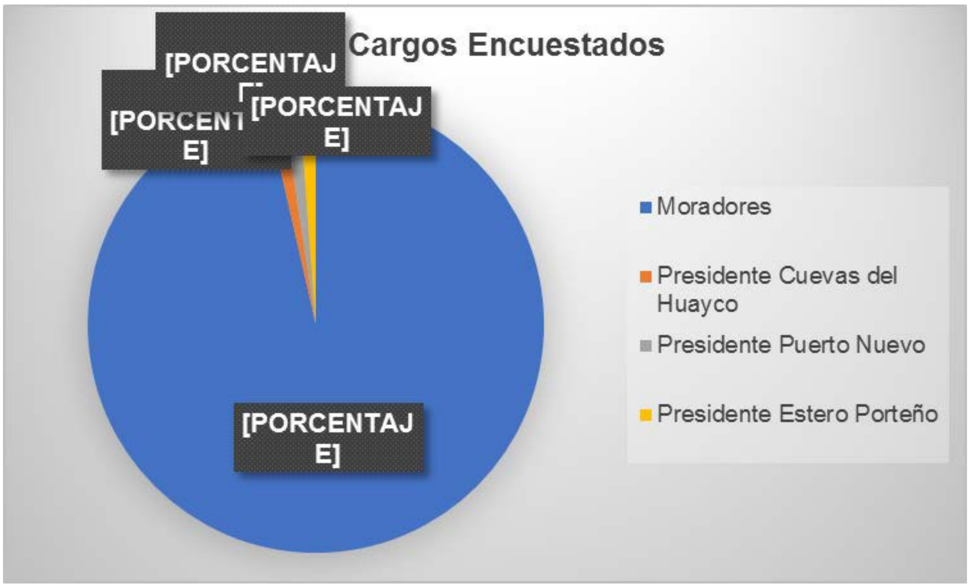


Elaborated by: Ecosambito 2020

15.1.2. Characteristics of Enquiry Respondents

This enquiry was applied 97% to common inhabitants and 3% among Quarters, Premises and Community presidents.

Figure 10. *Type of Enquiry Respondents*

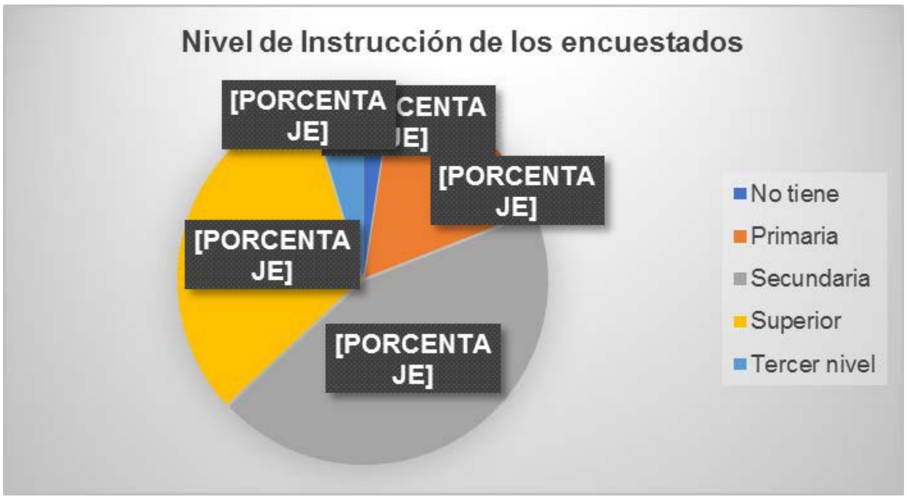


Porcentaje;Percentage, Cargos encuestados: Surveyed positions, Presidente:President

Elaborated by: Ecosambito 2020

A total of 44% respondents have secondary education, 32% have higher education (university), 17% have primary education, 5% have a tertiary educational level, and 2% lack of educational level.

Figure 11. *Educational Level of Enquiry Respondents*

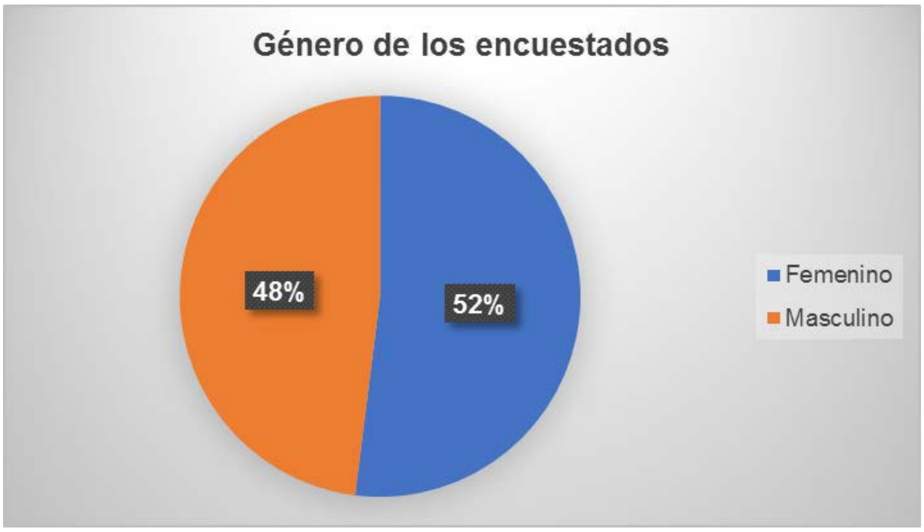


Nivel de Instrucción de los Encuestados: Education level of survey respondent, Porcentaje: Percentage, No tiene: Does not have; Primaria: Primary, Secundaria: Secondary: Superior: Superior; Tercer nivel: Third level.

Elaborated by: Ecosambito 2020

Regarding gender percentage of respondents, 52% are women and 48% are men. The highest percentage for female gender is mainly originated because in this area, women stay at home to take care of their children and perform house chores.

Figure 12. *Gender of Respondents*



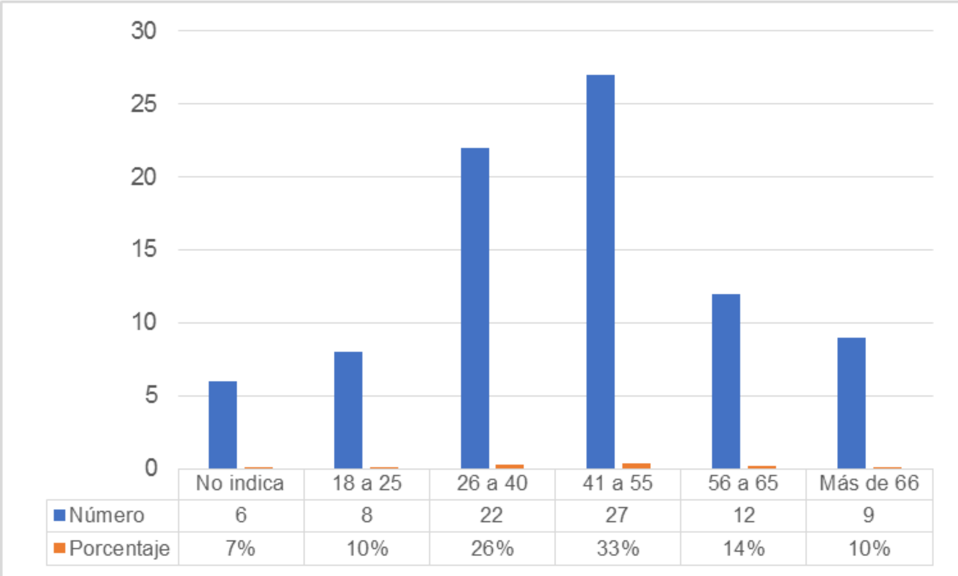
Nivel de Instrucción de los Encuestados: Gender of survey repondents; Femenino: Female; Masculino: Male

Elaborated by: Ecosambito 2020

This enquiry considered the last electoral register (currently being used for 2021

Ecuadorian Presidency including men and women older than 18) as in the case ofenquiries, the majority (33% of respondents) ranges between 41 to 55 years of age, 22% range between 26 and 40 years of age, and the third group ranges between 56 and 65 years of age.

Figure 13. *Age Rate of Respondents*

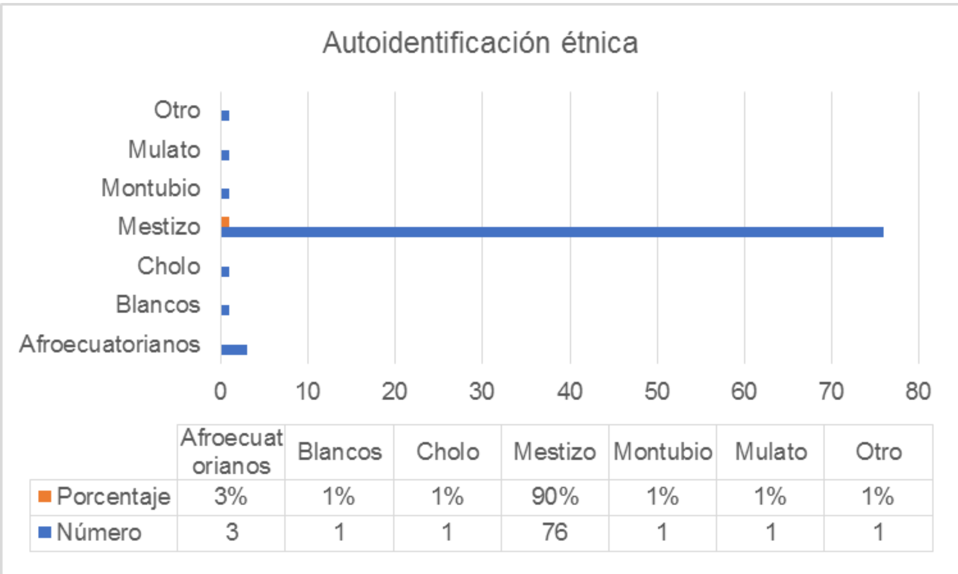


Not indicated, Number, Percentage, More than 66

Elaborated by: Ecosambito 2020

Self-identification of respondents show 90% are mestizo, while 3% are Afro-Ecuadorian and 7% is distributed among white, *cholo,* Montubio and mulatto.

Figure 14. *Ethnic Self-Identification of Respondents*

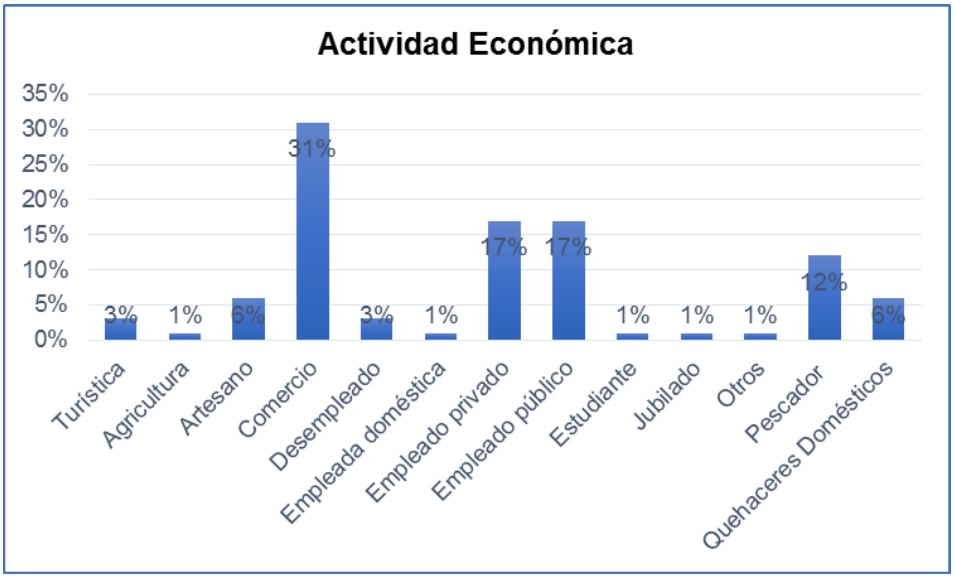


Elaborated by: Ecosambito 2020

15.1.3. Economic Activity of Respondents

Respondents have typical economic activities in the area, considering it is a district with a high production and trading rate. The main activity of respondents is trading (31%), while private workers and civil servants share the same percentage (17%) and fishermen range 12%. Respondents ranging 3% are currently unemployed mainly because many businesses have closed due to the pandemic.

Figure 15. *Economic Activity of Respondents*



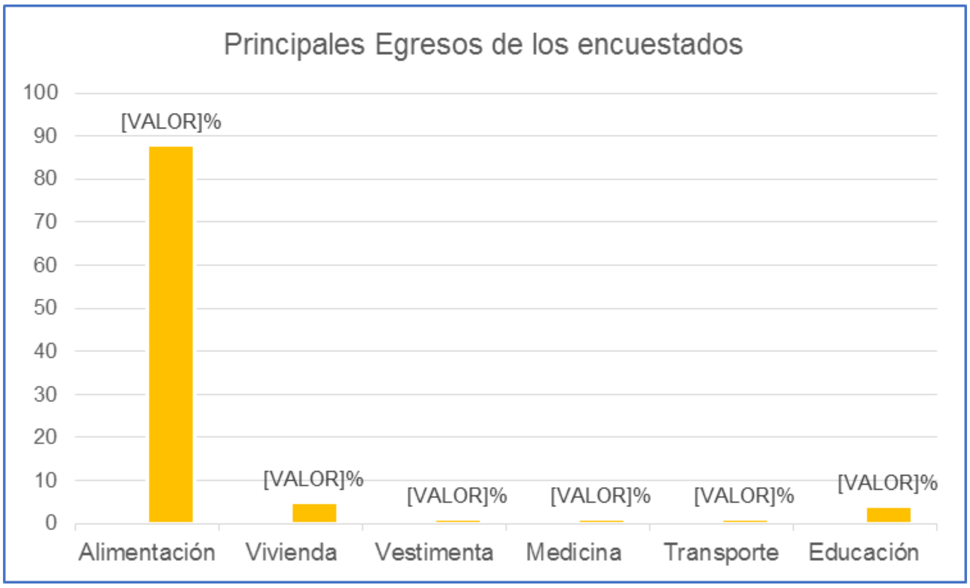
Economic activity; Tourism, Agriculture, Artisan, Commerce, Unemployed, Domestic employee, Private employee, Student, Retired, Other, Fisherman, Housework

Elaborated by: Ecosambito, 2020.

Among percentage of respondent families, the first place is for parents who work in trading business (31%); the second place is for public servants (18%); in the third place are private workers (17%) and in the fourth place are fishermen (16%). Remaining 18% corresponds to daily workers, farmers, artisans and other activities as house work. Families with children in working age mainly perform trading, handicraft and fishing activities.

Main expenses by families of respondents are food, housing, education, clothing, medicine and transportation with the following percentages:

Figure 16. *Expenses of Respondents*



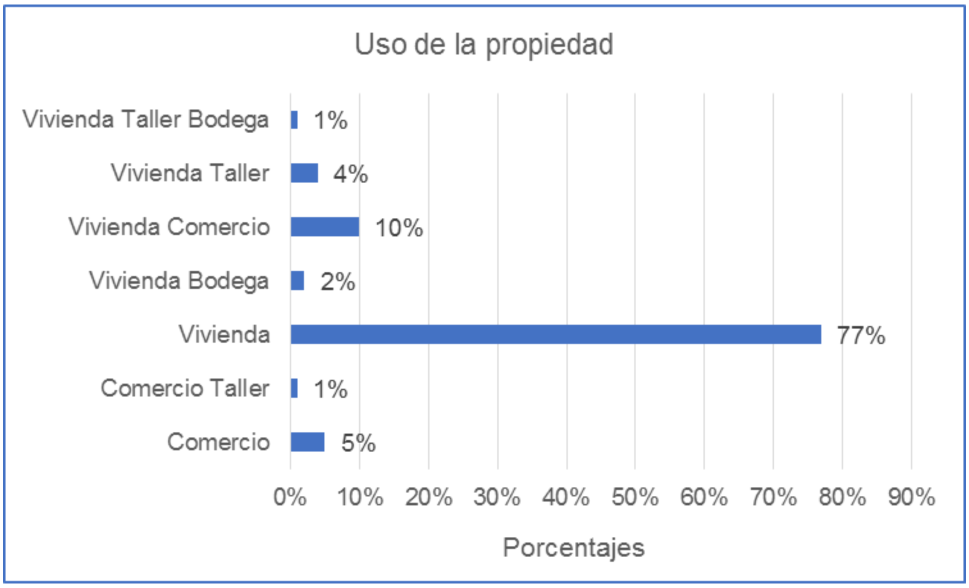
Main expenses of respondents, Food, Housing, Clothing, Medicine, Transport, Education

Elaborated by: Ecosambito, 2020

Regarding real estate properties owned by the respondents, 77% are homes, 10% are used both as home and business, 5% are stores or business, 4% are used as homes and workshops, 2% as homes and warehouses, and the rest (2%) are shared as home-workshop-warehouse all in a single room, and as business and workshop.

The use of real estate properties reveals a significant aspect of life conditions for people, since many families use the front part of their real estate as store or business and the back part as home in order to avoid double renting.

Figure 17. *Property Use of Survey Respondent*



Property Use, Home Workshop Warehouse, Home business, Home Warehouse, Home, Commerce workshop, Commerce

Elaborated by: Ecosambito, 2020.

15.1.4. – Utility Services

A total of 89% of Quarters, Premises and Communities where enquiries were performed have every utility service: electricity, drinking water, sewage system, telephone. Only 26% have internet service, which currently due to the pandemic has also become a utility service. The majority of respondents use communication media such as television, radio and printed press.

15.1.5. Educational Services

The following educational centers were found in the surveyed area:

Mauro Matamoros Mesa Primary School (enquired)

Its principal is Mrs. Maira Canga. This is a primary school including first to seventh grade, Spanish-speaking, and financed by the Central Government via Ministry of Education. It operates in the morning, in presence-based modality (currently due to the pandemic, classes are in the virtual/online mode), and has 171 students (School Year 2020-2021); none with special ability. Last year, 185 students were enrolled.

This school has an audiovisual room used as computing class including a few computers without internet connection. No uniform or school meal is provided to students. The government only provides with school texts. Administrative premises are shared with an infirmary. They have multipurpose fields and restrooms are in poor conditions. They have every utility service: electricity, water supply and telephone, except for internet service.

Access road to this center is Primera Este Street in regular condition. Students enrolled in this school come from *Cuatro de Abril, Wilson Franco,* and *Gonzáles Rubio* quarters. There is a Parent Committee in charge of supporting efforts to improve this institution.

Julio María Matovelle Private Educational Center (enquired)

Its principal is Sister Bertha Velasquez. This is an integrated school including first to twelfth grade, Spanish-speaking, and financed by private funds (parents pay on a monthly basis). It operates in the morning, in presence-based modality (currently due to the pandemic, classes are in the virtual/online mode), and has 400 students (School Year 2020-2021), 17 with special abilities. Last year 560 were enrolled. This shows a dropout situation is present due to the pandemic and parents' low income that makes it difficult to keep on paying a monthly fee for education.

This center has an audiovisual room and a library. No school meal, uniform or text is provided to students. It has a multipurpose field and restrooms. Every utility service, electricity, water, telephone and internet, is available. Access road to this center is Gonzalo Cordova Street. Students enrolled in this Educational Center come from surrounding quarters up to El Guabo. There is a Parent Committee in charge of supporting efforts to improve this institution.

Manuel Isaac Encalada Primary School (enquired)

Its principal is Mrs. Natividad Fernandez. This is a primary school including first to seventh grade, Spanish-speaking, and financed by the Central Government via Ministry of Education. It operates in the morning, in presence-based modality (currently due to the pandemic, classes are in the virtual/online mode), and has 484 students (School Year 2020-2021), 3 with special abilities. Last year 362 were enrolled. This increasing number of students results from parents changing their children from private to state schools to avoid paying monthly fees due to the pandemic because several have lost their jobs.

This school has a computing classroom with deficient internet service. No school meal, uniform or text is provided to students. Administrative premises are small. It has a yard, a basketball court and restrooms in regular condition. Every utility service, electricity, water, telephone and internet, is available. Although a robbery took place and internet services are being reestablished. Students enrolled in this school come from *Amazonas 1 & 2, Tiwntza*, and *La Unión* quarters. There is a Parent Committee in charge of supporting the institution by self-supporting activities and cleaning the school.

- Virgen de Fatima Secondary School
- 24 de Julio Primary School
- Virgen del Cisne Secondary School
- Simon Bolivar High School
- Juan Bautista Primary School

15.1.6. Healthcare Services

Regarding healthcare, Pomerio Cabrera Municipality Hospital, Puerto Bolivar Healthy Sub-centers, and Amazonas Health Center (enquired) are present in the area.

Amazonas Healthcare Sub-center

Located in Amazonas 1 Quarter, its representative is Dr. Maria Fernanda Banchon. It includes 3 general physicians, 1 obstetrician, 2 odontologists, 2 nurses, 1 administrative assistant, 2 statistics experts, and 2 auxiliary assistants. They have corresponding instrumental and equipment, and medical supplies. It is open from 8:00 a.m. to 5:00 p.m. Appointments are required by call center, but they assist directly in case of emergencies. Service is free and assistance average is 20 to 40 patients per day. Coverage extends from Loja Private Technical University to Port Authority. When a case cannot be assisted, it is sent to first or second-level healthcare facilities.

Main diseases treated in this healthcare center are: urinary infections, diabetes, common colds, tonsillitis, and hypertension.

Immunization and Ministry of Public Health programs are available in this center. Currently, they are working on a program to avoid gender violence.

They have every basic utility and special waste is sent to GADERE, an environmental management company.

15.1.7. Community and Recreation Services

Regarding community services, terrestrial transportation service, Puerto Bolivar Taxi Cooperative, Communal Police Units (in Amazonas 1, Cuatro de Abril, and Olmedo quarters), and Community Centers (*Casas Comunales*) are available in every quarter.

Main recreational and sport services are located in: Huaylá Estuary, El Cangrejo Theme

Park, Parque de la Madre (Mother's Park), Malecón de Puerto Bolívar (boardwalk), Isla del Amor (Love Island).

15.1.8. Communication Roads

Regarding communication roads, 63% have pavement in regular condition, 14% with pavement in good condition; 10% have pavement in bad condition, 6% are cobbled roads in good condition, 4% are cobbled roads in regular condition and 3% are cobbled roads in poor condition.

15.1.9. Main Requirements in Enquired Area

Main requirements in surveyed quarters, premises and communities are:

1. A total of 64% of enquiry respondents stated that policy security in quarters is the most important requirement since delinquency has increased.
2. Secondly, 30% stated public lighting is missing in some streets.
3. In third place, 6% stated that repairing streets is a significant requirement, -due to their poor conditions-, as well as implementing green areas.

15.2. Social Actors

Social actors identified in enquiries are local organizations:

- *Estero Porteño* Artisan Women Group
- *Puerto Nuevo* Older Adults Group
- *Productos del Mar* Autonomous Seafood Producers and Others Association
- *Venecia del Mar* Autonomous Seafood Producers and Others Association
- *24 de Junio* Coast Fishermen Association
- FUNDACORP
- *Puerto Bolívar* Artisan Women Association

15.3. Social Perception

15.3.1. Project Acknowledgement

Enquiries performed show that 82% of respondents know nothing about the "Extension of Dredging Operations, Facility Improvement and Dock 6 Construction in Puerto Bolivar" Project. Therefore, they request inclusive and participative socializations through Disclosure Meetings (48%); Information Stands (23%); Brochures and Information Leaflets (21%) and Radio (8%).

15.3.2. Usable Goods and Services

Regarding usable goods and services in the coastal area, the respondents answered the most important are artisan fishing (62%); species trading (24%); and tourism (14%).

15.3.3. Sensitive Habitats

Sensitive habitats in the area identified by enquiry respondents are the following:

- Huayla Estuary
- *Isla del Amor* (Love Island)

Regarding women participation at work in the area, the following were identified: beheading seafood (32%), seafood trading (32%), handicraft manufacturing (11%), fishing (11%) and shellfish collection for sale (8%).

15.3.4. Advantages and Disadvantages of Dredging Operations

Public perception and criteria regarding pros and cons of dredging operations in the area were the following:

Table 17. *Advantages and Disadvantages of Dredging Operations*

Advantages	Disadvantages
More employment	Harmful to Nature
Tourism growth	Adverse impact to fishermen
Canal improvement	Harmful to the ecosystem
Improved access to Jambelí	Adverse impact to species
Business Activation	High swells
Bad odor minimization	Scaring away marine species
Deep-sea Ships Entrance	Danger of Extinction for shrimps
Boat traffic improvement	Much traffic in the area
Greater productivity and trading	Damage to sea floor
Greater appreciation for Puerto Bolívar	Fauna imbalance
Economic growth in this District	Environmental Impact

Original Source: Ecosambito, 2020.

15.3.5. Women Participation in Fishing, Shellfish Collection and Shrimp Catching Activities

Most enquiries identified shrimp beheading as the main activity performed by women, followed by business, craftsmanship and other activities.

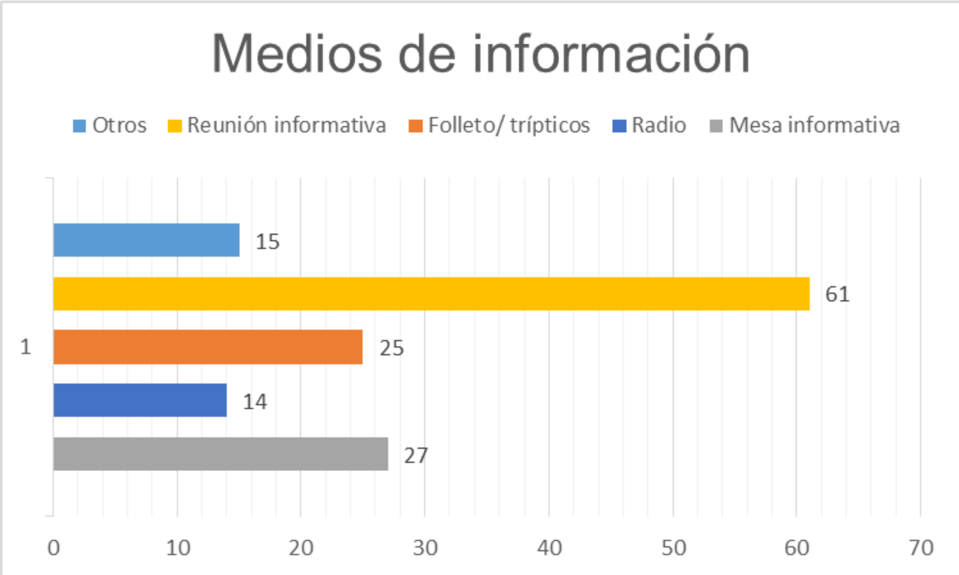
Figure 18. *Women Participation in Fishing, Shellfish Collection and Shrimp Catching Activities*

Elaborated by: Ecosambito, 2020.

15.3.6. Would you like to get more environmental and social Information about the Project?

Answers to this question were 98% affirmative. Many options to obtain this information were suggested. From these, disclosure meetings were the most favored, followed by information stands, and information leaflets.

Figure 19. *Favorite Means of Environmental and Social Information about the Project*



Information media, Other, Information meeting, Brochure/triptych, Radio, Information table

Elaborated by: Ecosambito, 2020.

16. Social actors and stakeholders

The identification of people, organizations, institutions, and any other group that may be or feel affected, or in turn, affect, directly or indirectly, the development of the project, is necessary in order to identify the expectations and roles that each of these parties has within the project. With this identification and analysis, we will be able to establish management strategies that consider the participation or involvement of these groups in an effective and active way.

The identification of social actors has been obtained from three sources:

1. Previous social participation processes of the project
2. Surveys, informative workshop, and interviews conducted as part of the primary data collection.
3. Secondary information.

The following is the list of identified social actors, in which 8 groups have been established:

- Governance and control institutions
- Production associations: shrimp and bananas
- Educational Institutions

- Health institutions
- Fishermen's associations
- Women's associations
- Neighborhood associations
- Tourist transportation cooperatives.

Table 18. List of Project Stakeholders-Governance and Control Institutions

Name	Cargo	Institution/ Organization
Alberto Velez Cevallos	Zonal Coordinator Loja-El Oro	Ministry of Environment and Water - MAAE
Clemente Bravo	Prefect	GAD Provincial de El Oro
Mario Leon	Coordinator	Secretary of Environmental Management GAD Provincial de El Oro
Dario Macas	Mayor	GAD Machala
Cristhian Cabrera Gia	Director	Directorate of Environmental and Risk Management GAD Machala
Yajaira Tandazo	Director	Directorate of Tourist and Cultural Development GAD Machala
Hugo Ruilova Perez	Chief	Fire Department of Machala Canton
Danilo Maridueña	Governor	Government of the Province of El Oro
Fabian Briceño	Chief	UPC Puerto Bolivar
Javier Tocto Palacios	Prosecutor	Prosecutor's Office Pto.
Leonardo Palomeque	Commander	Capitanía de Puerto Bolívar CAPBOL
Xavier Rubio Garcés	Commander	Coast Guard Sub Command SUBSUR
Romel Chiriboga	Director	Provincial Director of Agriculture and Livestock of El Oro
Hector Zambrano	Commissioner	Puerto Bolivar Municipal Police Station
Javier Astudillo Gómez	Zonal Coordinator	ECU 911 Machala
Evelyn Icaza Domínguez	Manager	Port Authority of Puerto Bolivar
Gorky Moscoso	Chairman	Puerto Bolivar Parish Council
Fabiola Briones	Coordinator	National Institute of Popular and Solidarity Economy

Prepared by: Ecosambito, 2020.

Table 19. List of Project stakeholders-Associations and neighborhoods.

Type	Name	Cargo	Institution/ Organization
Shrimp producer associations	Segundo Calderon	Chairman	El Oro Chamber of Shrimp Producers (PCO)
	Ufredo Coronel	Chairman	Asociación Productores Camaroneros Fronterizos de El Oro (ASOCAM) (El Oro Border Shrimp Producers Association)
Banana Guilds	Marianela Ubilla	Director	Association of banana exporters of Ecuador
			Banana Marketing and Export Association
Educational Institutions	Jefferson Saavedra	Rector	Victor Naranjo Fiallos Educational Unit
	Mercedes Orellana	Director	Sara Serrano de Maridueña School
	Mayra Paulina Murquincho Carrión	Coordinator	Universidad Técnica Particular de Loja - Machala Campus
Health institutions		Director	Municipal Medical Unit "Dr. Pomerio Cabrera".
			Puerto Bolivar Sub-Health Center MSP
Fishermen's, women's and craftsmen's associations	Danny Castellano	Chairman	President of UOPPAO
	Luis Calle	Chairman	La Playita de Jambelí Association
	Arturo Cruz	Chairman	Association of Self-Employed Shellfish Harvesters and Annexes "Venecia Del Mar".
	Bolivar Alvarado	Chairman	Coastal Fishermen's Association "24 de Junio".
	Edinson Pezo	Chairman	San Antonio" Artisanal Fishermen's and Related Associations
	Tarcila Cruz	Chairman	Association of Self-Employed Shellfish Harvesters and Annexes "Productos del Mar".
	Stalin Espinoza	Chairman	Association of Cangrejeros "17 de Enero".
	Renee Carrasco Santos	Chairman	Association of Self-Employed Cangrejeros "Amor y Esperanza" (Love and Hope).
	Pedro Lucas	Chairman	16 de Julio" Artisanal Fishermen's and Related Fishermen's Association
	Beczaida Tejada	Chairman	Los Isleños" Association of Shellfish Harvesters and Related
	Lorenzo Valiente	Chairman	Mar de Galilea Artisanal Fishermen's Association
	Martin Acosta Vera	Chairman	Asociación de Pescadores Artesanales y Afines 24 de Diciembre (Association of Artisanal and Related Fishermen 24 de Diciembre)
	Tania Cuenca	Chairman	Leonidas Plaza" Artisanal Fishing Production Cooperative
	Dionicio Cruz Pezo	Chairman	Cooperativa de Producción Pesquera Artesanal "Virgen del Cisne".
	Evelio Cedeño	Chairman	Artisanal Fishing Cooperative "Costa Azul".
	Pedro Mendoza Rivera	Chairman	Asociación de Mariscadores Y Afines Defensores Del Manglar
	Pablo Valiente Ramírez	Chairman	Los Preciados" Fishermen's and Shellfish Fishermen's Association
	Kleber Valdiviezo	Chairman	Dos Bocas Artisanal Fishermen Association
	Andrea Reyes	Chairman	Fishing Production Cooperative "Recolectores de Marisco Puerto Grande".
	Wellington Velez	Chairman	Shell Collectors Association "Ni Un Paso Atrás" (Not One Step Back)

Type	Name	Cargo	Institution/ Organization
	Luz Mena Valdiviezo	Chairman	Puerto Mar Fishing Production Cooperative Coopropesmar Coopropesmar
	Miguel Chalen Rivera	Chairman	Cooperativa de Pescadores Artesanales 14 De Junio Coopjun
	Eduardo Tevante	Chairman	Simon Bolivar Handicraft Production Cooperative
	Washington Oyola	Chairman	Cooperativa de Producción Y Comercialización Jesús El Gran Pescador "Cooprograp".
	Hugo Quinde	Chairman	Asociación de Mariscadores y Anexos (Shellfish Harvesters Association) January 11th
	Brenda Medina	Chairman	Artisanal Fishing Production Cooperative "Vikingos del Mar".
	Luis Merchan	Chairman	Asociación de Producción Pesquera Artesanal Puerto Jelí (Puerto Jelí Artisanal Fishing Production Association)
	Hugo Serrano	Chairman	Artisanal Fishermen's Association "19 de Octubre".
	Gabriel Jordan	Chairman	Bellavista Island Association
	Leopoldo De La Cruz	Chairman	Asociación de Producción Pesquera Artesanal Y Afines "10 De Agosto".
	Feliciano Potes Cruz	Chairman	Association of Seafood Harvesters "Archipiélago de Jambelí".
	Javier Jimbo	Chairman	Association of Artisanal Fishermen "Nuevo Milenio".
	Gabriel Suarez	Chairman	Asociación de Producción Pesquera de Recolectores de Mariscos Asoprorecmar (Association of Seafood Harvesters)
	Jose Salazar Cuzme	Chairman	Association of Shellfish Harvesters and Allied Workers "Divino Niño".
	Cesar Tejada	Chairman	Las Huacas Association of Concheros, Crustaceans and Artisanal and Related Fishermen
	Franklin Cruz	Chairman	Association of Artisanal Fishermen, Shellfish Harvesters and Similar "Costa Rica".
	Anibal Potes Pezo	Chairman	Autonomous Fishermen's Association and Annexes "9 De Octubre".
	Roberto Montes	Chairman	Association of Artisanal and Related Fishermen Bajo Alto
	Alberto Campos	Chairman	Association of Seafood and Seafood Collectors "24 De Octubre".
	Jose Ortega	Chairman	Artisanal Fishing Production Cooperative "Río Chaguana".
Women's associations	Rosa López Machuca	Coordinator	El Oro Women's Movement, MMO
	Rocio Reinoso Mite	Chairman	Association of Women Artisans "Estero Porteño".
Neighborhood associations	José Palas	Chairman	Simón Bolívar Neighborhood
	Ariosto Carchi Salazar	Chairman	Rafael Morán Valverde Neighborhood
	Maryuri Cruz	Chairman	La Unión Neighborhood
	Nuvia Chavez	Chairman	Harry Álvarez Neighborhood
	Roberth Diaz	Chairman	Pacific Quarter
	Oscar Correa	Vocal	Pacific Quarter

Type	Name	Cargo	Institution/ Organization
	Wilfrido Banchón	Chairman	5 de Diciembre Neighborhood
	William Ramirez	Chairman	Centenario Neighborhood
	Javier Ponguillo	Chairman	Puerto Nuevo Neighborhood
	Carlos Rosales	Chairman	Virgen del Cisne Neighborhood
	Pedro Chalén	Chairman	24 de Diciembre Neighborhood
	Dorian Rosero	Chairman	4 de Abril Neighborhood
	Fermín Alvarado	Chairman	Cdla. Venecia del Mar
	Carlos Espinel	Chairman	Atahualpa Neighborhood
	Manuel Granda	Chairman	Vencedores Neighborhood
	Bolivar Alvarado	Chairman	December 25th Neighborhood
	Eloy Cruz	Chairman	Bolivar Neighborhood
	Blanca Aldaz	Leader	La Unión Neighborhood
Tourist transport cooperatives	Betty Sanchez	Manager	Rafael Morán Valverde Cooperative
			July 31 Cooperative

Prepared by: Ecosambito, 2020.

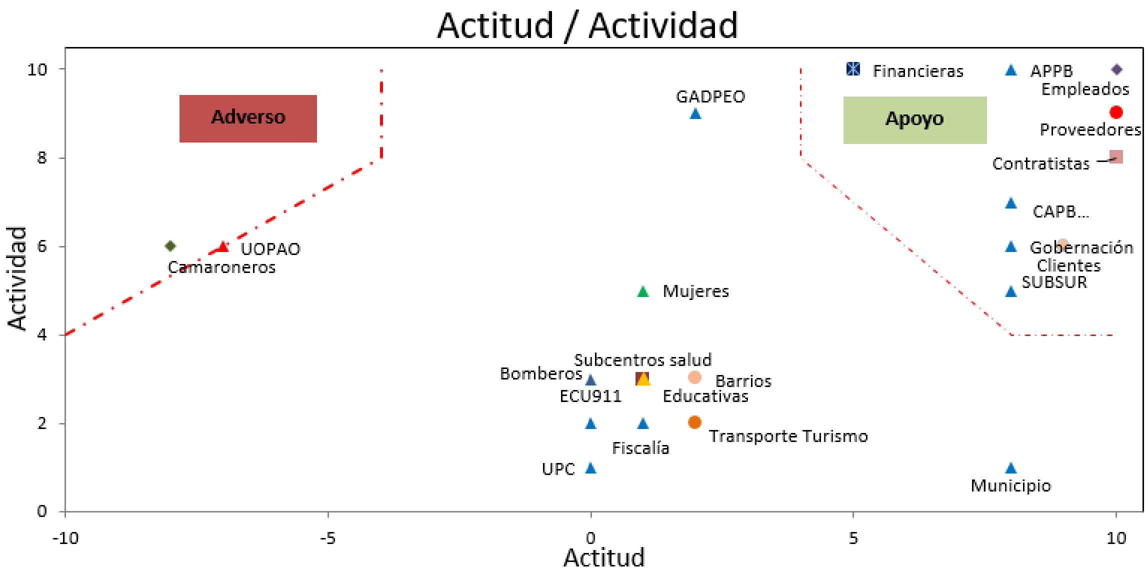
16.1. Stakeholder mapping

Stakeholder mapping is a representation that allows us to categorize stakeholders in a graphical representation that allows us to categorize graphically the level of interest and/or power that these groups have in relation to the project.
It is important to note that this mapping should be updated or redone whenever there is a substantial change in the project, or whenever necessary.

16.1.1. Attitude - Activity Matrix

The left reference line marks the point at which stakeholders are considered potentially adverse to the project. The reference line on the right marks the point at which stakeholders are considered likely to support the project. The challenge will be to appropriately manage the involvement of stakeholders who are in the area adverse to the project so that their perception of the project is improved.

Figure 20.. Attitude - Activity Matrix



Prepared by: Ecosambito, 2020.

16.1.2. Power - Interest Matrix

This technique groups stakeholders according to their level of authority (power), level of concern or desirability about project outcomes (interest).

The involvement of the different internal and external stakeholders will be planned according to the following classification:

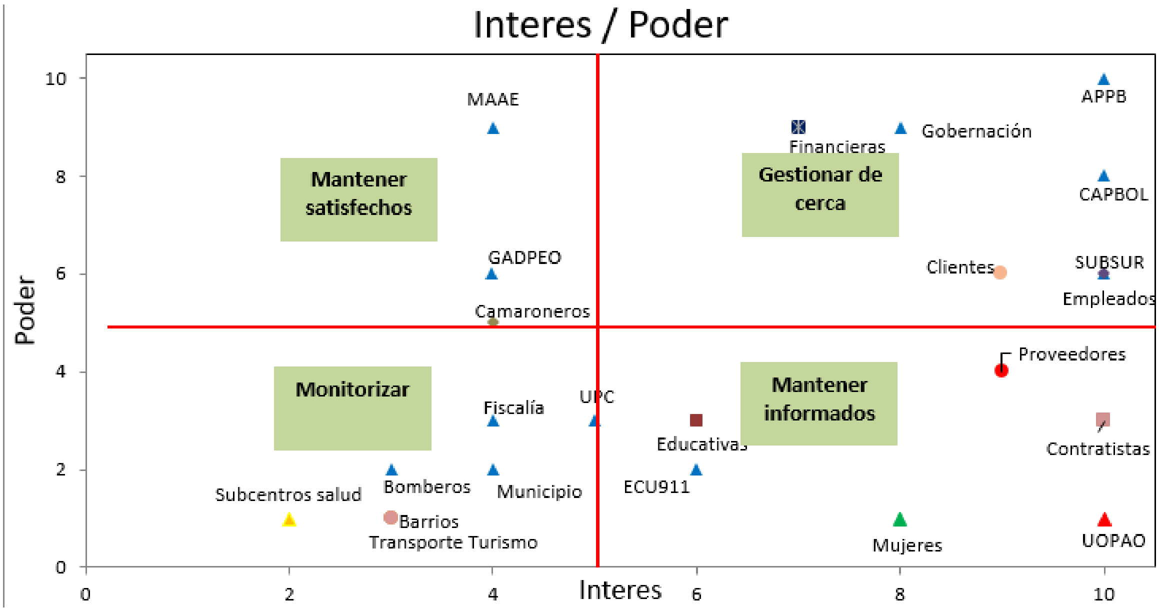
High interest - High power: manage very closely, as they can act as a source of opportunities and/or threats.

High interest - Low power: keep informed

Low interest - High power: keep satisfied, since sometimes we can find ourselves with a cancellation of the project that arises from someone with these characteristics.

Low interest - Low power: make as little effort as possible, in most cases it is enough to know how it evolves.

Figure 21. Power - Interest Matrix



Prepared by: Ecosambito, 2020.

16.2. Stakeholder management.

16.2.1. Roles and responsibilities in stakeholder management

Senior management shall establish mechanisms to manage stakeholders in a way that balances their expectations with those of the company. To this end, the environmental and social management plan shall establish the roles and responsibilities necessary to comply with stakeholder management.

16.3. Stakeholder communication and participation

Stakeholder communication and participation will be established for each group identified by its Stakeholder-Power. Thus, we will have four outreach strategies:

- Close Management
- Keeping satisfied
- Keeping informed
- Basic communication

Some of the communication and outreach strategies include direct and voluntary communication with stakeholders to be managed more closely, timely compliance with legal obligations, e.g. environmental regulations, perception and satisfaction surveys. Another strategy, for those parties to be kept informed, is publication in the press and other indirect media.

A complete list of communication and participation strategies is presented in the Environmental and Social Management Plan.

17. Community health and safety risk assessment

Performance Standard 4 contemplates that project activity, equipment and infrastructure may entail risks and impacts that leave a community exposed. Similarly, communities that are already subject to other impacts may experience an acceleration of these impacts due to project activity.

Therefore, it is necessary to assess the risks to the health and safety of the community due to the implementation of the project, in order to apply strategies to prevent and mitigate these impacts.

Anticipation and prevention of harmful impacts to the health and safety of affected communities can occur during and after a project.

17.1. Methodology

17.1.1. Health effects for the inhabitants of Puerto Bolivar

In the surveys conducted with the community surrounding the project, no fears or impressions of a negative impact on people were expressed. Responses regarding the possible disadvantages of the project focused on environmental risks and impacts on biodiversity, and therefore, on fishing of marine resources.

On the other hand, socioeconomic benefits derived from the project were identified, such as improved job opportunities, tourism and trade.

On the other hand, if we analyze the data on the health of the population (Chapter 8 and 15.1.6), there is no indication that the morbidity of the population is influenced by environmental effects, since the main causes of medical attention or morbidity are due to urinary tract infections and acute rhinopharyngitis [common cold].

17.2. Risks due to project activities.

Some of the risk factors that the project may exert on the population include:

Infrastructure design and safety. The location and location of the port's operational areas with respect to the terrain means that port activities and their emissions, such as noise and gases, are generated far from the populated area. However, the entry and exit of trucks does pose risks on Bolívar Madero Vargas Avenue, especially the risk of accidents with pedestrians, cyclists, and other vehicles, in addition to generating noise and dust that can affect residents and workers living in the area near the avenue.

Hazardous materials management and safety. Yilportecu stores and uses hazardous materials, mainly fuels, although this activity is carried out only for the use of specific machinery and equipment. Moreover, this storage is carried out under regulated conditions, so it does not represent a high risk.

Ecosystem services. The coastal marine ecosystem services near Puerto Bolívar are important: from fishing, bivalve and crustacean harvesting, to tourism and gastronomy. These services have not been affected by the operation of the Port Terminal, which has been operating there for several decades. Expansion and dredging activities could affect fishing on a temporary and ad hoc basis.

Community exposure to disease. As mentioned in the previous section (17.1.1), there does not appear to be evidence that Puerto Bolivar's morbidity is influenced by the Port Terminal's activities.

Emergency preparedness and response. Yilportecu has emergency response mechanisms in place. These include annual drills in which Yilportecu has participated with local security institutions such as ECU911 and the fire department. It is important to strengthen emergency response procedures with community participation.

Security personnel. Yikport receives private security services at its facilities and at the entrance. The security company that provides this service has annual training plans, with coverage of human rights and the rational use of force.

18. ANNEXES

APPENDIX 1. Systematization of Training Workshop

APPENDIX 2. Socio-Economic and Cultural Enquiry surveyed on-site

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PUERTO BOLÍVAR PROJECT - PHASE 1

- CULTURAL BASELINE (ARCHAEOLOGICAL DIAGNOSIS) -

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

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December 2020

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EXECUTIVE SUMMARY

This document contains an archaeological diagnosis of the project implementation area to be executed by Yilport Terminal Operations (YILPORTECU) S.A.

The methodology includes the review of technical reports submitted to the INPC-R7 (EIA - Study Projects) and printed documents (drawings, IGM letters, publications, etc.). A field phase was carried out with the pedestrian reconnaissance of the Port Terminal and the area of implementation of Dock 6. Based on the information collected, a preliminary map of archaeological sensitivity of the studied sector was drawn up.

In this study, the studies carried out by other archeology specialists on the past societies that settled in the vicinity of the observation area were summed up. This reference information let us know the state of the studies to date and locate probable sectors of archaeological interest, in order to estimate the greater or lesser sensitivity.

In the end, a Mitigation Plan and Archaeological Contingency Measures are presented.

ARCHAEOLOGICAL DIAGNOSIS

1. Archaeological background of the southern coast of Ecuador

The area of our study is located in the southern coast of Ecuador, which has had little archaeological studies, having as a close background the studies carried out by Estrada (1979); Christensen (1955); Estrada *et al.* 1964; Currie (1985); Staller (1992/93); Idrovo (1994); Zevallos (1995); Véliz (1996); Netherly (1988); López (2003, 2005, 2017), Rowe (2008); Vasquez *et al.* 2000; Delgado 2007; Vega *et al.* 2009; Almeida (2013) and others, in which pre-Hispanic vestiges were found.

Christensen (1955) carried out excavations in a funeral *tola* located in Hacienda La Esperanza, province of El Oro, and rescued cultural material of Milagro Quevedo origin, although the archaeologist had mistakenly associated it with the Manteño period.

Meggers (1966) mentions that the vestiges of the Jambelí phase were usually found in small shellfish dumps located in flooded lands that bordered inlets, rivers and swamps with an occupying power that rarely exceeded 50 cm below surface. He claims that, although their subsistence economy was based mainly on fishing, the discovery of stolica hooks also involved hunting activities. The hands and mills were used in the preparation of food.

In his publications, Estrada (1979) illustrates the presence of elevated mounds in the Balao and Machala sectors, which we were personally able to verify in the studies carried out at the Hacienda San José de Balao (López 2003).

In the late 1970s, the Tahuín Project (financed by the Central Bank of Guayaquil) began on the Arenillas River, surveying the Arenillas River, as well as surrounding areas, which allowed Netherly to define the tradition "Arenillas" and located it in the Late Formative period.[1] The survey allowed discovering sites of various periods (more than 500 sites), as well as determining settlement patterns, among the various sites located in the upper and middle valleys.

In the Guarumal shell-gathering sites (00-SR-SR-01) and in Punta Brava (00-AR-AR-318), Currie (1985) reports vestiges of Jambelí material, stating that "there is more than one culture associated with a tradition of small-scale use of coastal resources since pre-ceramic times, and the studies in the Arenillas river valley break the idea that the Jambelí sites mean an exclusive adaptation to the estuary and the mangrove." Guarumal, is represented by a group of shell mounds, located north of Santa Rosa, near Guarumal estuary. The site exhibited a long sequence but was in the process of destruction due to the creation of shrimp farms. Punta Brava, exhibited dense amounts of Jambelí material. Unlike the previous one, this site was located towards the interior of the mangrove line, on the top of a small elevation, close

[1] Netherly 1988.

to Arenillas. Idrovo (1994) reports Jambelí material (ceramic, obsidian, and copper plates) rescued from an elite tomb in Guarumales, a site previously studied by Currie.

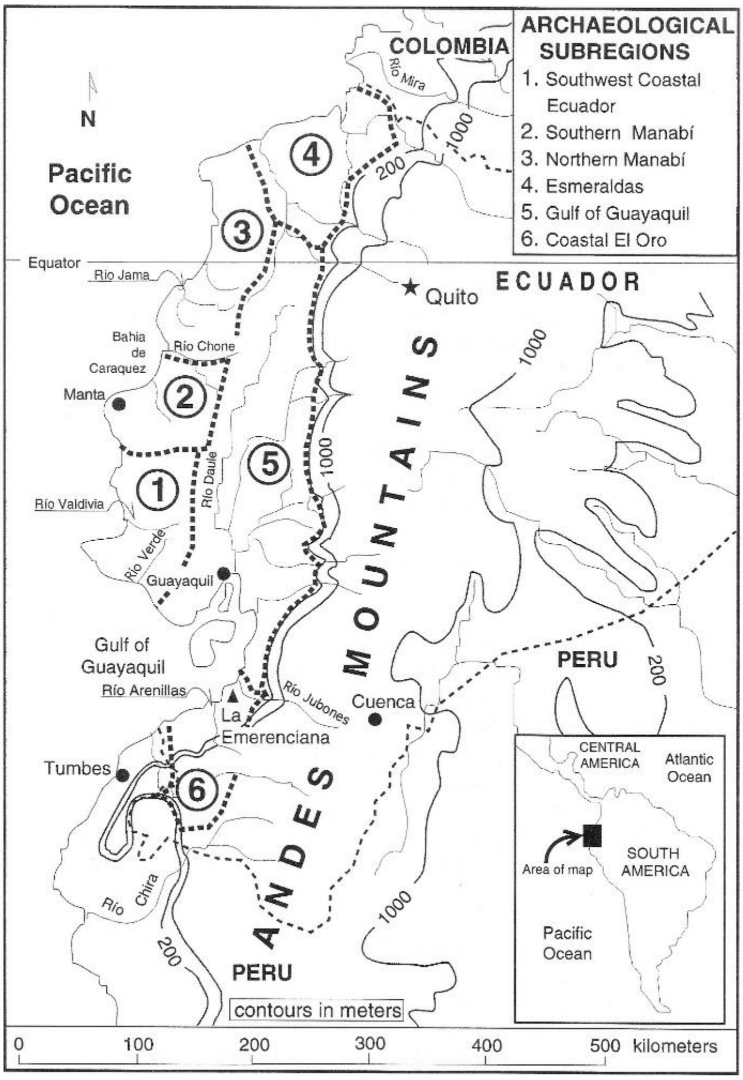
The presence of sites of the Pechiche and Garbanzal cultures, in the now arid region of Tumbes, can be considered within the context of probable climatic changes during recent periods, with the implication that this region once supported the mangrove forest within a forest more humid than the current one.

In turn, Staller (1992/93, 2000, 2001), in the excavations carried out at the La Emerenciana site, obtained cultural material associated with the Early Formative period, identifying a hierarchical pattern in the distribution of the sites for this period. La Emerenciana is located in what the author has called 'archaeological subregion 6,[2] coast of El Oro'. This archaeologist claims that the cultural sequence of El Oro begins in the Early Formative period with Valdivia, continuing the sequence with the Machalilla culture located in the Middle Formative period, with the Chorrera culture for the Late Formative period, continuing with the Jambelí culture for the Regional Development period, probably culminating in the Milagro-Quevedo (Chono) culture.

Staller mentions that sub-region 6 (coastal sector of the province of El Oro) refers to "……to the barrier island estuary of the Straits of Jambelí, specifically the area between the Jubones River near the city of Machala, and the border of Peru at the Zarumilla river"(Staller 2001:200, Figure 1).

[2] Staller J. 2001:199, fig 2.

Figure 1. Subregion 6 (coast of El Oro)



Source Staller 2001:199

At the Cañas site located on the right bank of the Arenillas River, Staller[3] found diagnostic material which he associated with the Valdivia-Machalilla transition, but then Stothert[4] later placed it as belonging to the Regional Development Period (Guangala).

Zevallos (1995) refers to what he called the southern sector of the Guayas Basin, as a sector with the greatest and most notable cultural advancement, both in artistic and technological terms. Precisely the largest number of unique artifacts due to their beauty, conception, and symbolism, which made up the CCENG gold collection in its time, came from the southern sector of the Basin (Balao sector).

Vásquez *et al.* (2000) reported a Jambelí settlement in the impact area of the Amistad field platform, Block 3. They reported discoveries of pot fragments of moderately large size,

[3] Staller J 1992-93
[4] Stothert K 1990

polypods of considerable size that indicated the presence of large vessels. A hand and a hammer were also recovered on the surface of the Chaguano site, which is made up of a shellfish-gathering site with the *Cassostrea* species, which formed a fundamental part of its diet.

In the studies carried out at the Hacienda San José, in the Balao parish, López (2003) reports the presence of elevated mounds, of different heights, most of them with a strong anthropic impact originated in the construction of banana and shrimp farms, all of them of Milagro-Quevedo origin. One of the preserved mounds (multi-occupational) exhibited evidence of a Milagro-Quevedo housing structure, under which vestiges of the Jambelí culture were found. An interesting aspect was discovery evidence of a metalworking workshop in the Chono housing unit.

In the layout of the Milagro-Machala Electric Transmission Line (López 2005), the presence of several settlements of Milagro-Quevedo (MQ) origin was reported, many of them with great anthropic impact due to agricultural work. One of these reported evidences was approximately 300 m from a settlement with Tola mentioned later by Delgado (2007).

Delgado (2007) reported the presence of six settlements with *tolas*, close to the town of Ponce Enríquez. This archaeologist mentions that it is located between "… the Fermín river and the plain bathed by the Tenguel river up to Santa Martha to the northeast and the entrance to Tenguel to the southwest, it was intensely occupied by a series of human settlements perhaps under a single complex political leadership (caciquism)." (Delgado 2007)

In the excavations carried out at the El Dornajo[5] site near Chacras, made up of three mounds, several burial patterns were found and, according to Rowe, it was occupied after an "environmental phenomenon" (El Niño). The site with the presence of public architecture "seems to be the center of a pre-Hispanic chiefdom from 300 to 1400 AD." The presence of mounds in the vicinity of the Arenillas river allows ratifying the expansion of Chono chiefdoms, in addition to a trade network through the river mentioned above.

2. Archaeological background in the study sector

In the late 1950s, Estrada *et al.* (1964) carry out a survey on the islands of Jambelí. Jambelí cultural material had previously been reported in Tendales. As for the southern coast of our country, the archaeologists mention that:

"The distribution and character of the Jambelí Phase sites indicates that the southern portion of the area conserves the appearance that the northern portion must also have presented around the beginning of the Christian Era. The mangrove islands extend at the present time from the Peruvian border northeastward to the vicinity of Machala along the coast of El Oro province." (1964: Figure 2).

They[6] mention that all Jambelí sites are shellfish dumps, the most common species being *Ostrea columbiensis*. Usually most of the sites present 50-cm thick accumulations, although others (G-86) presented up to 160-cm thick accumulations, scrambled with pots, with

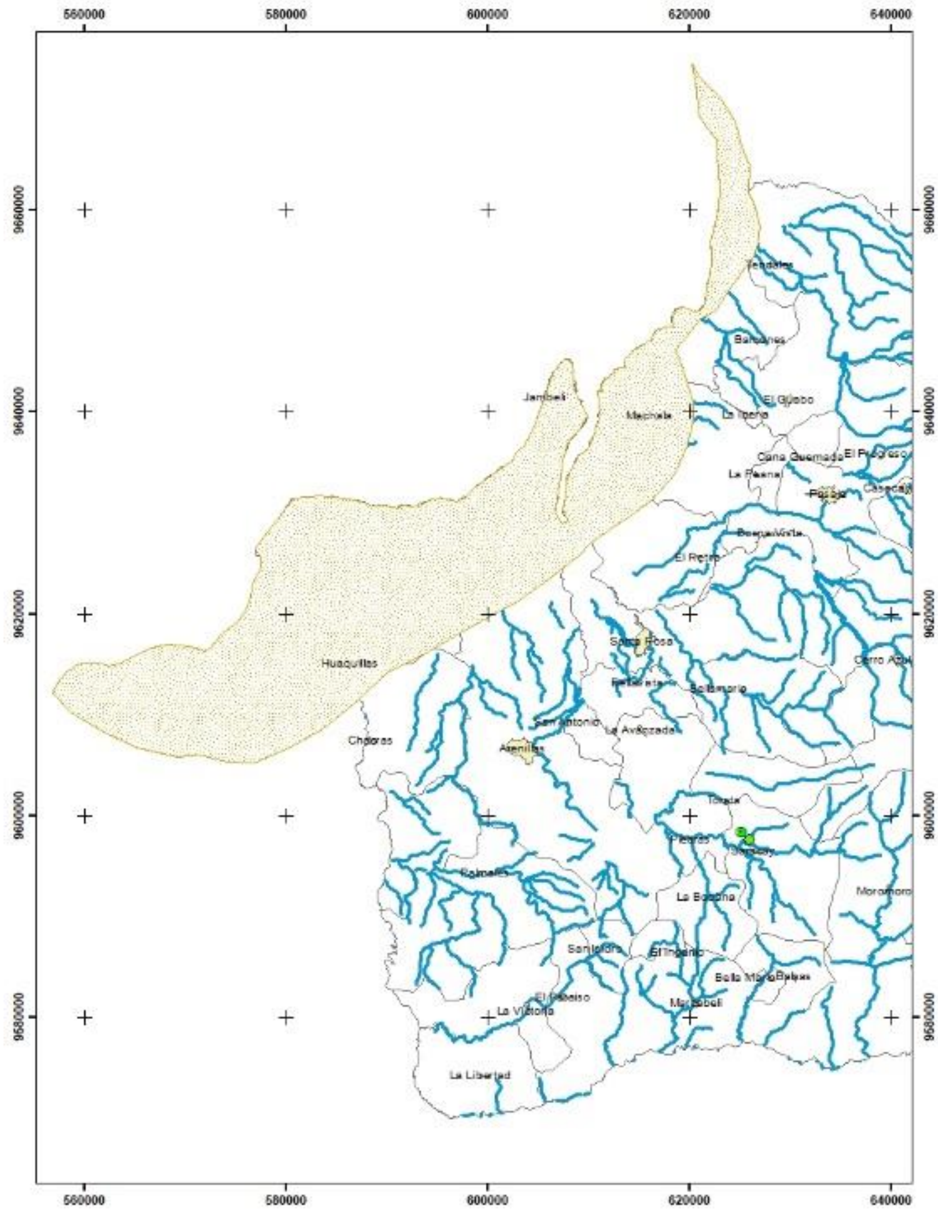
[5] Taylor S. 2008

[6] Estrada, Meggers & Evans, 1964.

settlements that occupy areas of 6000 m², although most of the sites fluctuate from 10 to 30 meters in diameter, with cultural evidence ranging from a depth of 20 to 40 cm.

In terms of the current environmental situation, the Jambelí sites are divided into two groups, those on the margins of the saltpeters and those of the active mangroves. Some of the Jambelí sites on Puná Island and all of the islands in province of El Oro are located in small areas of highlands scattered over what are predominantly mangrove swamps. Only three sites had sufficient deposit depth and were calm enough to allow stratigraphic excavation.

Figure 2. Estrada, Meggers and Evans illustrated the approximate geographic spread of the Jambelí culture (orange dotted line).



Redrawn from Estrada et al. 1964:485.

The archaeological site called Embarcadero is located about 5 km inland from the El Embarcadero estuary, where the left bank rises 2 m above the level of high tide. Shellfish debris was visible at a distance of about 150 m along this bank. The rubbish areas descend into the surrounding land, which gets approximately 1 m above high tide, an outline that is easily seen from the water. Along the eroded bank, vertical columns made of shells of about 10 cm in diameter and about a meter long could be seen in various places, possibly representing ancient post holes. The site is thickly covered, but the dump can be traced 30-40 m inward from the bank. In cross-section 1, sherds were found at a depth of 80 cm, where a dense layer of shells (20-25 cm thick) was found, and there was a sticky clay below, the natural soil of the bank. The only unusual artifacts were a ceramic statuette arm from level 20 to 40 cm and another statuette fragment from level 40 to 60 cm.

Figure 3. . Archaeological sites reported by Estrada, Meggers and Evans on the coast of the province of El Oro.

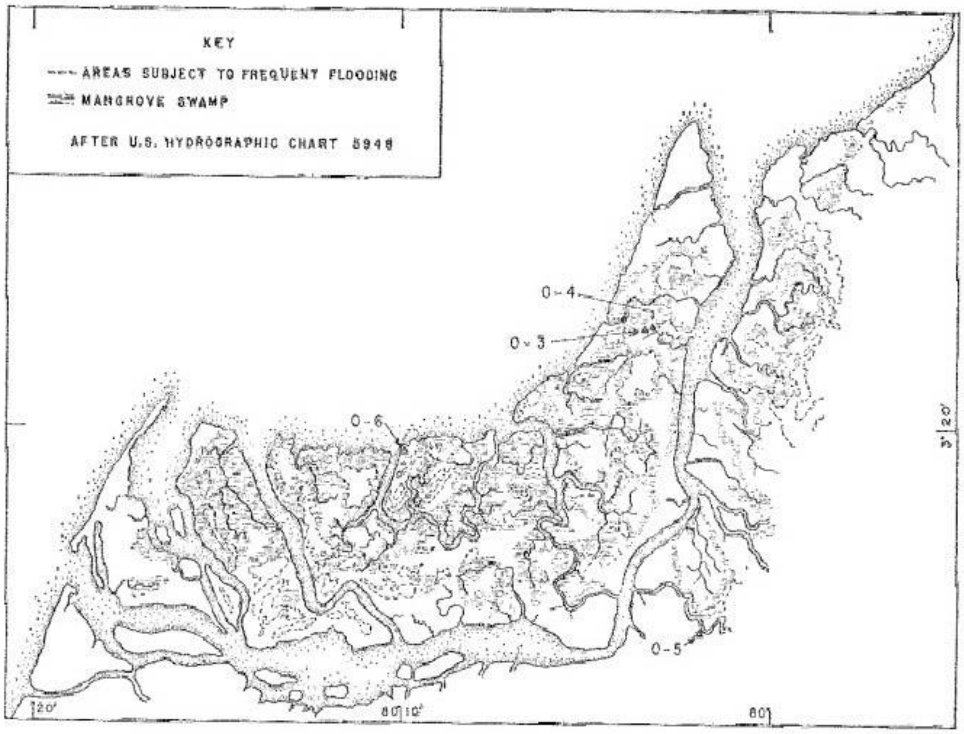


FIGURE 4.—Map of the coast of El Oro Province, showing distribution of mangrove swamp and location of Jambelí Phase sites.

Jambelí sites with ceramics in the province of El Oro (Figure 3):

- O3: Chiveria Estuary N1
- O4: Chiveria Estuary N2
- O5: Embarcadero
- O6: Las Huacas

- O7: Tendales

Initially Estrada *et al.* (1964) believed that all Jambelí culture sites were shell formations. However, in the late 1970s, sites were reported inland on the tops of low hills (Currie E. 1985, 1989).

3. Ethnohistoric Studies of the Area

The geographical area of the Chonos, called Daulis by the Spaniards, according to various documents from the General Archive of the Indies in Seville, made up a wide territory that encompassed several provinces of present-day Ecuador.

The Chonos, archaeologically identified as Milagro-Quevedo, occupied a vast area in the river basin of the Daule and the Guayas, ranging from the bases of the mountain range to the Jambelí channel, beyond Quevedo and Baba, up to the borders with the Niguas and Caráquez[7] (Figure 4).

Studies carried out during these last decades have made it possible to further expand the territory they occupied towards the south,[8] reporting traces of settlements near Machala (López 2005, image 4).

In this regard, Holm[9] mentions that the Chono territory encompassed the entire Guayas river system, setting its boundaries to the north with the Atacames culture, on the heights of Santo Domingo; on the eastern side with the foothills of the Western Cordillera, in the current provinces of Pichincha, Cotopaxi, Chimborazo, Bolívar, Cañar and Azuay; on the south side on the coasts of the province of El Oro, where it merges with the southern extension of the Manteña-Guancavilca culture, except for the Puná island.

In the 15th and 16th centuries, the caciquism or lordship of Chono had a ‘capaccuraca’ and “many chiefs were subordinated to this position.” All the chiefs dependent on him provided the income he required for his maintenance and practices of generosity and hospitality. Income included fruits of the earth in appreciable quantity and of the best quality.

The prestige of the chiefs of the Chono kingdom, called Daule by the Spaniards, was actually quite notorious not only because it encompassed the entire basin of the Amay River, Guayas at present times, and the land that extends north and south of it.

Their housing centers were generally located on the coastal beaches and on the riverbanks, which the Chonos used as means of communication. Their houses and villages were built on hills of land that were high enough to emerge as islands, around which they had abundance of farms and orchards where they cultivated their subsistence food. Many of its houses were built following a ‘barbecue style’, with room for only one person. They also built fortified enclosures, possibly shrines.

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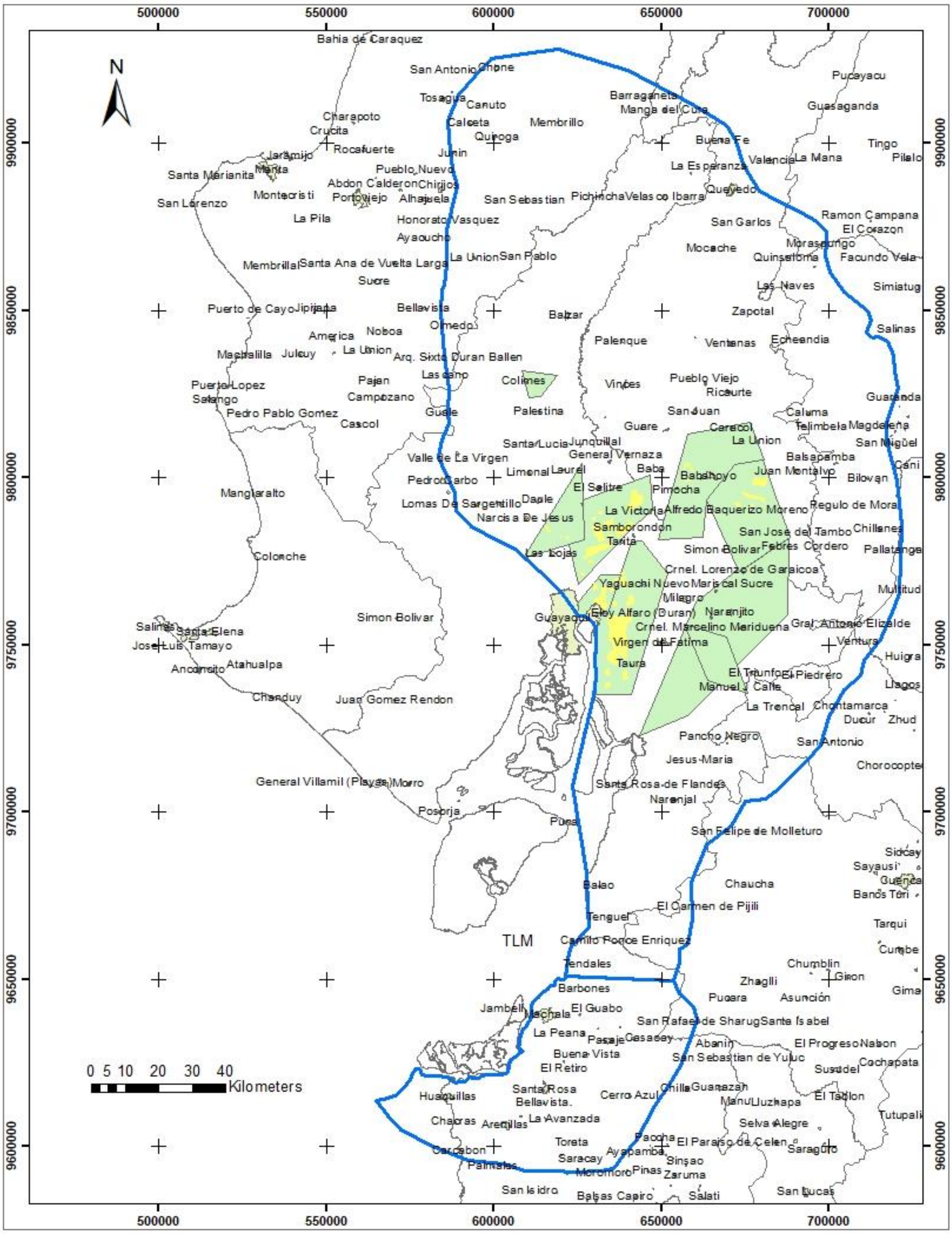
[7] Espinoza Soriano W., 1981

[8] Taylor S. 2011.

[9] Holm O. 1983

Figure 4. Chono occupation area in the Guayas river basin in blue line. Elevated field systems and platforms in green and yellow polygons



Espinoza Soriano, 1981:11; Denevan & Mathewson 1983:170.

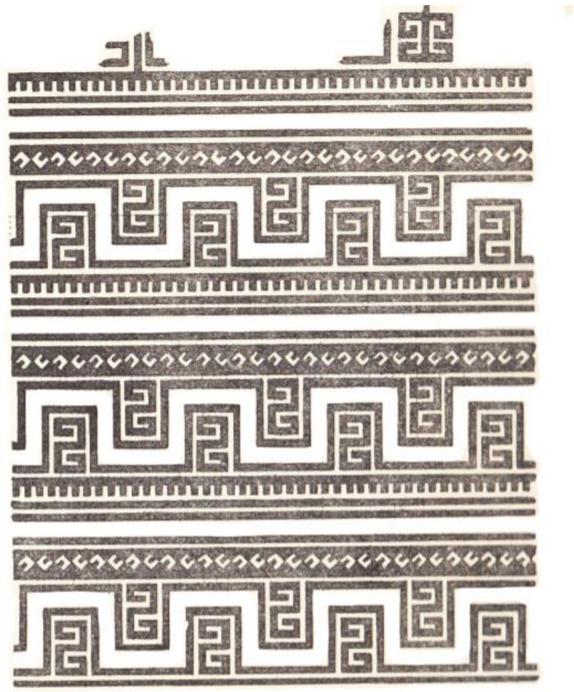
The Chonos were traditional enemies of the inhabitants of Puná Island, with whom they fought constant wars at sea. They also had wars with the Tumbesinos. In the last phase of the Chono kingdom, artificial mounds abounded, indicating a considerable population density. The niches of their tombs were largely occupying these artificial mounds, which had urns of different size, number, and arrangement. The large mounds contained a large number of niches, which included direct burials, urns covered with lids, and chimney-type urns, most of which were accompanied by varied burial goods.

Their household dishes were made of metal, ceramic, stone, and bone. In metallurgy, they reached the most intense development on the coast, working with gold, silver, and copper, making an infinity of sumptuous artifacts in addition to ornaments. The most beautiful collections of Milagro gold jewelry were kept in the Gold Museum of the *Casa de la Cultura Núcleo del Guayas*. The frequent use of gold wire not only as a constructive element, but also for the beautification of jewels, was characteristic of the distinguished goldsmiths of this culture.

Dora León (1964) mentions that the Chonos occupied a vast extension in the fluvial area of the Ecuadorian coast, reaching the provinces of Esmeraldas and El Oro. They apparently originated in the Amazon region.

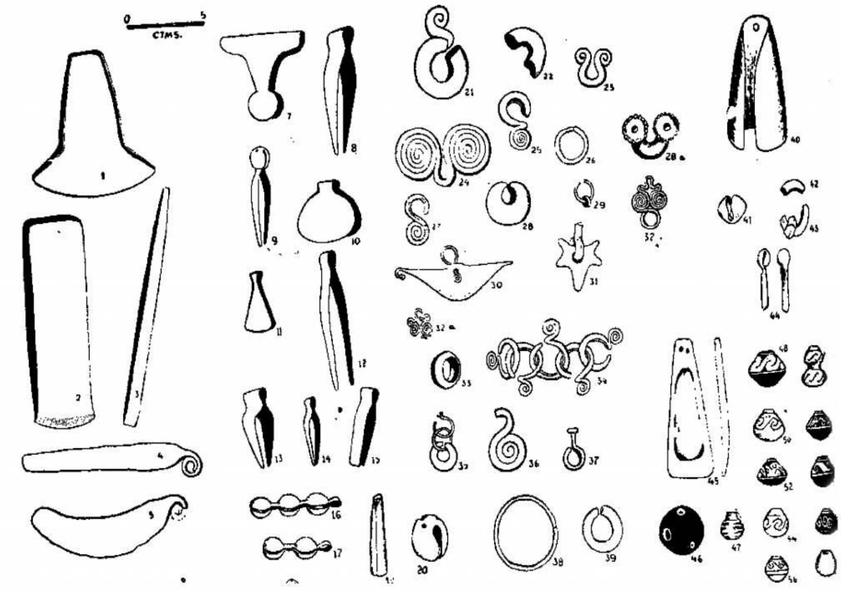
Szaszdi *et al.* (1980) mention that Juan de Salazar Villasante, BArch, claims that the Chono rafters “were naked, only wearing loincloths.” Various sources claim that the Chonos wove cotton blankets (Figure 5).

Figure 5. Chono blanket design, based on the photograph of the textile fragment found in a grave reproduced by B. Meggers.



As for the jewels worn by the Chonos, the ethnohistoric sources tell us nothing. On the other hand, the information provided by archaeological works is abundant, in which necklaces, nose rings and earrings of copper, silver and gold are mentioned. Preferably they used spiral-shaped wire to make various ornaments (Figure 6).

Figure 6. Artifacts and various ornaments.



Source: Estrada 1979:26.

4. Theoretical framework of the study

Archaeological studies in recent decades have let us know more aspects (occupation patterns, social complexity, socioeconomic formation) about the ancient pre-Hispanic cultures in our country, which has partially revealed the cognitive structures that are sustained in their way of life, ideology, technological processes, beliefs, and historical changes through time.

For this reason, the vestiges (architectural and decorative) found in the surveys and excavations are the fundamental elements to reconstruct the life forms of the group that made them. Thus, the archaeological study or intervention must be carried out with the purpose of recovering the greatest amount of information to reconstruct the history of cultures that have been transformed or have disappeared.

The reconstruction of forms of life implies getting to know the culture of the social conglomerates. Culture is understood as the set of parameters through which the reality in which individuals develop is assimilable and controllable, where all customs, traditions, legends, forms of interaction with the environment are incorporated, that is, everything what is inherited in a non-biological way.[10]

With this theoretical basis, the purpose is to identify the pre-Hispanic settlement patterns that exist in the area of interest, which should reflect indicators of temporality identified on the coasts of the province of El Oro and the coasts of northern Peru.

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[10] Hernando A., 2002.

5. Methodology

An archaeological diagnosis is considered to be:

"A systematic surface recognition with or without collection of paleontological or archaeological material, with or without excavations, that allows planning actions, programs and study projects in a territory under study.[11]"

The information reviewed was found in:

- Technical reports presented to the INPC-R7 (EIA - Study Projects).
- Printed documents (plans, IGM letters, publications, etc.).
- A pedestrian reconnaissance of the Port Terminal and the location of Dock 6 was carried out.
- Based on the information collected, a preliminary map of archaeological sensitivity of the studied sector was drawn up.

In this study, the studies carried out by other archeology specialists on the past societies that settled in the vicinity of the observation area were summed up. This reference information let us know the state of the studies to date and locate probable sectors of archaeological interest, in order to estimate the greater or lesser sensitivity.

5.1. Archaeological sites closest to the study area

In the vicinity of the evaluated area, we will mention the sites that have been reported at a distance of approximately 6 km (Table 1):

[11] Echeverría J. 2011

Table 1. Archaeological sites near the Port Terminal.

East	North	Code/Name	Type	Origin
605416	9636477	Chiveria Estuary 2	Housing	Jambelí
605054	9636490	Chiveria Estuary 1	Housing	Jambelí
613541	9637635	La Puntilla	Housing	Jambelí
617504	9641303	La Primavera	Housing	Jambelí
617882	9640536	Los Vergeles	Housing	Jambelí

Compiled by author

6. Archaeological Mitigation Plan

The mitigation measures (see Table 1) are linked to the construction phase of Dock 6, dredging activities and other works considered in the implementation of Phase I:

- The period of time the construction will take and,
- The protection of the potential heritage assets to be affected, directly or indirectly.

They will be aimed at being carried out using the following criteria:

1. Anticipate potential impacts,
2. Minimize impacts as much as possible and,
3. Mitigate through study.

The area where the construction works of Dock 6 and other works considered in the implementation of Phase I will be carried out, as well as several sectors of the Port Terminal, are close to pre-Hispanic settlements both in the island sector, as well as in the land sector and the interior of an area reported in the middle of the last century, as a sector of interaction of the Jambelí culture (Regional Development period 30 BC - 70 AD),[12] but these have also been filled up with soil and stone material for soil compaction over decades.

Within the process of obtaining the Environmental Licenses and Environmental Registry, an assessment or certificate of Cultural Heritage were not required by the pertinent authorities.

[12]Obelic B.& J.G.Marcos 1997.

Table 2. Archaeological Mitigation Plan

Action	Potential Impact	Action to Take
1. Construction of Dock 6	Low probability of vestiges on the beach	"If during the construction phase, the builder and/or the inspection is faced with unexpected situations, a team specialized in archeology is required to determine whether the material found…"
2. Project Closure	No alteration	In the event that the dock is no longer working, the intervened area and surrounding area must be left in adequate conditions, free of debris and pollutants.

Prepared by: Ecosambito, 2020.

7. Archaeological Contingency Measures

The measures proposed here are aimed at taking action in unexpected situations.

- ✓ In the event of facing a potential discovery of cultural material during the construction process, these must be fully identified to get to know their origin, and a team specialized in archeology must be hired to determine if the discovered material meets the conditions to be classified as cultural material.
- ✓ In the event that the team specialized in archaeological material determines that the discovery is cultural material, this event must be notified to the competent authorities.
- ✓ Make employees aware of how to proceed in the event of discoveries of cultural material.

8. Conclusions

As already mentioned in previous sections, due to ethnohistorical references and archaeological studies, on the southern coast of Ecuador, remnants of pre-Hispanic settlements have been reported and date back to the Formative period (Valdivia), passing through Regional development period (Jambelí) extending to the Integration (Milagro - Quevedo) period. Towards the north and east of the Port Terminal of Puerto Bolívar, vestiges of late pre-Hispanic settlements are still visible, although a large part of them have been impacted and destroyed by current human occupations, formal and informal settlements, civil infrastructure works as well as crops., generally combined with the natural processes over time (processes of cultural and natural transformation; Schiffer 1987). Currently adjacent to the Puerto Bolívar Terminal, a new situation has arisen with the invasion of families in an old sector of shrimp farms, the so-called Virgen del Cisne neighborhood (Source www.eluniverso.com/noticias 2020).

The high presence of late settlements linked to the Chono culture is related to the development of caciquism societies that established control and management systems through the modification of the landscape, with construction of elevated mounds, ridges, platforms,[13] etc., which required a huge labor force during its construction and maintenance, as well as a great knowledge of hydraulics. These constructions are related to intensive cultivation, with methods of maintaining soil fertility, and with at least dense populations in the localities where these configurations are found (Figure 9 in annexes). The reported sites revealed deep, as well as late, settlements, characterized by a ceramic assemblage that is closely related to what has been archaeologically defined as Milagro-Quevedo.

In this regard, Muse (1989:191) mentions that given the “diversity of borders shared by the Chonos and the formidable agricultural activity they developed through the construction of elevated fields, it is not difficult to imagine their key role in the production and distribution of so many basic material elements in the daily life of the western region and beyond (corn, yucca, balsa wood, bamboo cane, fish, game, cotton, textiles, copper products, coca).”

In the Tahuín dam, Almeida (2013) mentions that the ancient inhabitants of the Arenillas sites, despite being distant from the coastline (approximately 10 km), had the marine resource for their subsistence, which explained the presence of large dumps with malacological remains. At Hacienda Veintimilla, a large settlement associated with the Late Formative period was reported, although there also settlements associated with the Regional Development and Integration periods.

Based on the information obtained, we can indicate the following:

- The archaeological record indicates a permanent occupation dating back from the Formative to Integration (3700 BP) periods.
- Presence of multi-component settlements with deep deposits.
- Presence of settlements different in shape, size, function, and importance.
- Vestiges include concentrations of ceramic or malacological materials in flat spaces and concentrations of sherds in monumental structures (ridges and elevated mounds).

[13] Denevan et al. 1983, Parson et al. 1982.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT

– PHASE 1

– COMPLEMENTARY STUDIES –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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– 2019-2020 GREENHOUSE GAS REPORT –

Prepared for:

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GREENHOUSE GAS (GHG) EMISSIONS INVENTORY

1. Introduction

The greenhouse effect is a natural phenomenon that makes life on Earth possible. It is caused by a number of gases present in the atmosphere, resulting in some of the sun's heat reflected by the planet getting trapped, maintaining the mean global temperature. However, more than one decade ago scientists around the world started to warn that the earth was warming at an unprecedented rate (WWF, 2010).

This acceleration can be explained by the direct relationship between global warming and greenhouse gas (GHG) emissions. These gases have increased significantly since the industrial revolution, where the burning of fossil fuels released large amounts of CO2 into the atmosphere, causing the atmosphere to trap even more heat, resulting in the global warming: increased temperature in the atmosphere and the oceans.

The Intergovernmental Panel on Climate Change (IPCC) suggested in its latest report (2018) that global warming is likely to reach 1.5°C between 2030 and 2052, with the resulting increase in the frequency and intensity of rainfalls, forest fires, floods and droughts (Miller & Croft, 2018) (IPCC, 2018).

In order to help combat climate change, YILPORTECU has decided to measure and manage its carbon footprint. The purpose is to prevent or minimize the impacts on human health and the environment as well as contamination. With this in mind, it promotes a more sustainable use of resources such as energy and water, and seeks to reduce the emissions of Greenhouse Gas related to the project.

2. General Purpose

Determine the gas emissions generated during port operation in the years 2019 and 2020 and during the construction of the Puerto Bolívar Port – Phase 1; and identify alternatives to minimize its ecological footprint.

3. Requirements

This document seeks to comply with the requirements established by the International Finance Corporation (IFC) that are based on the Environmental and Social Performance Standards and the Equator Principles, taking into account the Guidance Notes to the Performance Standards.

Specifically, Performance Standard 3 on Resource Efficiency and Pollution Prevention will be taken into account, along with its respective Guidance Note 3 and the recommendations on greenhouse gas inventories.

Technical documents such as the General Environmental, Health and Safety Guidelines and the specific Environmental, Health and Safety Guidelines for Ports, Harbors and Terminals will be also taken into account.

In this manner, it is recognized that increased economic activity, in this case commercial activities related to the fluvial transportation of products in a maritime terminal, generate increased levels of pollution to air, water and land, consuming resources and increasing the risks for people and the environment at the local, regional and global levels. Therefore, it is necessary to measure GHG emissions and promote reduction strategies.

3.1. Resource Efficiency and Pollution Prevention

The Guidance Note (GN) related to this performance standard considers that the potential environmental impacts associated with the emission of greenhouse gases (GHG) are among the most complex to predict and mitigate due to their global nature.

It further establishes that key environmental impacts can occur at any phase of a project and depend on a great number of factors, including the nature of the industry and site location.

Specifically, with regard to greenhouse gases, GN3 urges to apply alternatives, implement solutions to reduce GHG emissions, and quantify direct and indirect emissions on a yearly basis, particularly for projects producing more than 25,000 annual tons of CO2.

It is recognized that anything that needs to be managed must be measured first; therefore, the quantification of GHG emissions is the first step in managing them. Such quantification must consider all significant sources of GHG emissions, including non-energy related sources such as methane and nitrous oxide, among others, and the appropriate methodologies are those recommended by the IPCC.

In the General Environmental, Health and Safety Guidelines, the quantification of emissions is framed within the preventive approach of the risks and potential impacts of the project during any of its phases (construction, operation or decommissioning).

The specific Environmental, Health and Safety for Ports, Harbors and Terminals states that it is important to consider the air emissions generated by the terrestrial and maritime activities of terminals or ports. During the construction phase, emissions are generated by the use of vehicles, equipment and engines of machinery such as tractors, excavators or tugs, to undertake dredging, excavating, paving, material transport and construction activities.

During operations of ports and terminals, emissions result mainly from the combustion of diesel engines used for the propulsion of ships or vessels, engines and boilers for power generation. Emissions are also generated from land-based activities involving the use of vehicles, cargo handling equipment, and other engines and boilers.

In addition to the above-mentioned Guidelines and Performance Standards, the Equator Principles Financial Institutions have established Principles to ensure that projects are developed in a manner that is socially and environmentally responsible.

These principles promote sustainable management in all aspects, respecting human rights. For this reason, for the purposes of this study, Principle 2 on environmental and social assessment considers an analysis of alternatives in the case of projects generating scope 1 and scope 2 emissions in excess of 100,000 tons of CO_2 equivalent annually. In this case, lower GHG intensive alternatives must be evaluated.

4. General Description of the Company

YILPORT HOLDING is a business group that operates port terminals around the world and that started operations in Ecuador in 2016 upon being awarded the Delegated Management Contract for the Design, Financing, Equipping, Execution of Additional Works, Operation and Maintenance of the Puerto Bolívar Port Terminal in the city of Machala, province of El Oro.

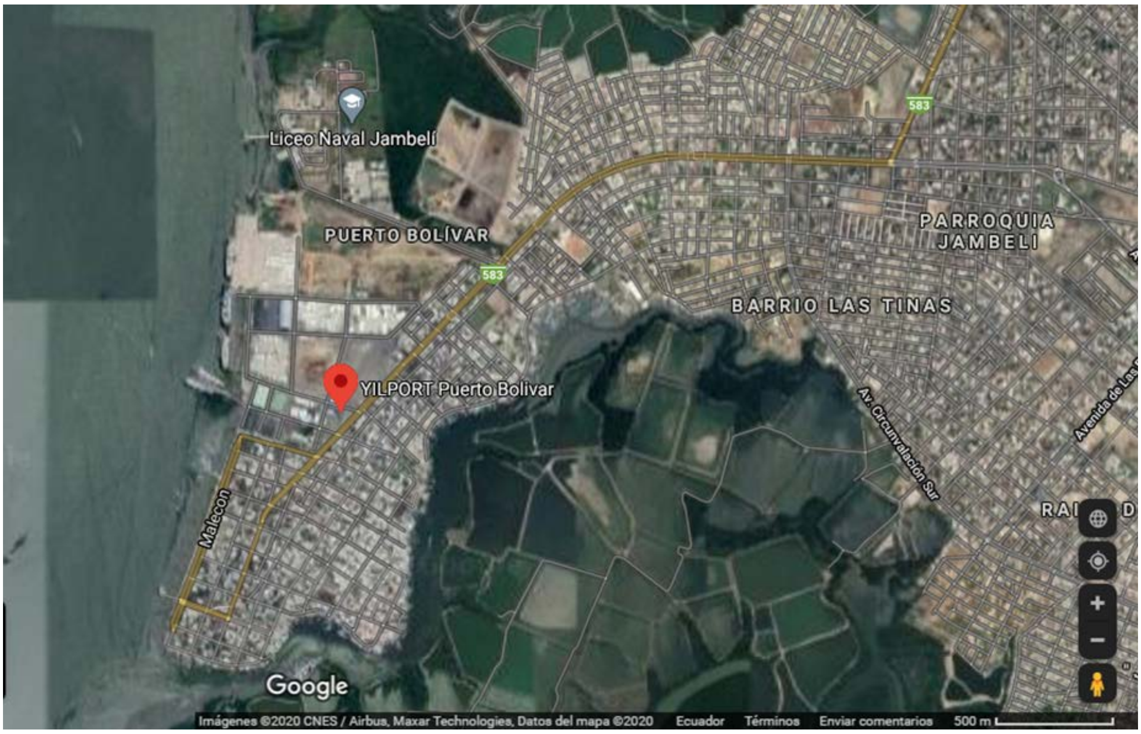
The operations and infrastructure that will be evaluated as part of the Puerto Bolívar Port – Phase 1, are those described in the Project Presentation and Description document.

5. Quantification of GHG Emissions from Port Operations

5.1. Definition of Organizational Limits

The greenhouse gas emissions generated within the physical and operational boundaries of the Puerto Bolívar Port Terminal are considered.

Figure 1. Location of the Puerto Bolívar Port Terminal

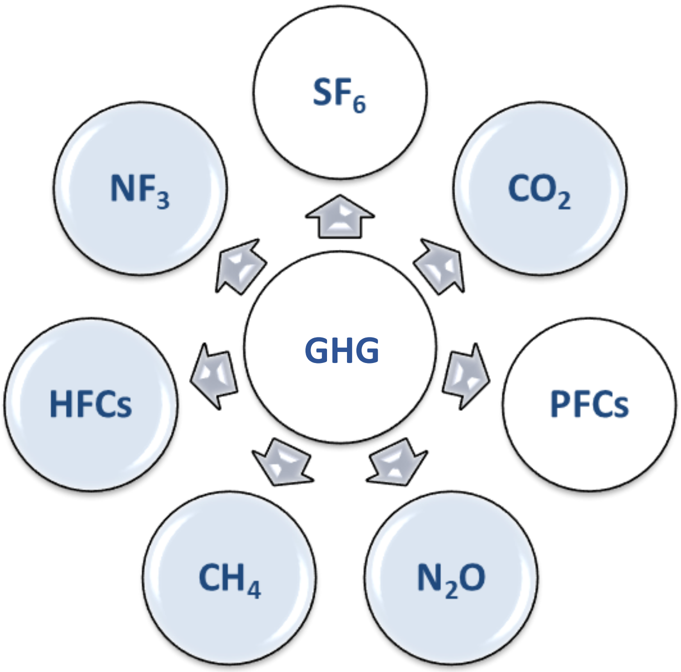


Province	Company	Terminal	Geo-referenced Points (Coordinates)	Address
El Oro	Yilport Terminal Operations	Puerto Bolívar	3°15’55’’ South Latitude and 80°00’01’’ West Longitude	Av. Bolívar Madero Vargas S/N, Puerto Bolívar - El Oro - Ecuador

5.2. Definition of Operational Limits

The greenhouse gases established in the Kyoto Protocol were considered: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF6). No nitrogen trifluoride (NF3) or perfluorocarbons (PFCs) were identified at the facilities (See Figure 2).

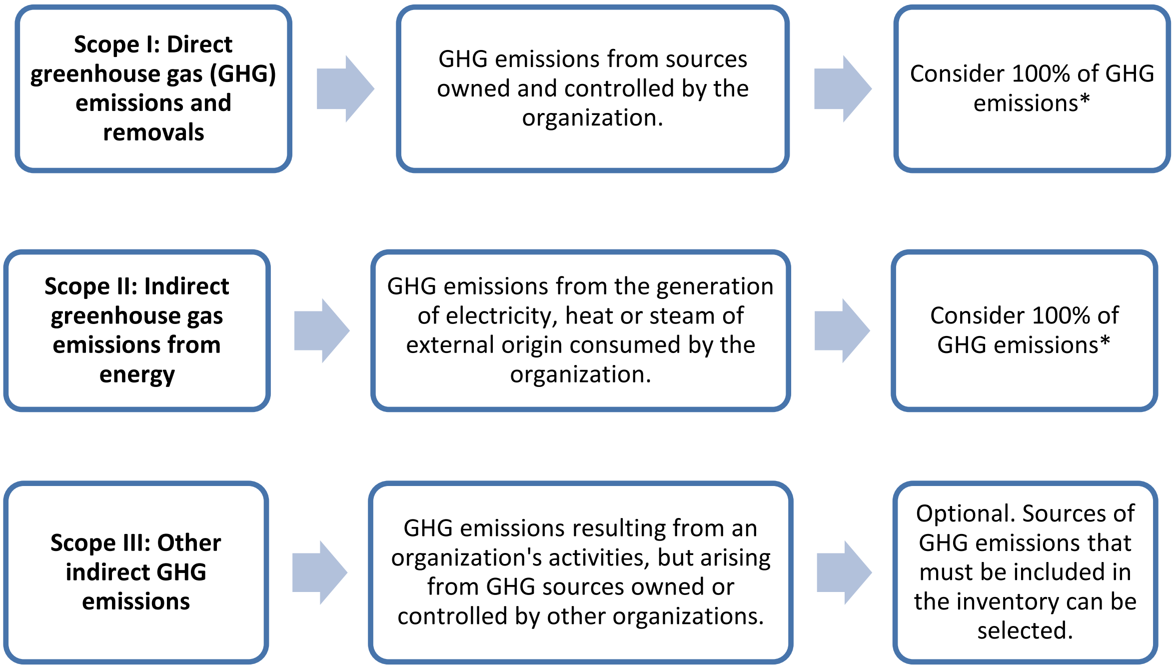
Figure 2. Greenhouse Gases



In accordance with the reference standards (GHG Protocol and ISO 14064-1), emissions may be classified into three categories (Scope 1, 2 and 3).

The considerations for this classification are detailed below:

Figure 3. Definitions and Requirements according to ISO 14064-1.



As can be seen in Figures 2 and 3, it is a mandatory requirement to consider all the "direct emissions and removals" (scope 1) and the "indirect emissions from energy" (scope 2). However, the inclusion of sources of emissions in the "other indirect GHG emissions" category (scope 3) is optional and this is the primary focus in defining operational limits.

In order to delimit the established scope, a tour of the Terminal's facilities was carried out. During such tour, the organization's activities representing sources of gas emission were determined, as detailed below:

- ✓ Consumption of fuels and lubricants by mobile machinery and equipment: container ships, light trucks, forklifts, spreaders, cranes, headers.
- ✓ Fuel for boats.
- ✓ Consumption of fuels and lubricants by stationary machinery and equipment: generators, power packs.
- ✓ Consumption of liquefied petroleum gas (LPG): forklifts.
- ✓ Consumption of power from the grid.
- ✓ Refrigerant gas recharge: air conditioners.
- ✓ CO2 fire extinguisher gas recharge.
- ✓ Biological waste (wastewater).
- ✓ Non-recyclable waste.
- ✓ Welds.
- ✓ Sulfur hexafluoride.

6. Base Year Selected

2019 is taken as the base year in view that YILPORTECU has developed a solid database since that year and has reliable supports and records that support the primary information required to determine the Carbon Footprint.

The base year will be recalculated when some of the following conditions are met:

- Significant changes in the quantification methodologies and/or emission factors.
- Significant structural changes in the facilities, including mergers, acquisitions and expansions.
- Changes in the operating and operational limits.
- New sources of data concerning other scope 3 indirect emissions.
- Discovery of significant errors or accumulation of a considerable number of minor errors progressively and significantly altering the total number of GHG emissions quantified.

YILPORTECU has identified and established that the significance levels that will be considered for the recalculation of the base year will be those above 10% of the values established in the base year.

7. Calculation of Greenhouse Gas Emissions

7.1. Calculation Methodologies Used

For purposes of the calculation, the methodology and emission factors contained in the IPCC 2006 (2019 update) were implemented, as it is the highest authority in greenhouse gas emission inventory matters; the GHG Protocol 2000 was also implemented. The only national factor used is the electricity factor issued by Ecuador's National Center for Energy Control (CENACE in Spanish) according to the country's energy matrix.

The calculation of emissions of each GHG (CO_2, CH_4, N_2O, etc.) is expressed in tons of CO_2-eq/year.

In order to make the greenhouse gas inventory, the following methodology was used:

Table 1. Methodology Used for GHG Calculation.

EMISSION SOURCE	METHODOLOGY
Electricity	Based on data from CENACE (National Center for Energy Control).
Refrigerant gases and sulfur hexafluoride	(AR5), Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forc-ing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
Biological waste	2006 IPCC Guidelines (2019 update) for National Greenhouse Gas Inventories. Volume 5. Chapter 6: Wastewater Treatment and Discharge.
Non-recyclable waste	IPCC - "V5_2_Ch2_Waste_Data.pdf" - Vol. 5 "Waste"- Chapter 2 - page 2.15.
Fuels (diesel, gasoline, LPG)	2006 IPCC Guidelines (2019 update) for National Greenhouse Gas Inventories. Volume 2: Energy, Chapter 2: Stationary Combustion, and Chapter 3: Mobile Combustion.
Lubricants	2006 IPCC Guidelines (2019 update) for National Greenhouse Gas Inventories.

For the calculation of CO_2 emissions, the process described below was followed:

a) Emission source: Electricity

In order to estimate GHG emissions from electricity, the following formula was used:

Emissions in tCO_2e = (Activity data × Emission factor).

The emission factors used are described below:

Table 2. GHG Emission Factors for Electricity

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Indirect	CENACE	Electricity	Mwh	2018: 0.5371 t CO_2/Mwh 2019: 0.4509 t CO_2/Mwh

b) Emission source: Refrigerant gases and sulfur hexafluoride

For the refrigerant gas emission source, the emissions were calculated in tons CO_2e as detailed below:

Emissions of each type of refrigerant gas in tCO_2e = *(Activity data × PCG).*

The global warming potentials used are detailed below:

Table 3. GHG Emission Factors for Refrigerant Gases and Sulfur Hexafluoride.

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Direct	IPCC 2006 (2019 update) AR5, 2013	Refrigerant gas and SF6	Pounds	Global warming potential R-22: 1.760 R-410 A: 1.924 SF_6: 23.500

c) Emission source: Biological waste

The estimation of biological waste was based on the number of persons, BOD and the factors listed below. The calculation is not detailed in the table due to the complexity, but the details can be viewed in SIM CO_2.

Table 4. GHG Emission Factors for Biological Waste

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Direct	IPCC, 2007	Biological waste	Number of persons	BOD: 0.40 g/person/day 65 kg protein/person/day 0.16 kg N/kg protein 1.10 adjustment factor for non-consumed proteins 1.25 industrial and commercial proteins co-discharged 0.005 kg N_2O/kg N (N removed with sludge)

d) *Emission source: Non-recyclable waste*

In order to estimate the emissions from non-recyclable waste, the following formula was used:

Emissions in tCO_2e = (Activity data x MS fraction x C fraction x 3.67).

The emission factors used are detailed below:

Table 5. GHG Emission Factors for Miscellaneous Waste

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Other indirect	IPCC 2006 (2019 update)	Non-recyclable waste	Kg	% non-recyclable matter: 90 Organic carbon content: 60% CO_2 conversion factor: 3.67

e) *Emission source: Fuels (gasoline, diesel, LPG).*

In order to estimate emissions from fuels, the following formulae were used:

CO_2 emissions in tCO_2e = (Activity data × CO_2 emission factor × GWP of CO_2) ÷ 1000

CH_4 emissions in tCO_2e = (Activity data × CH_4 emission factor × GWP of CH_4) ÷ 1000

N_2O emissions in tCO_2e = (Activity data × N_2O emission factor × GWP of N_2O) ÷ 1000

$tCO_2e = \sum tCO_2e\ (CO_2, CH_4, N_2O)$

Note: GWP = Global Warming Potential.

The emission factors used are detailed below:

Table 6. GHG Emission Factors for Fossil Fuels

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Direct	IPCC 2006 (2019 update)	Diesel for vehicles	Gallons	Fuel density: 0.83 NCV: 43 TJ/Gg E.F CO_2: 74,100 E.F. CH_4: 3.9 Global warming potential of methane: 28 E.F. N_2O: 3.9 Global warming potential of N_2O: 265
Direct	IPCC 2006	Diesel for heavy machinery	Gallons	Fuel density: 0.832 NCV: 43 TJ/Gg E.F. CO_2: 74,100 E.F. CH_4: 4.15 Global warming potential of methane: 28 E.F. N_2O: 28.6 Global warming potential of N_2O: 265
Direct	IPCC 2007	Diesel for stationary combustion (generators)	Gallons	Fuel density: 0.83 NCV: 43 TJ/Gg E.F. CO_2: 74,100 E.F. CH_4: 10.00 Global warming potential of methane: 28 E.F. N_2O: 0.60 Global warming potential of N_2O: 265
Direct	IPCC 2006 (2019 update)	LPG for forklifts	Kilograms	NCV: 47.30 TJ/Gg E.F. CO_2: 63,100 E.F. CH_4: 62 Global warming potential of methane: 28 E.F. N_2O: 0.20 Global warming potential of N_2O: 265

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Other indirect	IPCC 2007	Gasoline for boats	Gallons	Gasoline density: 0.73 NCV: 44.30 TJ/Gg E.F. CO_2: 69,300 E.F. CH_4: 5 Global warming potential of methane: 28 E.F. N_2O: 0.60 Global warming potential of N_2O: 265

f) Emission source: Lubricants

In order to estimate the emissions of lubricants, the following formula was used:

Emissions in tCO_2e = (Activity data x NCV x C contents x oxidation fraction x 3.67).

Note: NCV=net calorific value.

The emission factors used are detailed below:

Table 7. GHG Emission Factors for Lubricants

Emission Category	Methodology Used	Emission Source	Measurement Unit	Emission Factor
Direct	IPCC 2006 (2019 Update)	Lubricants - oxidation	Gallons	Fuel density: 0.864 NCV: 40.20 TJ/Gg Carbon content: 20 Oxidation during use: 0.20 C to CO_2 conversion factor: 3.67

8. GHG Emissions in YILPORTECU's Operations

8.1. Results of GHG Inventory 2019-2020

8.1.1. Analysis of GHG Emissions - 2019

During the base year (2019), the Port Terminal facilities emitted a total of 9,664.42 Ton CO_2e. In that year, the main emission source was energy consumption (6,315.19 Ton CO_2e/year), which accounted for 65.34% of the total emissions.

The second most important emission source was the consumption of fuels and lubricants for heavy machinery, which totaled 2,856.42 Ton CO_2e/year, i.e. 29.56% of total emissions in 2019. The third most important emission source was the consumption of fuels and lubricants by stationary combustion machinery, which totaled 205.71 Ton CO_2e/year, i.e. 2.13% of total emissions. In the fourth place, the emissions from miscellaneous waste totaled 107.89 Ton CO_2e/year, which accounted for 1.12% of the total TonCO_2e/year.

The remaining emissions accounted for 1.85% of total annual emissions and consists of the emissions coming from the following sources: LPG for forklifts, consumption of gasoline for vehicles, gases such as sulfur hexafluoride, biological waste, consumption of gasoline for boats, consumption of lubricants and refrigerant gases (see Table 8).

Table 8. Greenhouse Gas Emissions – Year 2019.

No.	Emission Source	Classification	Total CO2 Emissions (ton CO2/year) 2019	Percentage (%)
1	Energy	Indirect	6,315.19	65.34
2	Fuels for heavy machinery	Direct	2,856.42	29.56
3	Stationary combustion fuels	Direct	205.71	2.13
4	Miscellaneous waste	Other indirect	107.89	1.12
5	LPG for forklifts	Direct	69.46	0.72
6	Diesel for vehicles	Direct	34.81	0.36
7	Biological waste	Direct	28.33	0.29
8	Sulfur hexafluoride	Direct	21.15	0.22
9	Gasoline for boats	Direct	16.89	0.17
10	Lubricants	Direct	4.58	0.05
11	Refrigerant gases	Direct	4.00	0.04
TOTAL			9,664.42	100.00

Based on the classification of emissions according to their scope, it can be determined that in 2019 the main GHG emission source corresponded to scope 2, that is, indirect emissions, represented by consumption of energy (6,315.19 Ton CO_2e/year), followed by scope 1 emissions with 3,241.35 Ton CO_2e/year, and finally scope 3 emissions with 107.89 Tn CO_2eq (see Table 9).

Table 9. Emissions classified according to Scope – Year 2019.

Emissions classified according to scope, as per NTE INEN-ISO 14064-1	GHG emissions by month (Ton CO2eq)
Scope 1: Direct GHG emissions	3,241.35
Consumption of fuels for heavy machinery	2,856.42
Consumption of fuels for stationary equipment	205.71
LPG for forklifts	69.46

Diesel for vehicles	34.81
Biological waste	28.33
Sulfur hexafluoride	21.15
Gasoline for boats	16.89
Lubricants	4.58
Refrigerant gases	4.0
Scope 2: Indirect GHG emissions	6,315.19
Energy	6,315.19
Scope 3: Other indirect GHG emissions	107.89
Miscellaneous waste	107.89
Emissions (Ton CO_2eq)	**9,664.42**

8.1.2. Analysis of GHG Emissions - 2020

During 2020 (January to November), Yilportecu emitted a total of 10,239.99 Ton CO_2e/ year. The main emission source was energy consumption (5,881.85 Ton CO2e/year), which accounted for 57.44% of the total emissions in 2020.

The second most representative emission source was the combustion of heavy machinery, which totaled 2,898.40 Ton CO_2e/year, i.e. 28.30% of annual emissions. The third most important emission source was the consumption of fuels for stationary equipment, which totaled 1,098.91 Ton CO_2e/year, i.e. 10.73% of the emissions of this year.

The fourth emission source in 2020 was miscellaneous waste, which totaled 192.46 Ton CO_2e/year, i.e. 1.88% of the total emissions.

The remaining emissions accounted for 1.64% of emissions and consists of the emissions coming from the following sources: LPG for forklifts, consumption of diesel for vehicles, biological waste, sulfur hexafluoride, consumption of gasoline for boats, consumption of lubricants and refrigerant gases.

Table 10. Greenhouse Gas Emissions – Year 2020.

No.	Emission Source	Classification	Total CO2 Emissions (ton CO2/year)	Percentage (%)
1	Energy	Indirect	5,881.85	57.44
2	Fuels for heavy machinery	Direct	2,898.40	28.30
3	Stationary combustion fuels	Direct	1,098.91	10.73
4	Miscellaneous waste	Other indirect	192.46	1.88
5	LPG for forklifts	Direct	51.22	0.50
6	Diesel for vehicles	Direct	31.91	0.31
7	Biological waste	Direct	29.90	0.29
8	Sulfur hexafluoride	Direct	21.15	0.21
9	Gasoline for boats	Direct	15.48	0.15
10	Lubricants	Direct	6.72	0.07

11	Refrigerant	Direct	12.00	0.12
	TOTAL		**10,239.99**	**100.00**

Based on the classification of GHG emissions according to their scope, it can be determined that most of them come from scope 2 indirect sources, that is, energy consumption, with 5,881.85 Ton CO_2eq, followed by scope 1 sources, that is, direct GHG emissions, with 4,165.69 Ton CO_2eq, and finally scope 3 sources, that is, other indirect emissions, with 192.46 Tn CO_2eq of the total emissions in 2020.

Table 11. Emissions Classified according to Scope - Year 2020

Emissions classified according to scope, as per NTE INEN-ISO 14064-1	**GHG emissions by month (Ton CO2eq)**
Scope 1: Direct GHG emissions	4,165.69
Consumption of fuels for heavy machinery	2,898.40
Consumption of fuel and lubricants for stationary equipment	1,098.91
LPG for forklifts	51.22
Diesel for vehicles	31.91
Biological waste	29.90
Sulfur hexafluoride	21.15
Gasoline for boats	15.48
Lubricants	6.72
Refrigerant gases	12.00
Scope 2: Indirect GHG emissions	5,881.85
Energy	5,881.85
Scope 3: Other indirect GHG emissions	192.46
Miscellaneous waste	192.46
Emissions Ton CO_2eq	**10,239.99**

8.2. Comparison of 2019 and 2020 Emissions

When comparing the GHG emissions generated during the base year (2019) with the 2020 carbon footprint, it can be seen that they have increased, given that 9,664.42 Ton CO_2e were emitted from January to December 2019, whereas 10,239.99 Ton CO_2e were emitted from January to November 2020.

This is due to the increase in the consumption of fuels for stationary and mobile machinery, the increase in miscellaneous waste and biological waste, and the consumption of lubricants and refrigerant gases, in view that the Port is increasing its operations.

Table 12. Analysis of CO2 Emissions.

No.	**Emission Source**	**Classification**	**Total CO2 Emissions (ton CO2/year) 2019**	**Total CO2 Emissions (ton CO2/year) 2020**
1	Energy	Indirect	6.315,19	5.881,85

No.	Emission Source	Classification	Total CO2 Emissions (ton CO2/year) 2019	Total CO2 Emissions (ton CO2/year) 2020
2	Fuels for heavy machinery	Direct	2,856.42	2,898.40
3	Stationary combustion fuels and lubricants	Direct	205.71	1,098.91
4	Miscellaneous waste	Other indirect	107.89	192.46
5	LPG for forklifts	Direct	69.46	51.22
6	Diesel for vehicles	Direct	34.81	31.91
7	Sulfur hexafluoride	Direct	21.15	21.15
8	Biological waste	Direct	28.33	29.90
9	Gasoline for boats	Direct	16.89	15.48
10	Lubricants	Direct	4.58	6.72
11	Refrigerant	Direct	4.00	12.00
TOTAL			**9,664.42**	**10,239.99**
Increase in CO_2 emissions			**575.57 Ton CO_2e**	

8.3. Efficiency Indicators

In order to determine the efficiency of the operation in relation to its carbon footprint, the GHG index per TEU (twenty-foot equivalent unit) was estimated. In 2019, it was 63.79 Kg CO_2e/TEU, whereas in 2020 it was 57.75 Kg CO_2e/TEU. This means that the operation improved the productivity of its processes, as it is making more dispatches with lower emissions per TEU (see Table 13).

Table 13. Emissions Index per TEU

Year	Total Emissions (Ton CO_2eq)	TEU	Ton CO_2eq/TEU	Kg CO_2eq/TEU
2019	9,664.42	151,498	0.063	63.79
2020	10,239.99	177,316	0.058	57.75

When comparing the indicator obtained (57.75 Kg CO_2e/TEU) with other ports of the country and the region, it can be seen that it is very high. For example, other Ecuadorian ports have recorded values of 39.58 Kg CO_2e/TEU and the Arica Port in Chile has recorded values of 32.50 Kg CO_2/TEU. This difference is mainly due to the fact that such other ports have implemented actions to reduce their environmental impact, such as the electrification of reefer towers, preventive maintenance programs for machinery, etc. Another factor that favors the Arica Port is Chile's energy matrix, since it is based, to a greater extent, on renewable energies. In contrast, Ecuador still heavily relies on thermoelectric power stations.

9. Quantification Exclusions in the Terminal Operations

The following is excluded from the calculation of the emissions from the Port Terminal operations:

- The consumption of fuel by the trailers and trucks carrying the containers and cargo, because they arrive on time to leave the cargo only and belong to different carriers, thus falling under scope 3.
- The transportation of tank trucks with the fuel and the transportation of personnel.
- The emissions from welding, as they account for 0.05% of the inventory emissions, for which reason they are not considered a significant source.
- Acetylene emissions, as they account for 0.001% of the inventory emissions and, hence, are not a significant source.
- Fire extinguishers, as they account for 0.01% of the inventory emissions and, hence, are not a significant source.

10. Quantification of GHG Emissions and GHG Precursors in Vessels

10.1. Considerations for the Calculation of Emissions

According to Prieto Montañez (2019), it is widely recognized by the scientific community that ships are a major source of contamination in port cities and river regions, have a negative impact on air quality, and contribute to global warming.

As per this author, currently 90% of the world trade is carried out by ships, for which reason it is necessary to estimate the gas emissions they generate. These emissions are produced by ship propulsion engines (main engine), auxiliary engines and boilers.

Upon preparing the inventory of maritime traffic emissions, a distinction is made between the three following operations or phases of a ship, which are detailed below:

- Cruising. This phase covers the vessel's journey to the open sea, which is counted between breakwaters, i.e. the distance it travels to get from one port to another until reaching the breakwater. During this phase, the vessel travels at a service speed of about 94% of its maximum speed and maintains a main engine load of 83% (ICF, 2006, p.17).

- Maneuvering. In this operation, the vessel travels the distance between the port's breakwater and the docking wharf. Here both the vessel speed and the engine load are reduced.

- Hotelling. This phase refers to the stay of the vessel at the dock. During this phase, operations such as loading/unloading of goods are carried out. Although the vessel remains moored and does not need energy for propulsion, during this operation it is necessary to generate such energy to feed the electrical, heating and ventilation systems, pumps, etc.

The Cruising operation is not taken into account in the calculation of gas emissions, given that such emissions do not directly affect the port infrastructure and its surroundings.

While most of the emissions into the atmosphere occur during the Cruising operation, the Maneuvering and Hotelling operations are very important, as the pollutants emitted during such phases directly affect the air quality of the population centers located near the ports and of the ports themselves.

This inventory considers combustion gas emissions generated during the Maneuvering and Hotelling phases, thus focusing on the emissions produced at ports.

The primary pollutants considered in the emissions inventory are: NOx, CO, SO2, PM, HC, CO2 y N2O.

For this study of YILPORTECU, the phase of maneuvering and docking of cargo vessels and container ships will be considered, as they are the main types of ships arriving at the Port. Small boats and tourist or recreational cruises with people are excluded because they arrive sporadically.

The calculation of emissions for such boats and cruises was based on information provided by the Port on the most representative types of ships arriving at the port and on data obtained from the "Marine Traffic" system, which collects data from the various Automatic Identification System (AIS) stations. Data such as the year of construction, gross tonnage, average and maximum speed were obtained from the above-mentioned database.

This study also used the methodology and emission factors described in "Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions. EPA EPA-420-B-20-046. September 2020".

The installed power capacity (kW) of the main engines was estimated based on the gross tonnage and type of vessel, through a non-linear regression developed by the Italian physicist Trozzi, 2010. It corresponds to equations (1) and (2):

$ME = a \times GT^b$ Eq. (1)

$AE = r \times ME$ Eq. (2)

Where:

ME= main engine used for ship propulsion

AE= auxiliary engine

GT= gross tonnage

r= ratio of the installed power capacity of the auxiliary engine and main engine (AE/ME);

a and b= the regression coefficients.

The table below shows the indicated variables by type of vessel.

Table 14. Linear Regression Coefficient for Estimation of Installed Power Capacities.

Type	a	b	r
General	6	0.7425	0.191
Bulk	35.9120	0.5276	0.222
Container	2.9165	0.8719	0.22

Source: Nunes et al., 2017a; Port et al., 2017; Sanabria et al., 2014; Trozzi, 2010; quoted by Prieto Montañez, 2019.

No information was obtained on the boiler systems of the vessels that arrived at the Puerto Bolívar. Therefore, for purposes of the calculation, such values were assumed according to the type of vessel, based on secondary sources. Table 15 shows the installed power capacities of the auxiliary boilers. Just as in Nunes et al., 2017a, their operation was only considered in the maneuvering and docking phases.

Furthermore, the load factors of the auxiliary engines were obtained from secondary sources according to the operating phase (Table 16).

Table 15. Installed Power Capacity of Auxiliary Boilers.

Type	Maneuvering (Kw)	Hotelling (Kw)
Bulk	132	132
Container	506	506
General	137	137

Source: Nunes et al, 2017a.

Table 16. Load Factors by Operating Phase.

Operating Phase	ME LF (%)	AE LF (%)
Cruising	80	30
Maneuvering	20	50
Hotelling	20	40

Source: Nunes et al, 2017a.

It is considered that the vessels traveling to Puerto Bolívar have a Slow Speed Diesel (SSD) engine and that the type of fuel they use belongs to the Bunker Fuel Oil (BFO) category.

Table 17. Specifications by Type of Vessel.

Type of Vessel	Type of Engine	Rpm	Type of Fuel	Engine	Type of Fuel
General cargo	Ssd	Rpm≤300	Bfo	Msd/hsd	Bfo
Container ship	Ssd	Rpm≤300	Bfo	Msd/hsd	Bfo

On the other hand, YILPORTECU supplied the data on the number of vessels that arrived in 2019 and 2020 (cut-off until November). The data of 2019 was used because full-year information was available.

The following gas emission factors were used:

Table 18. Emission Factors used to calculate Vessel Emissions.

	Type of Engine	Type of Fuel	PM	HC	CO	NOx	N2O	CO2	SO2
			g/kwh						
Main engine	SSD	HFO	1.40	0.6	1.4	18.1	0.031	607.23	10.29
Auxiliary engine	MSD	HFO	1.54	0.4	1.1	14.7	0.031	706.878	11.98
Boiler	Boiler	HFO	1.87	0.1	0.2	2.1	0.08	949.77	16.10

Source: EPA 2020.

10.2. Results

In 2019, a total of 558 vessels arrived at Puerto Bolívar, of which 314 are container ships and 244 are general cargo vessels.

Table 19. Details of Arrival of Vessels at Yilportecu

Month	Vessels with Containers	Vessels with General Cargo
Jan-19	30	15
Feb-19	27	19
Mar-19	29	22
Apr-19	26	21
May-19	27	26
Jun-19	22	16
Jul-19	25	17
Aug-19	24	23
Sept-19	23	20
Oct-19	24	20
Nov-19	27	26

Month	Vessels with Containers	Vessels with General Cargo
Dec-19	30	19
Total	**314**	**244**

Vessels' maneuvering time is 2.16 hours approximately. Maneuvering is the distance they travel from the breakwater to the port and, during such journey, vessels move at a slower speed.

In the Hotelling phase, container ships stay in the port 10 hours in average (0.42 days) and general cargo vessels stay in the port from 5 to 7 days while the unloading and loading operations are carried out. Vessels' dwell time in port depends on several factors, such as ease of loading and unloading of goods, the technologies used at the port, among others. Therefore, a longer dwell time may cause more emissions. Furthermore, cargo vessels must wait longer in the port until the cargo is complete to be able to depart again.

In the case of cargo vessels, most of the emissions occur during the Hotelling phase (it is assumed that the main engine does not operate during this phase) because this is the phase during which vessels stay the longest at the Port. This is due to the fact that the auxiliary engine is in charge of supplying the energy to carry out the different operations in the port, thus being the main source of pollutant emission. In contrast, the maneuvering phase takes less time and, hence, emissions are lower (Table 20).

In the case of container ships, the situation is different because the greatest emissions occur during the maneuvering phase due to the fact that these vessels have a larger gross tonnage (GT). A larger GT implies a higher installed power capacity, which is logical taking into account that a larger volume of goods must be transported and the installed power capacity translates into greater atmospheric emissions (Table 21).

Table 20. Gas Emissions from Cargo Vessels in 2019

Emissions from cargo vessels during maneuvering	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from vessels in 2019	3.09	1.14	2.76	34.88	0.06	1,364.44	23.71

Emissions from cargo vessels during hotelling	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from vessels in 2019	49.36	11.27	30.69	407.86	1.16	23,017.68	390.18

Total emissions from cargo vessels during maneuvering and hotelling	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from vessels in 2019	52.45	12.41	33.45	442.75	1.23	24,382.12	413.89

Table 21. Gas Emissions from Container Ships in 2019.

Emissions from container ships during maneuvering	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from vessels in 2019	10.05	3.58	8.70	110.25	0.227	4,457.15	77.31

Emissions during hotelling	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from container ships in 2019	7.72	1.69	4.59	60.94	0.19	3,616.84	61.31

Total emissions from container ships during maneuvering and hoteling	Ton gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Total emissions from container ships in 2019	17.77	5.27	13.30	171.19	0.42	8,073.99	138.62

In 2019, container ships and cargo vessels emitted 32,456.11 Ton CO2, followed by NOx (613.93 Ton) and by SO2 (552.52 Ton) (Table 22).

Table 22. Total Emissions from Container Ships and Cargo Vessels during Maneuvering and Hotelling.

Source of Emissions	Ton Gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Gas emissions from container ships during maneuvering and hotelling in 2019	17.77	5.27	13.30	171.19	0.42	8,073.99	138.62
Gas emissions from cargo vessels during maneuvering and hotelling in 2019	52.45	12.41	33.45	442.75	1.23	24,382.12	413.89
Total emissions	70.22	17.68	46.74	613.93	1.65	32,456.11	552.52

According to the growth YILPORTECU expects to achieve in the coming years, the emissions that could be generated each year were estimated, obtaining the following results: 91,244.04 Ton CO2, 1,694.59 Ton NOx, 1,551.64 Ton SO2, 196.93 Ton PM, 128.68 Ton CO, 48.35 Ton HC and 4.64 Ton N2O (Table 23).

Table 23. Projected Emissions from Container Ships and Cargo Vessels during the Maneuvering and Hotelling Phases.

Source of Emissions	Ton Gas						
	PM	HC	CO	NOx	N2O	CO2	SO2
Gas emissions from container ships during maneuvering and hotelling in 2019	44.98	12.29	31.56	409.54	1.07	20,626.49	352.75
Gas emissions from cargo vessels during maneuvering and hotelling in 2019	151.95	36.06	97.12	1,285.05	3.57	70,617.56	1,198.89
Total emissions	196.93	48.35	128.68	1,694.59	4.64	91,244.04	1,551.64

11. Alternatives to Reduce GHG Emissions from the Project during the Operation Phase

YILPORTECU is committed to sustainability in all its actions. For this reason, after measuring its carbon footprint, it will promote processes to reduce its greenhouse gas emissions.

The alternatives proposed to reduce GHG emissions include the following:

Table 24. Alternatives Proposed to Reduce GHG Emissions during the Operation.

Alternatives Proposed	
1-Action to reduce GHG emissions: Implementation of photovoltaic energy	
Description of the reduction action to be implemented	The implementation of solar panels allowing for the use of photovoltaic energy provides energy to the system during the day, which reduces consumption from the conventional network, the invoice amount, and GHG emissions. It also lowers operating costs, contributes to the achievement of the Sustainable Development Goals (SDG) proposed by the United Nations Organization (UNO), and reduces the carbon footprint.
2-Maintenance of cold systems and use of refrigerant gases of low environmental impact	
Description of the reduction action to be implemented	Refrigerant gases have a high global warming potential, which implies that any leakage in the equipment will emit significant amounts of this type of gases. When equipment is changed, it is necessary to prioritize the purchase of efficient equipment with refrigerant gases of low global warming potential. For example, the following gases have a low global warming potential:

Alternatives Proposed

Refrigerant	GWP
R-449a	1,400
R-449b	1,412
R-448a	1,387
HFC-32	675
R-513a	630
R-450a	601
R-447a	583
R-446a	461
R-451b	164
R-451a	149
HFO-1234ze(E)	6
R-441a	<5
HFO-1234yf	4
R-600a (isobutane)	3
R-290 (CO2)	3
R-744 (CO2)	1
R-717 (ammonia)	0

Source: Adapted from (Environmental Protection Agency [EPA], 2016)

The Terminal is provided with R22 refrigerant gas equipment, so it is possible for it to shift to more efficient and sustainable equipment. On the other hand, it is important to be attentive to their maintenance to prevent any possible leakage and thus reduce GHG emissions and their consequences on the ozone layer and climate change.

3-Diesel purification and filtration systems

Description of the reduction action to be implemented	This action seeks to improve diesel quality to reduce diesel consumption and thus reduce GHG emissions. The diesel sold in Ecuador is of poor quality, since it contains a large amount of impurities, resulting in an inefficient combustion process. In this regard, there are several diesel purification and filtration systems that turn diesel into an ultra-clean fuel that meets the highest international standards. This will translate into significant savings for the company by reducing fuel consumption. The available technologies include: - FMS: It is an Ultra-Efficient technology capable of retaining particles as small as 0.1 micron, and its certified Beta Factor 4 >4000 (ISO 16889:99 multi-pass test) proves that the particle filter is more efficient than others available in the market. - Fueltron: It enhances fuel burning efficiency by reducing its viscosity, resulting in better atomization. Fuel passing through the Fueltron receives an electrical charge that clusters the largest molecules and spreads out the smallest ones. This treatment enhances combustion and reduces fuel emissions, with a 2.5% to 14% saving. By purifying the diesel, a more efficient combustion is achieved, which contributes to reducing fuel consumption and

Alternatives Proposed	
	helps lower GHG emissions. It also brings economic benefits for the company because it lowers production costs by consuming less fuel.
4-Preventive maintenance of equipment	
Description of the reduction action to be implemented	The preventive maintenance of equipment and machinery enables their optimal operation and helps the combustion process to be complete, which avoids an incomplete combustion and thus the waste of fuel, resulting in lower GHG emissions. Some of its advantages are that it enhances the efficiency of equipment, prolongs their useful life and saves time on repairs that slow down processes.
5-Crane electrification	
Description of the reduction action to be implemented	The installation of E-RTG conductor rail system for the electrification of diesel rubber-tyred gantry cranes enables to significantly reduce fuel consumption and the use of lubricants, since diesel rail-mounted gantry cranes consume a significant amount of energy and, hence, are responsible for a considerable amount of CO2 emissions. Thus, cranes can quickly switch to cost-saving and electrical operation and reduce environmental impact.
6-System to connect vessels to the port grid	
Description of the reduction action to be implemented	The connection of vessels to the port grid allows docked vessels to switch off their diesel engines and connect to the power grid to reduce noise and environmental pollution. This is one of the problems that cities with busy ports face, since, for example, today a cruise ship emits in eight hours the same amount of nitrogen oxides as 10,000 diesel cars while docked at a port. The Onshore Power Supply (OPS), equipped with a medium to low voltage transformation station, enables to reduce noise, vibrations and pollutants from vessels while they are docked at ports.
7-Waste separation and plastic reduction	
Description of the reduction action to be implemented	Waste sorting at source makes it possible to start recycling processes and insert such waste into a circular economy chain, which brings not only environmental benefits but also economic and social benefits by activating productive chains from the recycling base. YILPORTECU produces large amounts of plastics in the dining hall that can be managed so that they do not end up in the landfill and can be recycled.

12. GHG Emissions in the Project Construction Stage

The project is an EPC contract, that is, a design, construction and equipping contract for building Dock 6 at Puerto Bolívar Port Terminal. This contract was awarded to Consorcio PBO and is currently in the design stage, for which reason the final details as to the quantity of materials and equipment that will be used are not still available and, hence, it is not possible to estimate GHG emissions at this stage. However, it was possible to identify on a preliminary basis the emission sources in the different stages of the project, including strategies to minimize the impacts in each stage. It was also possible to generate forms for the periodical collection of the information required to measure and calculate its carbon footprint.

The Dock 6 construction project is divided into several phases. The first design phase is estimated to take about 6 months out of a total construction time of 25 months. The construction works are expected to start between October and November 2021.

Below is an estimated table showing the planned stages, the possible emission sources, and the actions to be taken to reduce environmental impacts.

Table 25. Estimation of Emission Sources during the Construction Stage

Project Stage	Possible Emission Sources	Actions to reduce Environmental Impacts
Camp construction and operation	Fuel for tractors and container lifts, fuel for vehicles, waste, welding, wastewater and energy	
Subsea research and geotechnics	Fuel and lubricants for barges, drilling rigs and drilling trucks	
Platform improvement	Fuel for backhoe loader, motor graders and front-end loaders	
Pipe stacking for piles	Carriage of pipes by sea, welding, energy consumption	
Construction of the new station	Fuel for machinery	Equipment that does not contain sulfur hexafluoride are evaluated
Demolition of the pre-existing structure	Fuel for barges, crane hoists, crushers and diamond wire cutting equipment	Concrete will be recycled on site
Ground-level demolition	Consumption of fuel and lubricant by cranes and heavy machinery	
Implementation	Consumption of fuel by heavy machinery and welding	
Dock 6 construction	Consumption of fuel by machinery, land transportation of inputs, carriage of steel by sea, and consumption of fuel by barges	
Conditioning of strategic areas	Consumption of fuel and lubricants by machinery and energy consumption	
Construction of the refrigeration area	Consumption of fuel by machinery and consumption of refrigerant gases	Use or refrigerant gases of low global warming potential and high-efficiency equipment

12.1. Alternatives to reduce GHG Emissions during the Design and Construction Stage

Consorcio PBO has embedded in its organizational culture a strong environmental awareness by applying several guidelines to reduce its carbon footprint, such as the following ones:

- the ongoing in-house training in sustainability.
- the application of environmental criteria and best practices in the designs.
- the decreased use of fuel in the organization's and third-parties' motorized equipment.
- the use of energy-efficient resources.
- the optimization of water use at the project site.
- the recycling of materials and the reduction of waste at the project site.
- the conservation of natural environments.

13. Air Quality and the Environment

The EHS Guidelines establish that the permissible parameters and limits for environmental conditions measurements will be those set forth in the legislation in force and in IFC Environmental, Health and Safety Guidelines for Ports, Harbors and Terminals and that, should there be any discrepancy between them, the most stringent ones will be used.

According to the standard on ambient air quality and immission level, and as set forth in Ministerial Resolution 097-A, dated July 30, 2015, *Annex No. 4 Standard on Ambient Air Quality or Immission Level*, Point No. 4 Requirements, 4.1.1.1, the following are established as ambient air criteria pollutants: sedimentable particles, particulate matter with aerodynamic diameter less than 10 (ten) microns (PM10), particulate matter with aerodynamic diameter less than 2.5 (two and five-tenths) microns (PM 2.5), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and ozone (O_3).

13.1. Measurement Points

Air quality monitoring was conducted at several points of Dock 6 of the Puerto Bolívar Terminal between 2017 (baseline) and 2020. The dock is located on the shores of the Pacific Ocean at a height of 4 meters above sea level (masl).

Table 26. Characteristics of the Air Quality Measurement Station

Type of Area	Sector's Infrastructure	Potential Receptors
Port	Sea port	Pacific Ocean

Table 27. Points Designated for Air Quality Measurement

Measurement Date	Monitoring No.	Location	Coordinates	
*April 2017	1	Dock 5 SW corner		
May 2018	2	Dock 5 SW corner		
June 2018	3	Dock 5 SW corner		
Sept 2018	4	Dock 5 SW corner		
2018/12/21	5	Dock 5 SW corner	611146	9639828
2019/03/25	6	Dock 5 SW corner	610994	9639822
2019/06/17	7	Dock 5 SW corner	610981	9639822
2019/09/02	8	Dock 5 SW corner	610981	9639822
Dec 2019	9	Dock 5 SW corner		
2020/03/16	10	Dock 5 SW corner	610981	9639822
2020/06/08	11	Dock 5 SW corner	610951	9639819
2020/09/22	12	Dock 5 SW corner	610988	9639818
2020/12/20	13	Dock 5 SW corner	610985	9639824

*Baseline; prior to the start of Dock 6 construction activities.

Figure 4. Air Quality Monitoring Stations

13.2. Methodology

The methodology used to monitor ambient air quality was that indicated by the laboratory. Laboratories GRUENTEC and AFH SERVICES CIA. LTDA. participated in this monitoring.

13.3. Results

The results are evaluated according to Point 4.1.2 of the General Rules for Concentrations of Criteria Pollutants in Ambient Air. For the purposes of this analysis, the results will also be evaluated considering the limits set in Table 1.1.1: WHO Ambient Air Quality Guidelines of the World Bank Group's Environmental, Health and Safety General Guidelines (Table 29).

It is worth noting that the ambient air quality standards refer to the quality levels set and published from national legislative and regulatory processes, whereas the ambient air quality guidelines refer to the air quality levels mainly obtained from clinical, toxicological and epidemiological data (such as those published by WHO) [1].

Table 28. Evaluation of the Monitoring Results based on Annex No.4 to A.M. 097-A.

Parameters	Measurement Unit	Year 2017	Year 2018				Year 2019				Year 2020				Maximum Permissible Limit (µg/m^3)	Evaluation
		1	2	3	4	5	6	7	8	9	10	11	12	13		
Carbon monoxide (CO) b)	µg/m^3	2086.62	1412.8	2505.62	3.50	524	<114	556	365	432	4291	541	751	432	10000	All measurements COMPLY with the MPL.
Carbon monoxide (CO) c)	µg/m^3	-	-	-	-	1497	<114	1247	802	-	4745	4793	1860	-	30000	All measurements COMPLY with the MPL.
Nitrogen oxides (NO) c)	µg/m^3	-	-	-	-	<94	133	<94	<94	-	<94	<94	<94	-	N/A	All measurements COMPLY with the MPL.
Nitrogen dioxide (NO_2) c)	µg/m^3	11.29	12.30	11.93	5.47	<94	<94	<94	<94	19	<94	<94	<94	19	200	All measurements COMPLY with the MPL.
Sulfur dioxide (SO_2) a)	µg/m^3	8.9	11.75	10.76	10.78	<125	<125	<125	<125	26	<125	<125	<125	26	125	All measurements COMPLY with the MPL.
Sulfur dioxide (SO_2) d)	µg/m^3	-	-	-	-	<125	<125	<125	<125	-	<125	<125	<125	-	500	All measurements COMPLY with the MPL.
Ozone (O_3) b)	µg/m^3	23.56	25.69	24.94	4.18	<98	<98	<98	<98	37	<98	<98	<98	37	100	All measurements COMPLY with the MPL.
Particulate Matter PM 10	µg/m^3	-	-	-	-	29	22	29	17	54	45	<42	33	54	100	All measurements COMPLY with the MPL.
Particulate Matter PM 2.5	µg/m^3	-	-	-	-	19	8	15	10	20	9	<42	18	20	50	All measurements COMPLY with the MPL.

a) Average value of hourly measurements taken over a 24-hour period.
b) Average value of hourly measurements taken over an 8-hour period.
c) Maximum concentration of measurements taken every ten minutes over a 1-hour period.
d) Average value of measurements taken every minute over a 10-minute period.

Table 29. Evaluation of Monitoring Results based on Table 1.1.1 - WHO Ambient Air Quality Guidelines

Parameters	Measurement Unit	Year 2017	Year 2018				Year 2019				Year 2020				Maximum Permissible Limit ($\mu g/m^3$)	Evaluation
		1	2	3	4	5	6	7	8	9	10	11	12	13		
Carbon monoxide (CO) [b)]	$\mu g/m^3$	2086.62	1412.8	2505.62	3.50	524	<114	556	365	432	4291	541	751	432		
Carbon monoxide (CO) [c)]	$\mu g/m^3$	-	-	-	-	1497	<114	1247	802	-	4745	4793	1860	-		
Nitrogen oxides (NO) [c)]	$\mu g/m^3$	-	-	-	-	<94	133	<94	<94	-	<94	<94	<94	-		
Nitrogen dioxide (NO_2) [c)]	$\mu g/m^3$	11.29	12.30	11.93	5.47	<94	<94	<94	<94	19	<94	<94	<94	19	200	All measurements COMPLY with the MPL.
Sulfur dioxide (SO_2) [a)]	$\mu g/m^3$	8.9	11.75	10.76	10.78	<125	<125	<125	<125	26	<125	<125	<125	26	125	All measurements COMPLY with the MPL.
Sulfur dioxide (SO_2) [d)]	$\mu g/m^3$	-	-	-	-	<125	<125	<125	<125	-	<125	<125	<125	-		
Ozone (O_3) [b)]	$\mu g/m^3$	23.56	25.69	24.94	4.18	<98	<98	<98	<98	37	<98	<98	<98	37	160	All measurements COMPLY with the MPL.
Particulate matter PM 10	$\mu g/m^3$	-	-	-	-	29	22	29	17	54	45	<42	33	54	150	All measurements COMPLY with the MPL.
Particulate matter PM 2.5	$\mu g/m^3$	-	-	-	-	19	8	15	10	20	9	<42	18	20	50	All measurements COMPLY with the MPL.

a) Average value of hourly measurements taken over a 24-hour period.
b) Average value of hourly measurements taken over an 8-hour period.
c) Maximum concentration of measurements taken every ten minutes over a 1-hour period.
d) Average value of measurements taken every minute over a 10-minute period.

13.4. Conclusions

NO_2, SO_2, CO and O_3 levels **are below the maximum permissible limits** established in the Ambient Air Quality Standard, Annex 4, Book VI of the Unified Text on Secondary Environmental Legislation (TULSMA in Spanish), as well as in Table 1.1.1 of the World Bank Group's Environmental, Health and Safety General Guidelines.

Similarly, Particulate Matter (PM10 and PM2.5) levels **are below the maximum permissible limits** established in the Ambient Air Quality Standard, Annex 4, Book VI of the TULSMA, as well as in Table 1.1.1 of the World Bank Group's Environmental, Health and Safety General Guidelines.

Emissions do not produce pollutant concentrations equivalent to or higher than those permitted by the national environmental regulations and the World Bank's Ambient Air Quality Guidelines.

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ENVIRONMENTAL AND SOCIAL ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– CLIMATE CHANGE RISKS ASSESSMENT –

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December 2020

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ABBREVIATIONS/ACCRONYMS

APG	Autoridad Portuaria de Guayaquil
APPB	Puerto Bolívar Port Authority
EP	EquatorPrinciples
MTOP	Ministryof Transport and Public Works
NDC	Nationally Determined Contributions
TCFD	*Task Force on Climate-Related Financial Disclosures*
TPH	Authorized Port Terminals (within the Port National System)

EXECUTIVE SUMMARY

This document constitutes the Climate Change Risks Assessment (CCRA) of the Phase 1 Puerto Bolivar Project, located on Av. Bolivar Madero Vargas/n, Bolívar Port Terminal, in the Machala canton, El Oro province, sponsored by Yilport Terminal Operations – YILPORTECU S.A. and carried out in compliance with the *Equator Principles* (EP), September 2020 version, adapted to the specificities of the Project. According to what is stated in EP Principle 2: Environmental and Social Assessment, Climate Change Risks Assessment should be carried out on all Category A Projects, and will include taking into account the relevant physical risks defined by the TCFD (*Task Force on Climate-Related Financial Disclosures*). Similarly, it should be aligned with Climatic Physical Risk Categories and Climatic Transition Risk from the TCFD.

The Project establishes the design, financing, equipment, execution of additional construction, operation and maintenance of the Port Terminal, property of Puerto Bolivar Port Authority (APPB in Spanish), and it is located on Bolivar Madero Vargas Avenue, no number, Puerto Bolivar Port Terminal, in the Machala canton, El Oro province. The emplacement area consists of a parcel of land with an irregular inverted trapezoid shape with an area of 72 hectares; a 3.1-hectare rectangular parcel where Dock 6 will be built; and an area corresponding to the Access Channel and Maneuvering Area of Puerto Bolivar, as well as the sediment deposit basin in open sea, although they are not the property of APPB or YILPORTECU.

Climate related physical risks were identified for this study (as much for acute impacts or impacts propelled by events, as chronic events or events due to long term changes in climate patterns). Tools provided by the World Bank, such as "Climate & Disaster Risk Screening Tools", and studies and/or country profiles carried out by other agencies such as "*German Watch"*and its"*Global Climate Risk Index 2020", Think Hazard*!, and the *UNDP* have been used for this projection.

Other sources of information were consulted, such as the time series available in the World Bank databases ("*Climate Change Knowledge Portal")*; and a literature search for publications related to climate change risks for port operations at national and global levels.

Finally, to reduce greenhouse gas emissions and to achieve greater resilience to the expected effects of it, recommendations from the pre-design stage (life cycle analysis, carbon footprint measurement, inclusion of ecologic engineering criteria), design (use of sustainable energy, implementation of green areas, urban agriculture, fostering biodiversity), construction (circular life cycle, alternative fuel transport, inclusion of social fabric), and operation and maintenance (restoration actions and mangrove conservation, buffer zones and urban protection borders, monitoring and surveillance) were established.

CLIMATE CHANGE RISK ASSESSMENT

1. Introduction

Port facilities are nodular components throughout the supply, transport and logistics chain, and as such, they are greatly exposed and vulnerable to direct and indirect impacts from climate change. Apart from possible sea level changes, the risk of floods resulting from coastal process alterations and the coastal geomorphology caused by the development of port infrastructure, in the future, the operation may be exposed to more damaging storms or a higher than historical sea level or to other impacts that result in losing connectivity between inland and coastal components, but also to the deceleration and/or the standstill of the cargo management activities. That is, the impacts from climate change may affect the viability of port operations.

Critical activities related to ports and ships (particularly, movement and mooring of ships, loading and unloading and dredging activities) and the infrastructure of the port's supply chain (in our case, freight movement by road), can be seen as vulnerable to the risks related to climate variability, such as the increase of the intensity of rains, flash floods, heatwaves, storms and strong winds.

With this in mind, the projected future impacts related to climate change and the development of adaptation measures should be considered in the design phase of new port projects and/or significant port expansions in order to allow the vulnerabilities and risks from climate change to be identified, analyzed and evaluated as part of the consideration of alternatives, design and location of the project.

Also, weather conditions should be evaluated periodically during the operational phase of the port.

Operational and design aspects for consideration as part of planning of the adaptation to climate change include:

- Design port infrastructure to increase its climatic resilience in the context of sea level changes and more extreme meteorological phenomena;
- Choose and replace handling, storing and cargo transport equipment (for example, taking into consideration crane stability, shutting material storage bays, location of electrical equipment, protection against corrosion) and review freight transport routes (e.g., avoid areas prone to flooding, improve drainage at the systems and maintenance site) to increase their climate resilience in the context of climate changing events.
- Evaluate the contribution of port construction and operation to the incremental impacts from climate change on high biodiversity habitats and on rare species, threatened species or critically endangered species which are found in the port vicinity.

2. Methodology

This document constitutes the Climate Change Risks Assessment (CCRA) for the area of the Puerto Bolívar Port Project – Phase 1, carried out in accordance with the GUIDANCE NOTE ON CLIMAGE CHANGE RISK EVALUATION from the Equator Principles (EP), September 2020[1] version, adapted to the specificities of the Project. Pursuant to what is established in EP Principle 2: Environmental and Social Assessment[2], the Evaluation of Climate Change Risks should be carried out on all Category A Projects[3], and will take into consideration the relevant physical risks defined by the TCFD (*Task Force on Climate-Related Financial Disclosures*). In the same way, it should be aligned with the Climate Physical Risk Categories and Climate Transition Risk of the TCFD[4].

In addition, the TCFD requires that physical risks related to the climate be identified as one of the main types of risk that the Projects should disclose, including acute cases (propelled by events) and chronic cases (due to long-term changes in weather patterns). In this regard, projection tools will be provided by the World Bank, such as Climate & Disaster Risk Screening Tools (see Annex I. *Climate and Disaster Risk Screening Tools* - Puerto Bolivar) and studies and/or country profiles carried out by other agencies such as *German Watch* and its *Global Climate Risk Index 2020, Think Hazard*!, and the *UNDP*.

Also, the information available (series of time) in the database of the World Bank[5] is analyzed.

A literature search of publications related to climate change risks for national and global port operations is carried out.

This document includes the identification, analysis and evaluation of the vulnerabilities and climate change risks associated with project activities of the port development of the Puerto Bolivar project.

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[1] Available at https://equator-principles.com/wp-content/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf, consulted on November 18 2020.

[2] Available at https://equator-principles.com/wp-content/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf, consulted on November 18 2020.

[3] Available at https://equator-principles.com/wp-content/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf, consulted on November 18 2020.

[4] Available at https://equator-principles.com/wp-content/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf, consulted on November 18 2020.

[5] Available at https://climateknowledgeportal.worldbank.org/country/ecuador , consulted on November 18 2020.

3. Ecuador in the Climate Change Context

The Ecuadorian Constitution, through Environmental Organic Code, governs the obligations, actions and responsibilities of Ecuador on climate change topics. Additionally, Ecuador has regulations, ministerial resolutions and municipal and provincial regulatory bodies which also govern climate change actions.

In 2017, Ecuador participated in the CMNUCC and ratified its participation in the Paris Agreement through Executive Decree #98.

The strategy determined in Ecuador in order to mitigate climate change has three parts:

1) The plan for implementing the internationally agreed actions (includes preparation of Nationally Determined Contributions NDC)

2) The launch of the National Strategy of Climate Finance

3) The fourth communication of climate change that allows national and local projects to be carried out.

In 2012, the document "National Strategy of Climate Change of Ecuador/ NSCCE 2012-2025" (Ministry of the Environment, 2012) was published. This document guides and governs in a coordinated way the actions and measures that Ecuador needs to stimulate to prepare the nation to face extreme climatic events of greater intensity and frequency. Likewise, it dictates the actions that Ecuador will proactively implement in order to reduce the level of greenhouse gas emissions in strategic productive and social sectors.

3.1 Priority Sectors

The priority sectors were defined based on information related to climate change generated by the Government of Ecuador and other stakeholders at the national level and international cooperation; and the information produced by different scientific studies internationally consolidated by the IPCC (Intergovernmental Panel on Climate Change). The priority sectors are those which the strategy should focus on since they are the most vulnerable in the face of climate change, and its impact could cause the greatest economic, social and environmental losses in the country. These are:

Energy

- Fuel burning activities
- Fuel emissions leak
- Carbon dioxide transport and storage

Industrial Processes and use of products

- Mining industry
- Metallurgic industry
- Non-energy products from fuels and solvent use
- Electronic industry
- Use of substitutes for ozone-depleting

- Manufacture and use of other products
- Other

Agriculture, Forestry and other Land Use

- Livestock
- Soil
- Accumulated sources and emission sources not related to CO2 in the soil
- Other

Waste

- Solid waste management
- Biological treatment of solid waste
- Incineration and open field burningof waste
- Wastewater treatment and discharge
- Other

Other

- Indirect N_2O emissions due to atmospheric nitrogen deposition in NOx and NH3
- Other

3.1.1 Priority Sectors to Adapt to Climate Change in Ecuador

In Ecuador, two criteria have been considered to define priority sectors (or priority “work areas”). The first criterion responds to the priority sectors in the National Plan for Good Living and in the country’s Public Policies. The second criterion considers the defined sectors as most vulnerable in the Fourth Report from the IPCC (IPCC, 2007).

Priority sectors to adapt to climate change in Ecuador are as follows:

- Food sovereignty, agriculture, livestock, aquaculture and fishing
- Productive and strategic sectors
- Health
- Hydric heritage
- Natural heritage
- Priority attention groups
- Human settlements
- Risk management

3.1.2 Priority Sectors for Reduction of GHG Emissions in Ecuador

In order to define priority sectors for the reduction of GHG emissions in Ecuador, three criteria were considered: the ones considered priority are those sectors that generate the most emissions in the country (according to the GHG national inventory in the Second National

Communication) and which showing a tendency to increase; the relative importance of the sector in the country's economy; and the future commitments that the nation may have for the GHG emissions report in relation to the UNFCCC. These are:

- Agriculture
- Land use, Change in land use and Forestry
- Energy
- Solid and liquid waste management
- Industrial processes

3.2 Strategic Plan: Adaptation to Climate Change

The general objective is to create and strengthen the capacity of social, economic and environmental systems in order to address the impacts caused by climate change.

Specific objectives are:

- Implement measures that guarantee food sovereignty in the presence of the impacts from climate change.
- Start actions so that the levels of productive and strategic sector performance as well as the infrastructure of the country are not affected by the effects of climate change.
- Implement prevention measures to protect human health before the impacts of climate change.
- Manage the hydric heritage with a comprehensive and integrated approach per hydrographic unit to ensure water resource availability, sustainable use and quality for the different human and natural uses in the presence of climate change.
- Conserve and sustainably manage natural heritage and marine and terrestrial ecosystems in order to contribute to their capacity to respond in the presence of impacts from climate change.
- Take measures to guarantee access of priority groups and priority attention to resources that contribute to strengthen its response capacity in the face of climate change impacts.
- Include comprehensive management of risks in the face of extreme events attributed to climate change in public and private scope and activities.
- Implement measures to increase the response capability of human settlements in order to deal with the impacts from climate change.

3.3 Strategic Line: Climate Change Mitigation

Its general objective is to create favorable conditions for adopting measures that lower GHG emissions and increase carbon sinks in strategic sectors.

The specific objectives are as follows:

- Identify and incorporate appropriate practices to mitigate climate change in the agriculture and livestock sectors that may also strengthen and improve their productive efficiency and competitiveness.
- Implement measures that help the integration and connectivity of relevant ecosystems for capturing and storing and sustainably managing manipulated ecosystems with the capacity to store carbon.
- Strengthen the implementation of measures to foster energy efficiency and autonomy, as well as the gradual change of the energy mix, increasing the proportion of generating renewable energy sources, thus contributing to climate change mitigation.
- Foster the application of practices that allow lower GHG emissions in the processes related to supply services and the generation of goods, from its manufacturing, distribution, consumption through final disposal.
- Foster the transformation of the productive matrix, incorporating measures that help lower GHG emissions and carbon footprint, the sustainable use of renewable natural resources and the responsible use of non-renewable natural resources.

3.4 Priority Measures

According to the National Communication, priority measures for the sector include:

- Establishing a climate change biophysical and monitoring program
- Reconfiguring the sewage systems and safe water systems of the city of Guayaquil
- Mangrove conservation and reforestation
- Reorganizing shrimping activities
- Establishing disengagement lines, buffer zones and urban protection boundaries
- Reconfiguring road drainage systems;
- Adopting adaptation programs and policies that include research on productive capacity
- Ecological needs, climate change assessments, monitoring and surveillance procedures
- Financing and economic incentive policies for marine conservation

4. Puerto Bolivar Port Terminal Expansion Project – Phase 1

The Puerto Bolivar Port Terminal Expansion Project takes into consideration the modernization, operation and maintenance of Puerto Bolivar Port Terminal. Phase I sets up modernization of infrastructure and equipment for a more efficient operation, with the objective to be able to manage a 600,000-TEU volume of containerization at the end of the phase. As part of this modernization, it contemplates the dredging works to increase draft depth of the access channel to -14.5 m, a new dock called #6 that is 450 meters long with a draft depth of -16.5 m, the container yard expansion, new blocks for piling up containers through RTG cranes, refrigerated warehouse, a new terminal access system, other smaller buildings and the purchase of new cargo handling equipment.

It is estimated that the approximated cost of the project is 350 million USD.

4.1 Project Carbon Footprint

Measuring the carbon emissions of the Project means calculating the total quantity of greenhouse gas (GHG) that the Project emits as part of its operations. This involves identifying emission sources and collecting data from each of them in order to calculate the total. Yilportecu has a rigorous GHG inventory and has established its internal reduction goals, as well as a system to measure and report progresses (SimCO_2).

The Project GHG inventory determines a carbon footprint of 9,664.3 tons of CO2e (taking 2019 as a base year), 65.35% of which comes from the consumption of electric energy, 29.56% is due to the consumption of fuel and lubricants by mobile machinery and 2.13% comes from stationary combustion sources.

In 2020, GHG emissions totaled 10,239.99 tons of CO2e, 57.44% of which come from electric energy consumption, 28.3% from the combustion of mobile equipment and 10.73% from the combustion of stationary equipment.

When comparing GHG emissions with the base year (2019) and the carbon footprint of 2020, it can be seen that it has increased as much from the increase in fuel used by fixed and mobile machinery, the increase in the generation of various wasteand biological waste (associated with the COVID-19 pandemic), the consumption of lubricants and refrigerant gases, and some hidden emissions due to the participation of contractors with different types of work.

However, when analyzing it in terms of the global operation relating the GHG emission with deployed cargo units (kg CO2e/ TEU), it results that in 2020 the GHG emissions were reduced by 9% with respect to 2019.

Table1. Project Greenhouse Gas Inventory

Year	Emissions Total (TonCO2eq)	TEU	Tons of CO2eq/TEU	Kgs of CO2eq/TEU
2019	9,608.90	151,498	0.063	63.43
2020	10,229.90	177,316	0.058	57.69

Prepared by: Ecosambito, 2020

While there is an improvement in efficiency in relation to its carbon footprint between the years of the study, it is still very far from the indexes from similar ports in the country and in the region, where values registered 39.58 Kg CO_2e/ TEU or as in Arica Port (Chile) where it reports 32.50 Kg CO_2e/TEU. This difference occurs mainly because the energy matrix of Chile has a greater proportion of renewable energy and, since it is mainly a banana port, the electric energy consumption for refrigerating banana containers in Puerto Bolivar is constant.

5. Risk Identification and Assessment

For the development of this analysis, a tool for the detection of climate risks and disasters from the World Bank[6] was used, which allows physical risks associated with climate change to be identified and assessed in the short and long term, by analyzing historical information of the parameters associated with such risks.

This tool generates a characteriziation of the risks based on historical data and the understanding of the topic and the context of the country in order to help inform the dialog, consultation and planning processes at a project and program level.

5.1 Identification of Physical Climate Risks

The physical risks related to climate refer to the possible negative impacts in an organization caused by climate change. The physical risks that derive from climate change may be driven by (acute) events such as: major severity in extreme climate events (for example, cyclones, droughts, floods and fires) or related to (chronic) long-term changes, such as an increase in precipitation and temperature, and an increase in the variability of weather patterns (for example, an increase in sea level).

To identify these and their influence and tendencies in Ecuador, we have also used other sources of information such as *Reporte de País de Gestión de Cambio Climático,* de la UNDP (Climate Risk Management - Technical Assistance Support Project - CRM-TASP, 2013); 2013); *Riesgo Climático y Adaptación, Perfil de País - Ecuador* (World Bank Group, 2011) (see Annex II); the report *Think Hazard! - Ecuador* (GFDRR, 2020) (see Annex III) and the guideline *GLOBAL CLIMATE RISK INDEX 2020* (Eckstein, Künzel, Schäfer, & Winges, 2019).

[6] Available athttps://climatescreeningtools.worldbank.org/

5.1.1 Historical Data and Trends

Ecuador has two main seasons that differ in the distribution of rains (a rainy season and a dry season). The coast has a tropical climate and a rainy season that extends from the end of December to May. The temperature regime is marked by having a variation of 2 to 3 °C between the hottest and the coldest months.

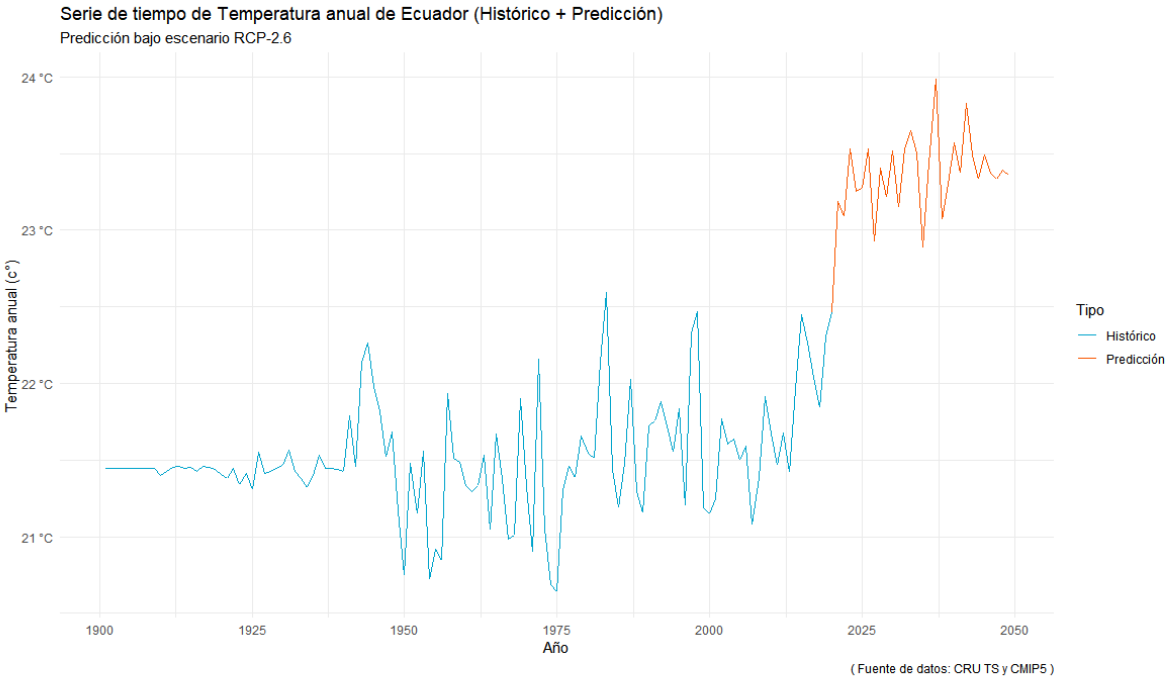
Melting of glaciers, increase in temperatures and increase in extreme precipitations are the trends that have been observed in various regions of Ecuador. The following list is based on information from the National Communication of the Republic on:

- Increase of temperatures, according the data from 14 stations located in different geographical regions of Ecuador (for example, change in the average temperature of 1.5°C at the Cotopaxi station during the 1901-2002 period). The rural coastal area does not show a clear positive trend in terms of temperature; however, the urban coastal area shows a growing trend in terms of average and extreme temperatures (between 0.5 and 1°C in the case of the average temperature).It has also been observed that there is a growing trend in the increase of temperature in hydrographic basins.
- There is no clear trend in the changes in precipitation at a national level, but a major inclination towards a reduction of precipitation has been observed, especially on the coast. Also, a positive trend of extreme rains on the western coast of Peru and Ecuador has been observed (1961-1990).
- The length of glacier 15 on Mount Antisana has decreased gradually from 1956 to 1998. More than 4,555 meters above sea level the glacier cover has decreased from 70% to 54% during that period of time. The El Niño – Southern Oscillation (ENSO) events of high intensity tend to decrease the value of the balance of the glacier mass on Mount Antisana; however, during the La Niña events, the value of the balance of the glaciers mass tends to stabilize and even become positive.
- There are increasing tendencies of cold nights in northern Peru and Ecuador, possibly related to the increase in the maximum length of dry period in this region (1961-1990).

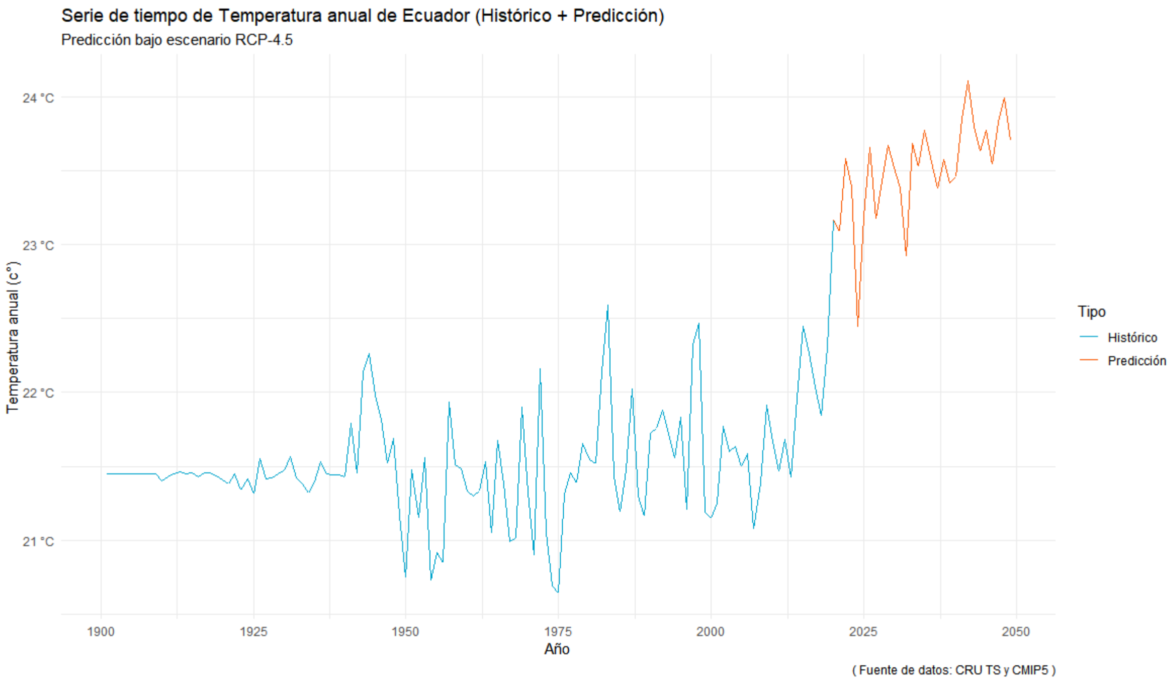
5.1.1.1 Temperature

For this analysis, the historic temperature (in degrees C) from the Climate Research Unit (CRU) and East Anglia University have been used, where the data is generated from thousands of meteorological stations around the world and collects temperature and precipitation observations in a recording period of 1901 – 2019.

The projected temperature data (in °K) used for the analysis come from the CMIP5 (Coupled Model Intercomparison Project Phase 5). The scenarios taken into consideration here are RCP-2.6, RCP-4.5, RCP-6.0 and RCP-8.5. The numbers attached to the RCP represent the global average radiative forcing in watts per square meter reached in each of the scenarios by 2100. The models that were taken into account were the models generated by NASA's Goddard Institute for Space Studies (GISS) for each scenario considered. The projections were carried out for the period 2020 – 2050.Figure1.Annual Temperature Time Series of Ecuador (Historical Plus Prediction), under RCP-2.6, RCP--4.5, RCP-6.0 and RCP-8.5 Scenarios

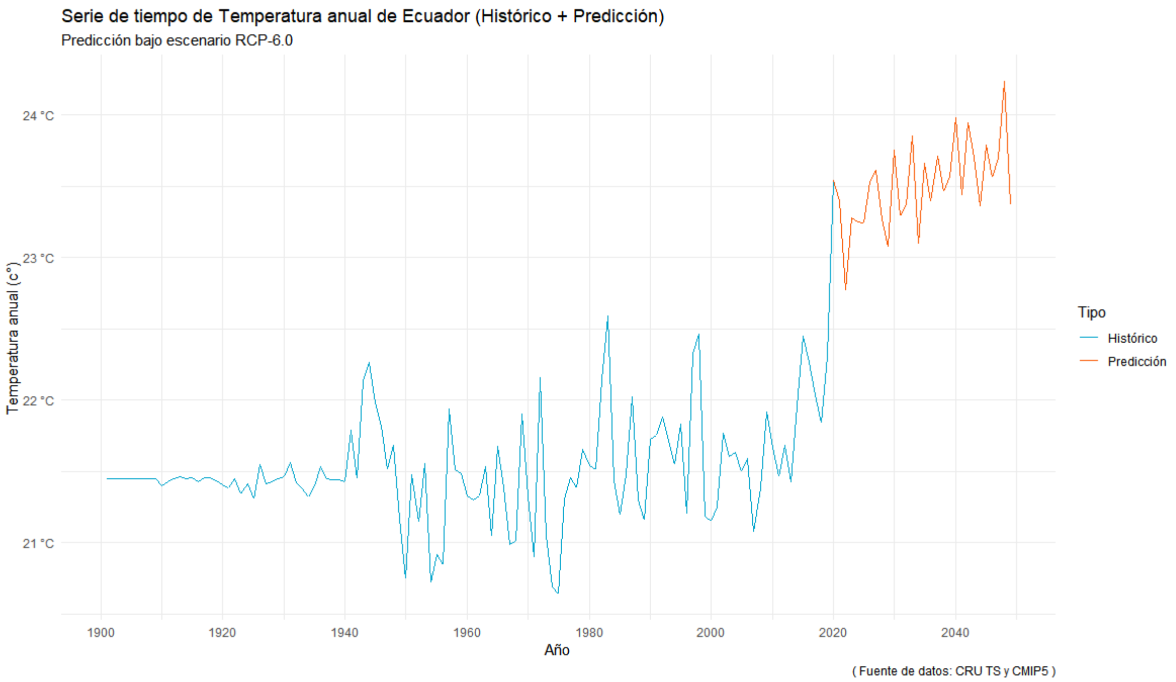


Annual Temperature Time Series of Ecuador (Historical plus Prediction)Prediction under scenario RCP -2.6Type, Historical, Prediction(Data Source: CRU TS and CAMP5)



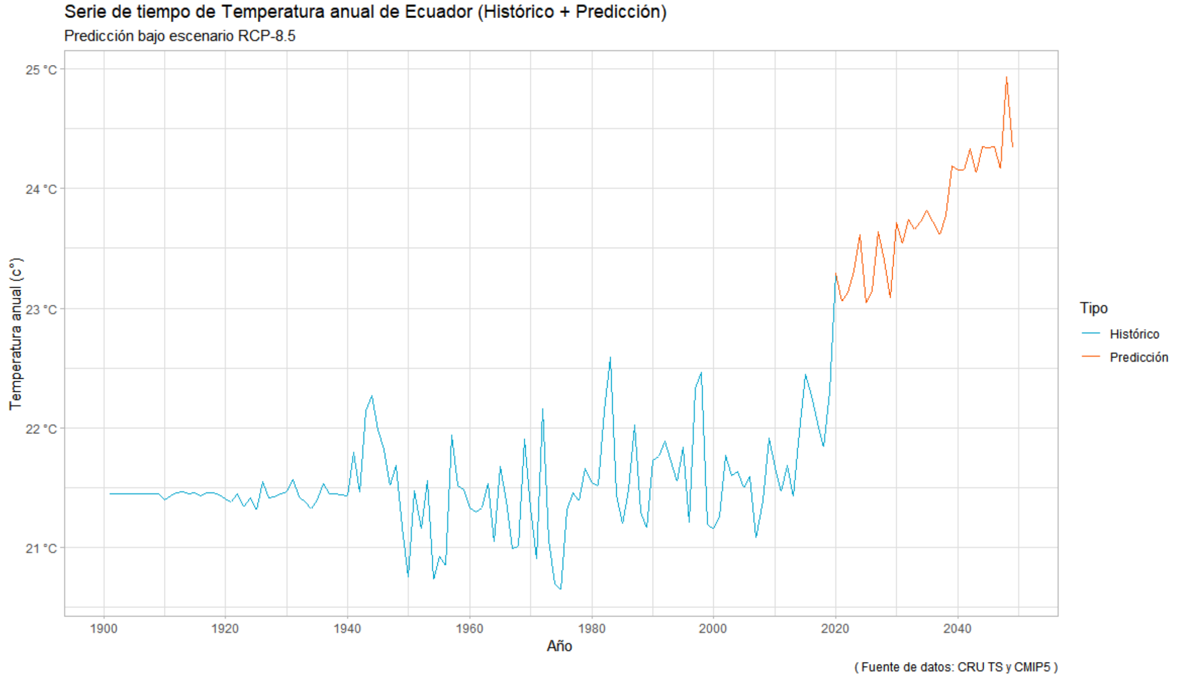
Annual Temperature Time Series of Ecuador (Historical plus Prediction)
Prediction under scenario RCP -4.5
Type, Historical, Prediction

(Data Source: CRU TS and CAMP5)



Annual Temperature Time Series of Ecuador (Historical plus Prediction)
Prediction under scenario RCP -6.0
Type, Historical, Prediction

(Data Source: CRU TS and CAMP5)

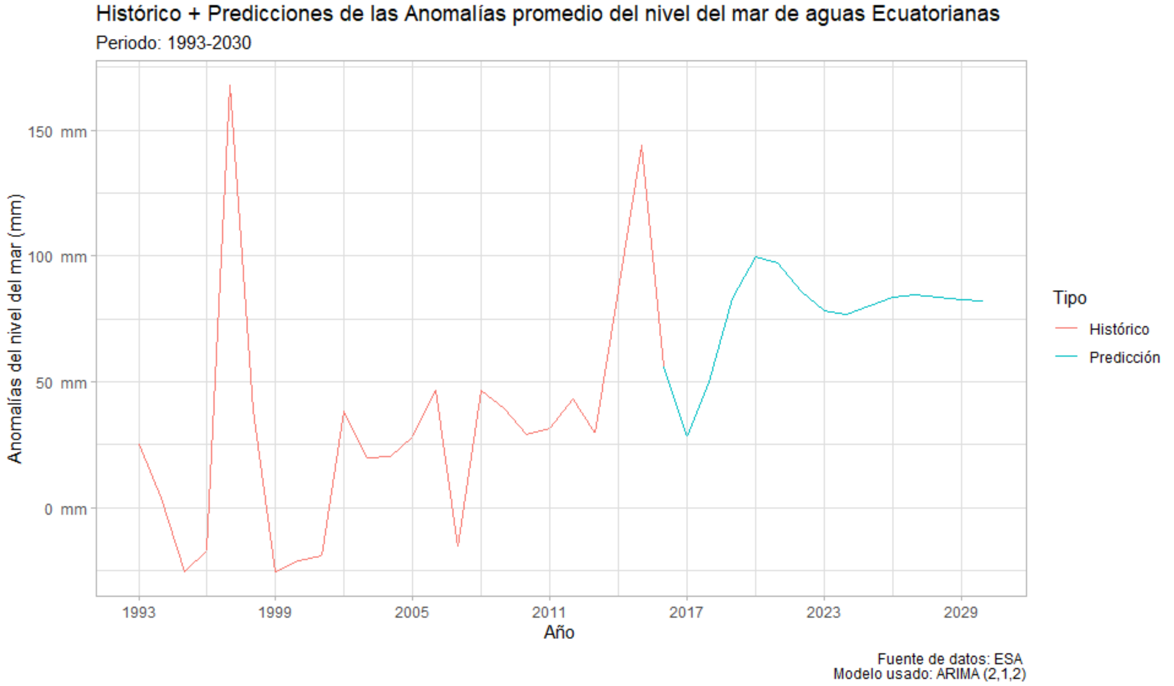


Prepared by: Ecosambito, 2020
Annual Temperature Time Series of Ecuador (Historical plus Prediction)
Prediction under scenario RCP -8.5
Type, Historical, Prediction
(Data Source: CRU TS and CAMP5

Sea level anomalies

The sea level anomaly data (in millimeters) was produced by the *National Centre for Space Studies (CNES)* as part of the *Climate Change Initiative* on sea level from the *European Space Agency (ESA).* It contains a combined time series of monthly seal level anomalies that has been produced starting in satellite altimetry measurements. For the Ecuadorian coastal waters there are records of the anomalies from 1993 to 2015. The anomalies are comparisons carried out among satellite observation and a calculated historical average starting from the years 1900 – 1990.

Figure2. Time Series of Sea Level Anomalies IN Ecuadorian Waters



Historical + Predictions of Average Anomalies in Ecuadorian Waters Sea Level
Period: 1993-2030
Type: Historical and Prediction
(Data Source: ESA) Model used: ARIMA (2,1,2)
Sea level Anomalies (mm)

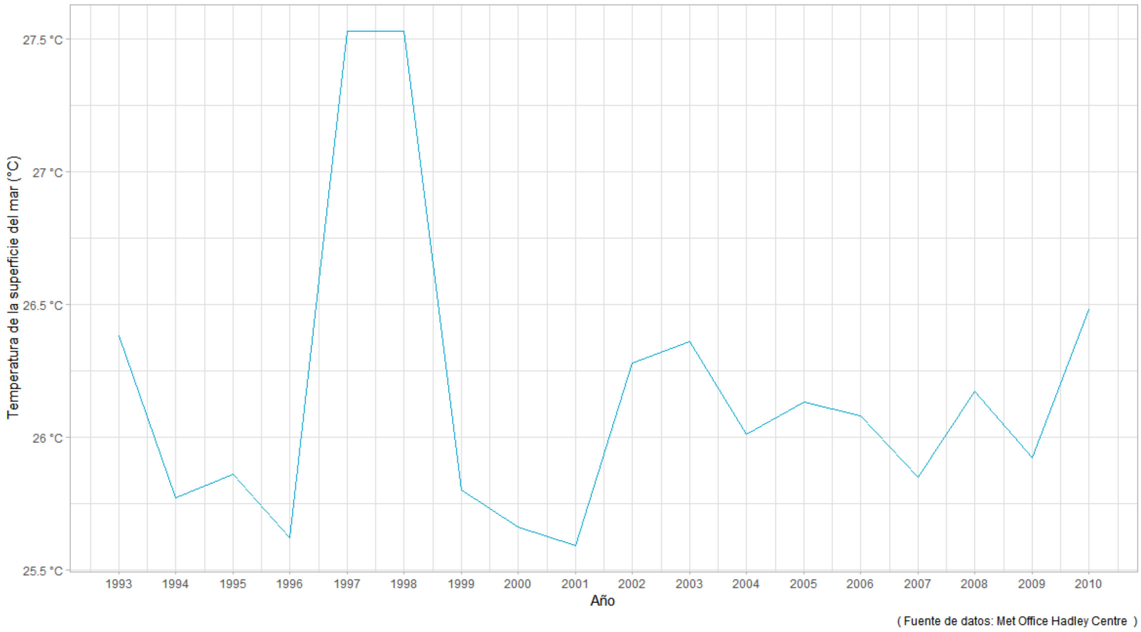
Prepared by: Ecosambito, 2020

In this case, a tendency can be observed in the increase of anomalies between 50 and 100 m.a.s.l. for the 2020 -2030 decade.

5.1.1.2 Sea temperature

The data on sea surface temperature (in °C) come from the *Met Office Hadley Centre* which gathers world sea surface temperatures. There are records for Ecuador from 1993 until 2010.

Figure3. Time Series of Sea Surface Temperature in Ecuadorian Waters



Temperature at Sea Level Surface
(Data Source: Met Office Hadley Centre)

Prepared by: Ecosambito, 2020

5.1.1.3 Impacts on Agriculture

The set of data for this section comes from *Global Agro-Ecological Zones 3.0 (GAEZ 3.0)* published by the *International Institute for Applied Systems Analysis (IIASA)* and *Food and Agriculture Organization (FAO)*. The data are represented as changes in the percentage of average potential performance (tons/hectare) from 1961-1990 in comparison with the projected potential performance (tons/hectare) for 2050. The data are separated according to performance based on high input agriculture or irrigation from rain or surface irrigation. For this analysis, the potential performance does not refer to the real performance or historical performance of the sector, but to the potential performance that there may be per hectare if applied to high input agriculture along with stream irrigation. The potential performance is calculated from various geographic variables pertaining to the study site. The model used for the projections to 2050 is from the *Canadian Centre for Climate Modelling and Analysis (CCCma) Coupled Global Climate Model (CGCM2) or its acronyms CCCMA CGCM2 A2*.

The projection of impacts is analyzed in this section, which is defined as the percentage of change in 2050 maize crop yields with regard to the historical average for the surface irrigation scenario and high input agriculture in planning zone 7 (El Oro, Azuay and Loja provinces) and Zone 4, Guayas. This, as a general impact indicator, that allows us to establish potential impacts on banana production, the main exportable product through Puerto Bolivar, and that, in the assessed areas, represent on average: Zone 7, <34% of the total national production and Zone 4, Guayas, with 22% of the national total (INEC, 2013).

Table2. 2009-2012 Annual Production (Thousands of Metric Tons)

Year/ Province	Los Ríos	El Oro	Guayas	Rest of the Country	National
2009	3,744.6	1,861.7	1,554.7	476.3	7,637.3
2010	3,887.1	1,892.6	1,719.4	432.0	7,931.1
2011	2,670.1	2,443.7	1,692.7	621.3	7,427.8
2012	2,753.7	2,269.9	1,585.1	403.5	7,012.2
Average (2009-2012)	3,263.9	2,117.0	1,638.0	483.3	7,502.1
Total National %	44%	28%	22%	6%	100%

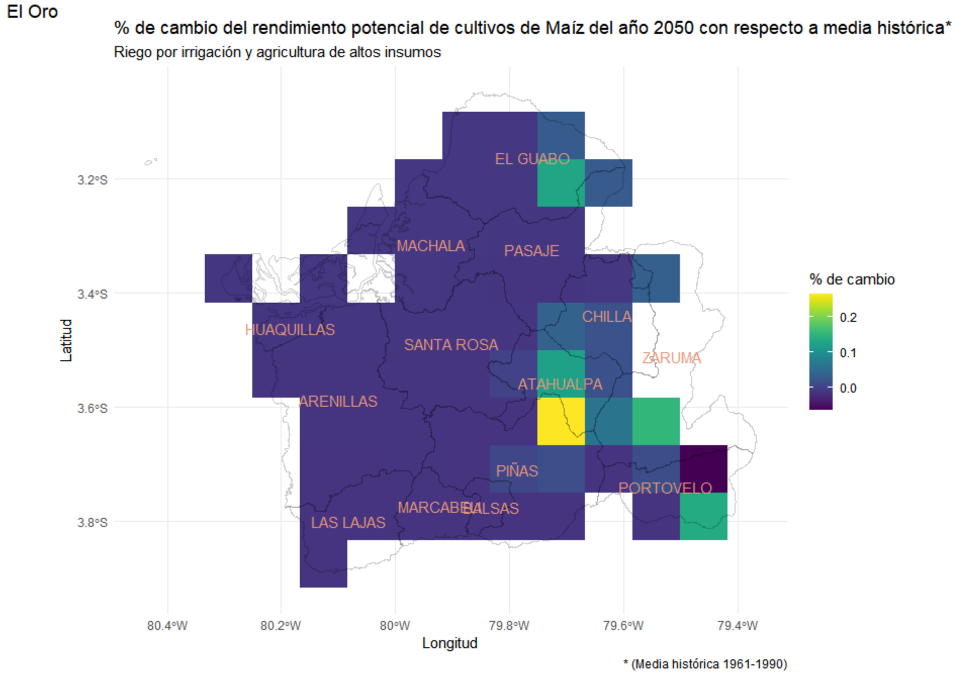
Prepared by: Ecosambito, 2020

The terms used are defined in the following:

Single Irrigation: It is a type of agriculture where controlled quantities of water are used on crops at the necessary intervals.

High input agriculture: Uses heavy equipment and large amounts of financial capital, fossil fuel, water, commercial fertilizers and pesticides to produce single crops, or monocrops.

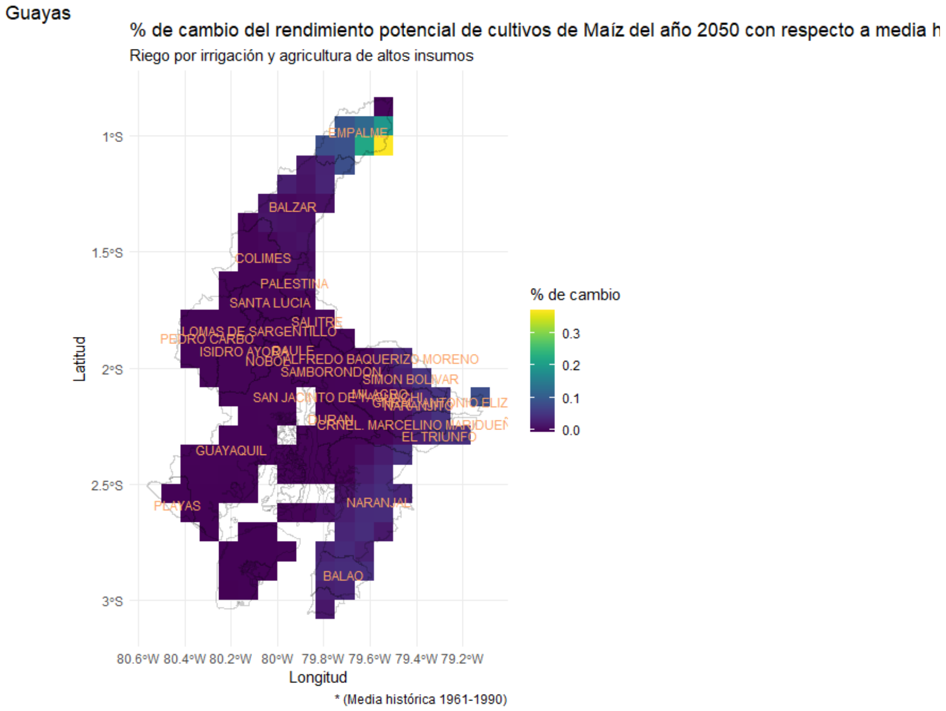
Figure4. Percentage of the Change in Corn Crop Output for 2050 with Regard to the Historical Average for High Input Agriculture in El Oro Province.



Percentage of Potential Corn Crop Output for 2050 Regarding the Historic Average.
Single Irrigation and High Input Agriculture Change % Latitude

Prepared by: Ecosambito, 2020

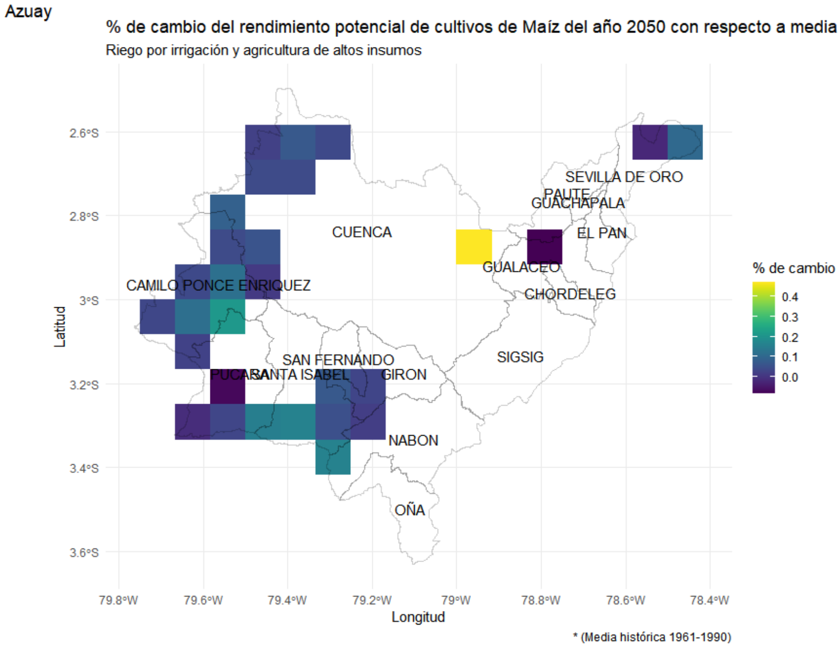
Figure5. Percentage of the Change in Corn Crop Output for 2050 with Regard to the Historical Average for High Input Agriculture in Guayas Province



Percentage of Potential Corn Crop Output for 2050 in Regard to Historic Media.
Single Irrigation and High Input Agriculture Change % Longitude

Prepared by: Ecosambito, 2020

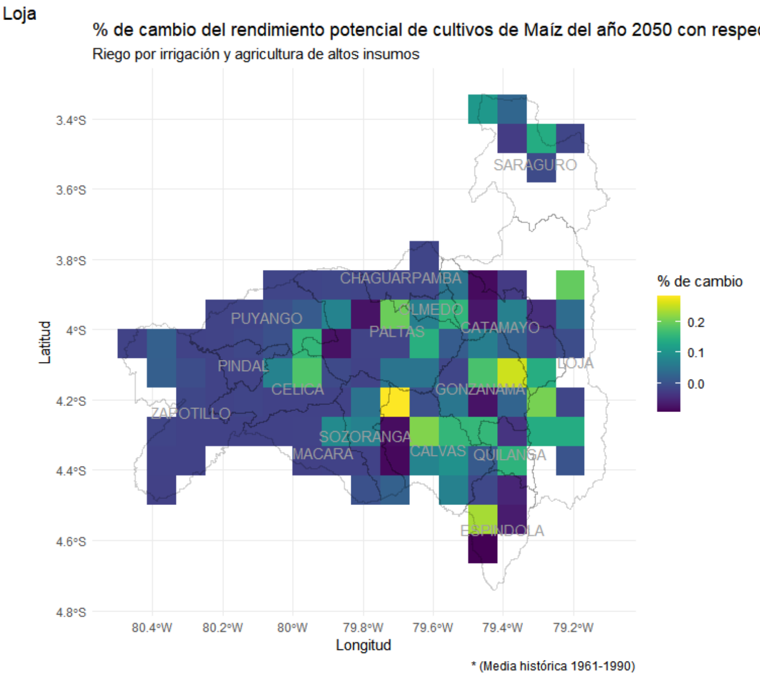
Figure6. Percentage of the Change in Corn Crop Output for 2050 with Regard to the Historical Average for High Input Agriculture in Azuay Province.



Percentage of Potential Corn Crop Output for 2050 Regarding the Historic Media.
Single Irrigation and High Input Agriculture Latitude Change % Latitude

Prepared by: Ecosambito, 2020

Figure7. Percentage of the Change in Corn Crop Output for 2050 with Regard to the Historical Average for High Input Agriculture in Loja Province.



Percentage of PotentialCorn Crop Output for 2050 Regarding the Historic Media.
Single Irrigation and High Input Agriculture
Latitude Change % Longitude
* (Historical Media 1951-1990)

Prepared by: Ecosambito, 2020

From this analysis, null impacts (0.0%) to positive (+0.1%) can be seen in a general way, which allows us to conclude that no impacts are expected on regional agriculture due to climate change.

5.1.1.3.1 Impacts on National Banana Production of

The sectoral study of climate change and sustainability of the banana in Ecuador (Elbehri, Calberto, Staver, Hospido, & Skully, 2015) concludes that it is unlikely that climate change may represent a significant problem for banana production capacity in Ecuador from now until halfway through the century, even though climate conditions will be continuously less favorable for banana production. However, in the second half of the century, the increase in average temperatures will start to harm banana plants, and this means important changes in production will have to be made. Greater precipitation and the decrease of glacier buffer zones may result in an increase in the risk of floods and create problems for current water management systems. In this scenario, two adaptations are proposed:

i. Move banana production to higher altitudes, around 500 meters, to fully compensate the average increase of 3.3 °C as foreseen by the IPCC.

ii. Develop and adopt varieties adapted to high temperatures.

On the other hand, the change of precaution relative to the frequency and intensity of tropical storms has as a net impact in the long- term risk that tropical cyclones may cause damage in a lot of important banana production areas, specifically in Central America, the Caribbean, Philippines and part of southeastern continental Asia. The increase in risk may reduce or modify banana production investment in these areas. It may also likely cause an increase in the attraction of banana production in areas where the risk that tropical cyclones occur may be little of none, such as on the Pacific coast of Ecuador, Peru and Colombia.

At a local level, it is considered that the Ecuadorian coast has an ideal climate for banana production and the magnitude of the rise in temperature expected for 2030 and 2050 will not seriously affect its suitability. This scenario turns out to be favorable for banana production on the Ecuadorian coast. However, from a historic analysis of drops in banana production, four out of six cases of a decline in banana exports of Ecuador analyzed (between 1961 and 2011) are related to climate events that affected banana production and exports, mainly due to floods or low temperatures linked to El Niño and Niña events. After the climate events, commercial restrictions, specially from the European Union, and international price fluctuations are the direct cause of the variations in banana exports.

5.1.2 Climate Risk Index

Considering that the signs of an increase in climate change can no longer be ignored globally when addressing climate change related risks, Ecuador is not among the countries that are predicted to have had and/or will have the greatest impacts. According to *Global Climate Risk Index 2020,* a Climate Risk Indicator (CRI) was calculated for Ecuador for the period between 1999 and 2018 giving a score of 92.83 (putting Ecuador in the 100th place), while in 2018, the CRI for Ecuador is 97.00 (in position 112). This analysis is carried out taking into consideration the total amount of losses caused by meteorological phenomena: storms, floods and extreme temperatures, the number of deaths, total insured damages and economic damages (these two indicated in millions of inflation-adjusted USD) and movements of masses (due to heat waves, cold waves, and others) (Eckstein, Künzel, Schäfer, & Winges, 2019).

Table3. Climatic Risk Index (CRI) - Ecuador

Period Evaluated	CRI Ranking	CRI score	Ranking per Parameter			
			Fatalities	**Fatalities per 100,000 Inhabitants**	**Losses in Millions of Dollars**	**Losses per unit of GDP (%)**
1999-2018	100	92.83	69	84	86	117
2018	112	97	62	73	122	126

Source: Global Climate Risk Index 2020
Prepared by: Ecosambito, 2020

5.1.3 Acute Physical Risks

The acute physical risks identified for the projects are shown below:

5.1.3.1 River Flooding

The danger of river flooding is classified as high (according to the available information on modeled floods). This means that it is expected that potentially damaging and fatal river floods happen at least once in the next 10 years. This is connected to increase of daily precipitation and the number of intense precipitation days. The level of danger may remain similar in the long term when only climate change is taken into account.

5.1.3.2 Urban Flooding

There is a danger of urban flooding classified as high (according to the information available on modeled floods). This means that it is expected that potentially damaging and fatal river floods happen at least once in the next 10 years. This is connected to increase in daily precipitation and the number of intense precipitation days. In this scenario, a standstill of the land transport access roads and towards the port terminal due to floods may put the continuance of operations at risk.

5.1.3.3 Coastal Flood

There is a danger of coastal flood classified as high (according to information currently available). This means that it is expected that waves may occur that will be potentially damaging at least once in the next 10 years,.

5.1.3.4 Heatwaves

A danger of extreme heatwaves classified as high exists according to the information available. This means that it is expected that a prolonged exposure to extreme heat occurs at least once, causing thermal stress, in the next 5 years.

5.1.4 Chronic Physical Risks

5.1.4.1 Change in Precipitation Patterns Resulting in Drought or Hydric Stress

From a high-resolution model (20 km) a decrease of annual average precipitation for the end of the twenty-first century is projected with it also probable that the levels of precipitation from December to February (DJF) and March to May (MAM) increase by 3% to 5%, while it is probable that the temperatures in December to February (DJF) increase by 1°C in the 2030 -2049 period. For the June to August (JJA) period, it is probable that the levels of precipitation decrease by 3% and that temperatures suffer an increase of 1°C in the same period.

Increases for the frequency and intensity of extreme rain events on the north coast of Peru and Ecuador in the 2071 - 2100 period are projected (PRECIS, IPCC SRES A2 y B2).

5.1.4.2 Growing Average Temperature

According to the majority of scenarios from IPCC’s *Global Climate Models*, annual average precipitation and temperature is expected to increase by 3% and between 2 and 3°C, respectively, in the 2030 – 2049 period. This is in comparison with the annual averages from the period 1980 - 1999. This represents increases in temperature substantially higher than the global average.

5.1.4.3 Sea Level Rise

The coastal area of Ecuador, and in particular the El Oro province, is highly vulnerable to natural hazards and to climate change due to the high population and infrastructure density, and its exposure to El Niño effects, sea level rise and river floods in general. This corresponds to what is established in the CLIMATE RISK MANAGEMENT IN ECUADOR (ArjunapermalSubbiah, 2013) document, where a sea level rise of around 10 to 20 cm is projected in the following 20 years along the continental area, with similar impacts as in the years 1982-83 and 1997-98 resulting from El Niño event.

5.2 Transition Climate Risks Identification

The risks related to climate can also be linked to the transition to a global economy with low carbon emissions. The most common are related to policies and legal actions, technological changes, market response and reputation concerns.

5.2.1 Risks Due to Policies Adopted by the Ecuadorian Republic

In its article 413, the Constitution of the Republic of Ecuador states that the State will foster energy efficiency, the development and use of environmentally clean and healthy practices and technologies, as well as renewable, diversified, low-cost energies that do not pose a risk to food sovereignty, ecological balance of ecosystems nor the right to water. In its article 414, it establishes that the State will adopt adequate transverse measures for climate change mitigation through the **limitation of emissions** of greenhouse gas, deforestation and atmospheric contamination. Measures will be taken to preserve forests and vegetation, and the population that is at risk will be protected. In article 415, the Constitution states that the Central State and decentralized autonomous governments shall adopt comprehensive and participatory territorial urban planning and land use policies that allow regulation of urban growth, urban fauna management and encourage establishing green areas.

Thus, there is a legal constitutional basis that makes the Ecuadorian State regulate and take actions on key issues related to sustainability and climate change, as well as mitigation and adaptation in the urban context.

The Environment Organic Code, CHAPTER II INSTRUMENTS FOR MANAGING CLIMATE CHANGE, in articles 250 – On the instruments and 251- Coordination and articulation mechanisms, states that managing climate change will be carried out according to policy and the National Climate Change Strategy, and its instruments that will be enacted and updated by the National Environmental Authority. This will be the entity that will coordinate with the prioritized intersectoral public entities for that purpose, and all the different levels of government, the formulation and implementation of policies and objectives addressing the effect of climate change. Also, it will safeguard its trasnverse incorporation in the programs and projects of such sectors through mechanisms created for such purpose.

The following Principles are established (Article 671) in the FOURTH BOOK. CLIMATE CHANGE, TITLE I. MANAGING CLIMATE CHANGE of the Regulation on the Environment Organic Code:

a) Self-management: Natural people or legal persons, either public or private, will develop their own actions to contribute to managing climate change aligned in compliance with national policies and commitments ratified by the State.

b) Co-responsibility: All natural or legal persons, public or private, have the responsibility of participating in climate change management according to what is established by the Constitution, Environment Organic Code and current regulation.

c) Benefit- effectiveness: Implementation of actions for managing climate change that bring greater social, environmental and climate change co-benefits will be a priority.

The selection of priority sectors for both adapting and mitigating climate change were already reviewed in section 3.1 of this document, and the general measures to adopt are described in sections 3.2, 3.3 and 3.4. While none of these lines of action directly implicate port activity, it does implicate it with respect to the repair and conservation of coastal-marine ecosystems, territorial planning and the farming sector.

There are also a series of international commitments and treaties aimed at conserving natural heritage and biological wealth of the ecosystems, as set up in the “National Biodiversity Strategy 2015-2030” (MAE, 2016) document, where commitments are present which have been acquired since 1975 (CONVENTION ON THE INTERNATIONAL TRADE OF ENDANGERED SPECIES, CITES) up-to-date.

However, since there is no secondary legislation yet and/or specific regulations for defining the objectives in the medium and long term, nor on the implementation and control mechanisms, the potential impact of these actions on the operation and performance of the Port Terminal is still uncertain.

5.2.2 Risk Due to Market and Technology

The changes in client demand (mainly from markets in developed or emerging countries) as an increase of product demand, and the associated logistics chain, with a lower carbon footprint, could affect operations or income of the Project, given that port activity decarbonization initiatives already exist in Ecuador. By mid-December, a milestone in the banana market was reached with the first container of Ecuadorian banana for exportation with a neutral carbon certificate of land and port logistics, achieved by Contecon[7], first terminal in America to comply with the ISO 14064 standard, and thus attracting Ecuadorian banana exporters, since it is recognized as a competitive advantage to enter the global market. The companies that took part in this milestone were SIIM / *Groupe Omer-Decugis* (banana distributor for the European market); *MSC Cargo*, leading company in transport of containerized cargo; and *Tropical Fruit Export*, important banana export group from Ecuador.

In this regard, the risk of not adopting measures for carbon neutrality or of adapting to climate change can result in a situation where the port will lose competitiveness, being less attractive than other existing logistics chain options. This is especially relevant when designing operations and defining the technology to adopt for a 5- to 20-year time horizon, since all new machinery acquisition and construction infrastructure should contribute to Port Terminal operations carbon footprint reduction and global sustainability.

5.2.3 Legal Risks

No current legal type of risk has been identified for the Project, considering that the physical climatic and transition risks of the Project have been evaluated, and a plan for its mitigation is proposed.

5.2.4 Reputation Impact Risk

From the beginning, the public-private partnership contract between APPB and YILPORTECU has had, on one side, a strong resistance from stakeholders and exporters from the banana sector and carriers that make comparisons between the previous management of APPB and the current one, due to the service and rate changes as well as control standards and terminal access procedures. Additionally, at the start of YILPORTECU operation, there was a negative perception, mainly from some social actors, part of the shrimping community and artisan fishermen. This negative perception was not based on any technical basis with regard to the dredging operations. After YILPORTECU carried out various monitoring and sediment dispersion studies, contributing to verifiable technical information, the negative perception of these actors diminished considerably.

Avoiding possible impacts on the reputation of the Project implies the need for adopting measures that minimize the risks perceived by different stakeholders through public consultation and socialization, pursuant to provisions in the Environmental Management Plan.

6. Physical Climate Opportunities

The TCFD defines “climate related opportunity” as “possible positive impacts related to climate change within an organization” and highlights that the opportunities “vary according to the region, the market and the industry in which an organization operates". Three major types of opportunities related to physical climate are identified.

[7] Contecon Guayaquil S.A. is the operator of Containers and Multipurpose Terminals of Guayaquil Seaport “Libertador Simón Bolívar”.

For the case of the Puerto Bolivar Port Terminal, taking into consideration that its main competitor for port services is located in the city of Guayaquil (MTOP, 2018), which in 2018 covered 84.2% of the total cargo exported (adding APG and TPH[8]), while APPB reached 13.9%; and that, precisely the city of Guayaquil has been identified as one of the 20 main coastal cities with major loss in 2050, assuming the SLR-1 scenario, sinking and optimistic increase of sea level (Stephane Hallegatte, 2013), an opportunity for receiving additional exportation cargo (mainly banana) and a new import destination is set up if current conditions foreseen for Guayaquil persist.

In this scenario (SLR-1), the port services offered by Puerto Bolivar, considering that it is not affected – or at least not in the same magnitude as Guayaquil and its ports – has the opportunity to contribute with a vertical type solution (that adapts to specific commercial sectors) in the medium and long term. The adaptation that the banana sector adopts to ensure sustainability under the same scenario will play a major role.

The design and/or planning of this solution should lie in the conversion of the logistic chain to a sustainable source wherein the Port Terminal serves as an anchor for transforming the regional logistic sector.

7. Adopted Measures

In this section, the measure and/or actions adopted by YILPORTECU are described that aim at preventing the risks already identified.

7.1 Processes and Systems

The processes and systems are implemented to ensure that this happens.

• How realistic are these plans/process/systems?

• How effective are these plans/ processes/systems expected to be?

- In the design of new berthing facilities and cargo storage yards, drainage and sewage systems, it takes into account a flood stage 0.5 m above existing facilities.
- Acquisition of port power sourcing equipment that enables energy transition to a clean source for port operation.

8. Recommendations

it is recommended that the following measures be adopted to reduce greenhouse gas emissions that generate climate change, achieving more resilience to it expected effects, and in general, to be capable of adapting to the challenges in the short and medium term.

8.1 Pre-design Stage

- Measure and estimate carbon footprint on projects and include this valuation in the analysis of alternatives, considering at least *Scope 1* + *Scope* 2.

[8] Autoridad Portuaria de Guayaquil and Authorized Port Terminals

- Analysis and selection of materials and supplies with a lower carbon footprint, through life cycle assessment (LCA) considering a "*cradle to cradle*" life cycle.
- Include an ecologic engineering team and/or criteria, whose role consists of preserving and developing biodiversity through adapted measures (assessments, publications, management) on the ecosystems potentially affected by its interventions.

8.2 Design Stage

- Design infrastructure with renewable energy sources, and collection and recycling of rain water and grey water.
- Design infrastructure that allows its environmental impact to be reduced throughout its life cycle by using photovoltaic and/or thermal technology integrated in buildings and dynamic glazing solutions, ventilated concrete floors (radiant floor) to generate a positive energy balance and work as energy hubs, that contribute with the power autonomy of insulated sectors, blue infrastructure, or other public use buildings.
- Include the implementation of ecological areas and maintenance of ecologic continuance within the conceptual design of the projects.
- Include alternatives for integrating biodiversity and urban agriculture in the projects with a certain impact on urban planning of the place (measurement of biodiversity potential of an urban project).The ecologic transparency works should be designed with the help of local naturalists, who will also be associated with supervision of biodiversity preservation measures.
- Include, whenever possible, elimination of waterproof surfaces, or the establishment of flood defenses at the project location.
- Adopt a strategy of gradual replacement of machinery for moving fossil fuel loads (cranes, container ships, loading platforms, cargo freight elevators and others) with machinery and equipment having power source technology.
- Implement facilities for electric energy provision by inclusing loading points for machinery and vehicles inside and/or outside the terminal.

8.3 Construction and Assembly Stage

- Foster circular economy through recovering and recycling waste from the operations (oils, filters, packaging, other), as well as recycling debris from demolition resulting from the project.
- Protect natural surroundings.
- Protect and include social fabric into Project considerations.
- Evaluate the use of hydrocarbon-based alternatives for transporting and evacuating construction materials and/or debris.

8.4 Operation and MaintenanceStage

- Support mangrove cleaning campaigns;

- Establish lines of withdrawal, buffer zones and urban protection borders;
- Reconfigure rain water drainage systems in the road network within port facilities;
- Adopt adjustment programs and policies that include studies on productive capacity.
- Ecological needs, assessment of climate change, monitoring and surveillance mechanisms.

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10. Annexes

ANNEX 1. Climate and Disaster Risk Screening Tools - Pto Bolivar

ANNEX 2. Climate Risk and Adaptation Country Profile - Ecuador

ANNEX 3. Think Hazard! Country Profile – Ecuador

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

PUERTO BOLÍVAR PROJECT

PHASE 1

– HUMAN RIGHTS RISK ASSESSMENT –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

This document establishes a risk assessment on human rights related to the activities of Yilport Terminal Operations. A human rights risk identification methodology has been used based on the United Nations Guiding Principles on Business and Human Rights, and in accordance with EP2: Environmental and Social Assessment.

After carrying out an initial identification of the threats to the human rights of the interested parties, identifying the related human rights, an assessment of the risks to human rights is carried out, considering the impact produced by the threat and its probability of occurrence. A qualitative assessment of the identified vulnerability is also presented. Then the risks are ranked from highest to lowest.

The results of the assessment show that there are present and potential risks, of medium and low magnitude, that can be managed with improvements in the activities, procedures, and protocols that Yilportecu has been developing. For this, corrective measures established as an Action Plan are included.

Finally, it is recommended to carry out a review of this human rights risk assessment every two years, or when a project generating substantial changes that require a review of this assessment is carried out.

HUMAN RIGHTS ASSESSMENT

Human rights are basic standards that have been established with the purpose of ensuring dignity and equality among people. Every human being is the holder of these rights by the simple fact of being, without any distinction of nationality, place of residence, sex, ethnicity, religion, language, or any other condition.

States are primarily responsible for guaranteeing human rights to all people. However, more and more private actors are taking initiatives to guarantee that human rights are fulfilled and promoted, within their organizations. This is because respect for Human Rights is not a passive responsibility, on the contrary, it requires establishing policies and processes that help identify, prevent, mitigate, and remedy the effects that may result from their violation. This responsibility applies to activities, operations, products, or services, and also to relationships with suppliers, customers, States. It is important to note that this responsibility applies to the broad spectrum of Human Rights.

In June 2011, the United Nations Human Rights Council approved the Guiding Principles on Business and Human Rights, which established a framework to “Protect, respect and remedy” that involves three aspects, i.e., the obligation of the State to offer protection against human rights violations committed by third parties, including companies; the obligation of companies to respect human rights; and better access for victims to effective remedies, both judicial and extrajudicial. These principles were enshrined as the global standard of conduct expected of all companies and all States in relation to human rights.

On the other hand, the Equator Principles, EP2: Environmental and Social Assessment, establish the need to evaluate the possible adverse impacts on human rights.

1. Methodology

In this document, the methodology established by CEADS & Deloitte (2016) has been adapted, which establishes, among other things, a matrix of Human Rights Risks, which has served as a basis for the identification of possible human rights risks, which then are evaluated based on Probability and Impact. Finally, the Vulnerability to the identified risks is also assessed, to propose improvements through an Action Plan.

1.1. Identification of risks.

The starting point for a risk assessment is identification, in which a list of applicable and relevant risks is obtained. In this instance, the analysis is made on the broad spectrum of risks that make up the universe and the risk profile of the organization. In this stage, the Human Rights Risks Matrix prepared by CEADS & Deloitte (2016) (ANNEX I) has been used.

1.2. Assessment Criteria.

The first activity within the risk assessment process is the development of a common set of assessment criteria. Risks and their associated opportunities are often evaluated by organizations in terms of degree, impact, and probability. The scales defined shall allow a significant differentiation to classify and prioritize risks.

1.2.1. Impact.

This refers to the degree to which a risk event could affect the organization. The impact assessment criteria can be financial, reputational, regulatory, health, safety, environmental, considering their influence on employees, customers, and suppliers. Companies typically analyze the impact of a given risk using a combination of the above considerations, as some risks may affect the company financially while others may impact reputation or health and safety.

Table 1. Value ranges for impact assessment

Impact (I)		
Description	**Definition**	**Value**
Extreme	• Economic loss above US$ 500,000 • Negative media coverage at the regional/international level • Loss of market share above 25% • Significant lawsuits and fines, imprisonment of executives • Severe injuries (including death) to employees or third parties • Loss of multiple experienced leaders	5
Major	• Economic loss from US$ 100,000 to US$ 500,000 • Negative media coverage at the national level with long-term impact • Loss of market share of up to 10% • Regulatory demands that require a significant corrective project • Inpatient clinical treatment for employees or third parties • Loss of certain executive levels, high turnover of experienced personnel. Lack of perception as a differential employer	4
Moderate	• Economic loss from US$ 25,000 to US$ 100,000 • Negative media coverage at the national level, medium-term impact • Regulatory demands that require immediate corrections • Outpatient clinical treatment for employees or third parties • High staff turnover, adverse work environment	3
Minor	• Economic loss from US$ 5,000 to US$ 25,000 • Damage to reputation at the local level • Regulatory fine • Minor damage caused to employees or third parties • Unfavorable working climate, increased turnover	2
Low	• Economic loss below US$ 5,000	1

Impact (I)		
Description	**Definition**	**Value**
	• Impact on local media easily remediable • No relevant impact on the health of employees or third parties • Lack of satisfaction in staff not generalized.	

Source: CEADS & Deloitte (2016)

1.2.2. Probability.

This presents the possibility for a certain event to happen. It can be expressed using qualitative terms (frequent, probable, possible, infrequent), as a percentage of possible occurrence, or as a frequency.

Table 2. Value ranges for probability rating

Probability (Po)				
Annual frequency		**Probability**		**Value**
Frequent	Once a year	Almost certain	90% or more	5
Probable	Once in 2 years	Probable	65% - 90%	4
Possible	Once in 5 years	Possible	35% - 64%	3
Unlikely	Once in 10 years	Unlikely	10% - 34%	2
Rare	More than 10 years	Rarely	Below 10%	1

Source: CEADS & Deloitte (2016)

1.2.3. Vulnerability.

This refers to the susceptibility of the company to a risk event in terms of its preparation to face it. The vulnerability assessment allows organizations to measure how well they are managing their most relevant risks. Vulnerability assessment may include the company's ability to anticipate events through, for example, scenario analysis, ability to prevent negative events, ability to respond and adapt quickly as events unfold.

Table 3. Value ranges for vulnerability rating.

Vulnerability		
Description	**Definition**	**Value**
Very high	• There are no planned scenarios • Lack of capacity at the company or process level to address risks • Undeveloped risk responses • Lack of contingency or crisis management plan	5
High	• There are only planned scenarios for strategic risks	4

Vulnerability		
Description	**Definition**	**Value**
	• Low capacity at the company or process level to address risks • Responses to risk are partially developed • Existence of contingency or crisis management plans with partial or limited coverage	
Medium	• There are scenarios developed that include sensitivity analysis and stress tests. • Medium capacity at the company or process level to address risks • Responses to risk are implemented and oriented to cover the control objectives for the majority of the occasions. • Existence of contingency or crisis management plans implemented with some level of tests conducted.	3
Low	• Strategic options have been defined • Medium/high capacity at company or process level to address risks • Responses to risk implemented and aimed at meeting control objectives, except for extreme situations. • Existence of comprehensive contingency or crisis management plans implemented with some level of tests conducted.	2
Very low	• High capacity at the company or process level to address risks • Existence of redundant risk response mechanisms implemented and periodically assessed in relation to the most critical risks • Existence of contingency or crisis management plans implemented and periodically assessed	1

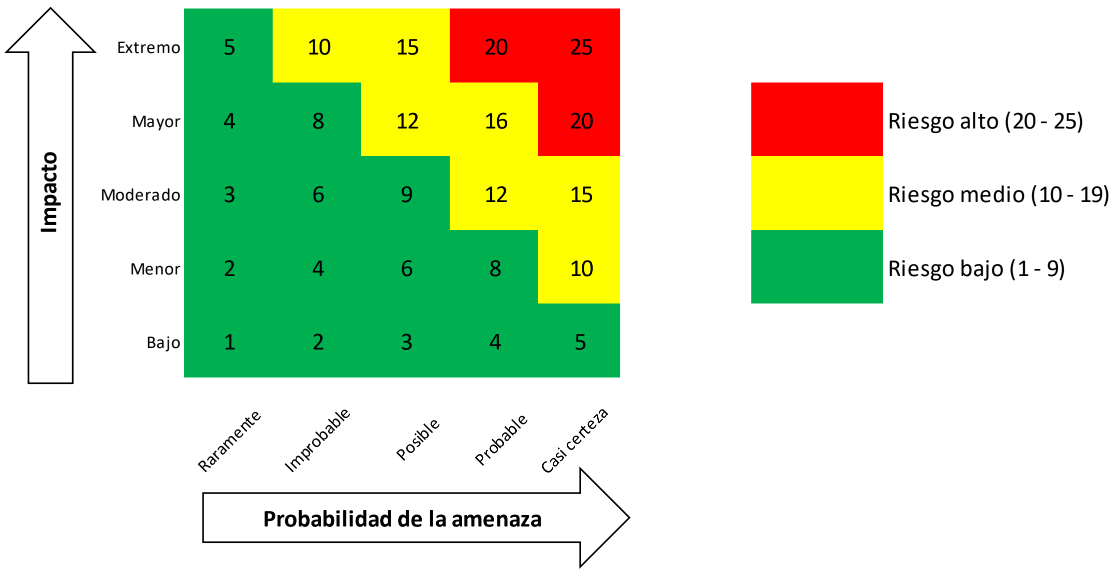
Source: CEADS & Deloitte (2016)

1.3. Risk assessment

This consists of assigning a value to each risk, taking as a reference the criteria defined above. The assessment can be carried out in two stages where initially a selection of the risks is made using qualitative criteria, followed by a more quantitative analysis of the most important ones.

Risk = Impact x Probability

Figure 1. Value ranges for impact assessment.



Legend:

Riesgo *= Risk;* ***Alto*** *= High;* ***Medio*** *= Medium;* ***Bajo*** *= Low,* ***Extremo*** *= Extreme,* ***Mayor*** *= Major;* ***Moderado*** *= Moderate;* ***Menor*** *= Minor;* ***Bajo*** *= Low;* ***Raramente*** *= Rarely;* ***Improbable*** *= Unlikely;* ***Posible*** *= Possible;* ***Casi Certeza*** *= Almost certain;* ***Probabilidad de amenaza*** *= Threat Probability*

Prepared by: Ecosambito, 2020.

Once the risk is obtained, a qualitative rating of the level of vulnerability is made, so that risk management priorities can be established.

1.4. Risk prioritization.

With the results of the assessment and based on the tolerance threshold defined by the management and taking into account the organizational objectives, the risks that need to be managed as a priority are defined. To do this, a prioritization list is presented that shows the threats to human rights, ordered from highest to lowest.

2. Human Rights Risk Assessment

The results of the risk assessment are shown in ANNEX 1.

3. Conclusions and recommendations

- 45 threats to human rights have been identified in the project activities. However, the assessment shows risks of low and medium level, mostly.
- A vulnerability assessment has also been established in which the existence or lack of response processes, procedures and protocols is analyzed, in order to be able to propose the corresponding activity that allows the improvement of this indicator.
- It is recommended to carry out this assessment every two years, or when carrying out major projects that cause changes in relationships with stakeholders and the community.

4. References

United Nations. Human Rights Committee. (2012). Guiding Principles on Business and Human Rights: Implementing the United Nations" Protect, Respect and Remedy" Framework. Human Rights Committee.

Consejo Empresario Argentino para Desarrollo Sostenible CEADS & Deloitte, Co. (2016). Risk Analysis of Human Rights

5. Appendixes

Appendix 1. Human Rights Risk Assessment Matrix.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
PUERTO BOLÍVAR PROJECT
- PHASE 1

– PORT TRAFFIC ASSESSMENT –

Prepared for:

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ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

Traffic is one of the main components of port activity and mobilizes a diversity of both sea and land cargo. This assessment of port traffic makes a quantitative and qualitative analysis of this activity.

For this analysis, 3-year historical data have been taken as a basis, from 2017 to 2020 and provided by YILPORTECU, to describe the current traffic characteristics, trend to change, and forecast. For this forecast, two scenarios have been taken as a basis, one of which considers the expansion of the port capacity planned by YILPORTECU in 2030. In this analysis, the impact of activities during the construction of Dock 6 has also been considered.

PORT TRAFFIC ANALYSIS

Among port activities, both land and sea cargo transport must be evaluated in order to have accurate information that allows analyzing environmental impacts. These impacts will be influenced by the volume of cargo, the type of transport, the power used, the emissions generated, and the infrastructure on which operations are conducted. In general, both sea and land transport are linked to large consumption of fossil fuels, which causes an environmental impact, both globally (emission of greenhouse gases, particularly carbon dioxide), and locally (nitrogen oxides, sulfur oxides, noise, etc.). However, in recent decades, several shipping companies have been investing in reducing fossil fuel consumption and reducing carbon dioxide emissions.

Other expected impacts are those coming from the interaction of transport with the environment, such as traffic accidents. In the case of sea transport, we also have the discharge of bilge water, hydrocarbons, and a rise in sound pressure.

In this regard, it is very important to quantify the traffic generated by the Puerto Bolívar operation, characterize it, and be able to estimate its variation with future expansion.

1. Legal and institutional framework

The Constitution of the Republic of Ecuador (2008), in the transportation section, article 394 establishes that the state shall regulate land, air and water transportation and airport and port activities.

The Port System of Ecuador is regulated by national laws, regulations and municipal norms. The President of Ecuador acts as the highest body advising the National Council of Merchant Marine and Ports (CNMMP) which standardizes all public and private maritime and port activities. The General Directorate of the Merchant Marine (DIGIMER), an entity under the General Command of the Navy, oversees compliance with the regulations determined by the CNMMP and related laws, regulations and international conventions.

The legal framework is composed of laws that regulate all port activities and maritime and river terminals, such as the General Ports Law, the National Port Administrative Regime Law, and the General Regulations for Port Authorities in Ecuador. Other laws in force that regulate marine traffic, port captaincy and other activities related to water transportation are the Maritime Police Code and the General Law of Maritime and River Transportation.

Ecuador exercises its sovereignty and jurisdiction over the extension of maritime space established by the United Nations Convention on the Law of the Sea (UNCLOS). Ecuador's maritime space is classified into: Inland Waters, Territorial Sea, Contiguous Zone, Exclusive Economic Zone, Continental Shelf, High Seas and The Area.

The Ecuadorian Navy is in charge of developing maritime capabilities and providing integral security of aquatic spaces, supporting national maritime development and public and State security. The geographical coverage of the Ecuadorian Navy includes the maritime space of the territorial sea, the contiguous zone and the exclusive economic zone, in addition to the fluvial coastal space of inland waters.

Of the Port Captaincies established in the Maritime Police Code, 3 are established in the Coast of the Republic: Port of Guayaquil, Manta and Puerto Bolivar. The purpose of the Port

Captaincies is to oversee the correct and safe navigation of all national or foreign vessels, to demand order, comfort and safety of passengers and crew members on board, to maintain order, morality and safety on beaches, docks and other maritime establishments and to collaborate with the National Defense within the limits of their respective jurisdictions.

The Capitanía Mayor de Puerto Bolívar has as its northern limit the mouth of the Tenguel River and to the south, Peru. With respect to the military naval nature, the captaincies depend on the Command of the Naval Zone to which they belong. The Maritime Police has jurisdiction over internal waters, territorial sea and platform. Ports, rivers and lakes are part of inland waters.

2. Sea traffic

The area of influence of Puerto Bolívar is very active in sea traffic. Thus, we can list 3 entry and exit points for vessels to and from Puerto Bolívar, through the Santa Rosa Channel.

Port Terminal of Puerto Bolívar (YILPORTECU).

- The Port Terminal has 5 docks totaling 920 meters of berthing line, which allows up to 5 merchant vessels to dock simultaneously.

Cabotage Pier (0.2 km South of YILPORTECU):

- Berth and operation of tourist sea transport cooperatives, towards the Jambelí beach resort.
- Berth and operation of Navy vessels.
- Berth and operation for Tugboats serving at the Port Terminal.

Huaylá estuary (1 km South-East of YILPORTECU).

- Private docks where more than 1200 boats dock and provide transportation and supply services to shrimp farms and carry out artisanal fishing.

The Ecuadorian Navy registers 540 active vessels (less than 10 GRT) in Puerto Bolívar, of which 43% is registered for fishing, while 54% is registered for cargo and passengers, and 3% is related to sport, recreation, and passenger vessels.

This port traffic analysis includes indicators that collect the movements of cargo and supply vessels, concerning vessels in port and on land (loading, unloading, transit and transshipments), stopovers of merchant vessels (docking and undocking), passengers (docking and undocking), fishing (fresh fish catch) or number of active vessels.

2.1. Port Terminal of Puerto Bolívar (YILPORTECU).

In the sea traffic statistics of the Port Terminal, there are several important data with which it is expected to describe the characteristics of port traffic.

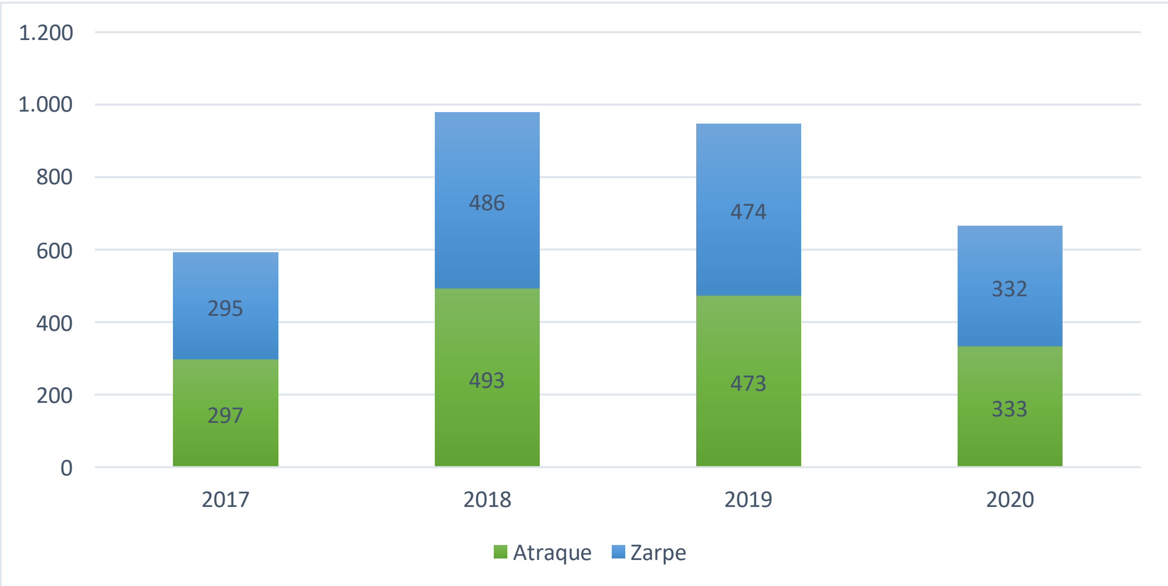
Time spent in port.

The first quantification is carried out through the berthing and departure data.

Berthing is the operation of mooring a vessel at an allotted place. Departure is the departure of a vessel from the port to the sea or another port. Both data represent the direct sea traffic produced by Yilportecu, on its sea environment.

The following graph shows the annual berthing and departure values for the period analyzed. The data in 2017 are shown as of March, while the data in 2020 are up to September.

Figure 1. Accumulated Annual Port Sea Traffic



Berthing Departure

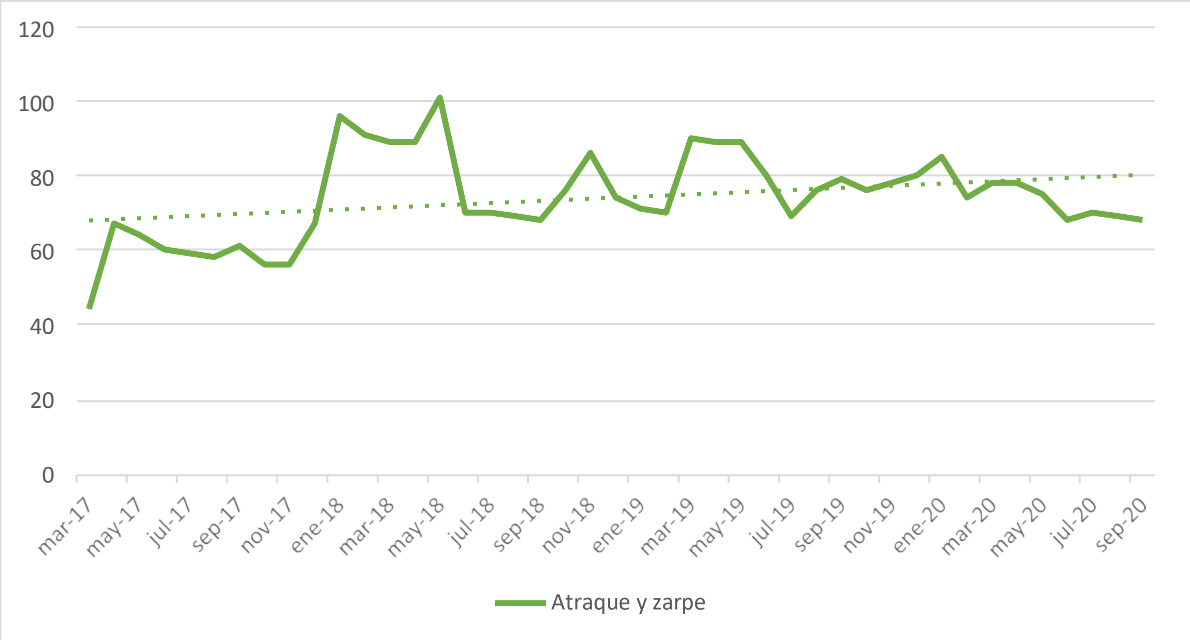
Source: Yilportecu S.A.
Compiled by author

Due to the fact that the annual data available are not complete in 2017 and 2018, it is more useful to carry out an analysis of the monthly movements during the period analyzed.

The graph below shows the entrances and exits of vessels to and from the Yilportecu docks in the analyzed period. The dotted line shows a trend of slight increases in these monthly movements.

Please note that each movement of a cargo vessel is accompanied by the movement of at least two tugboats. The port terminal is serviced by four tugboats.

Figure 2. *Monthly Sea Port Traffic, total entries and exits of vessels.*



Berthing & Departure

Source: Yilportecu S.A.
Compiled by author

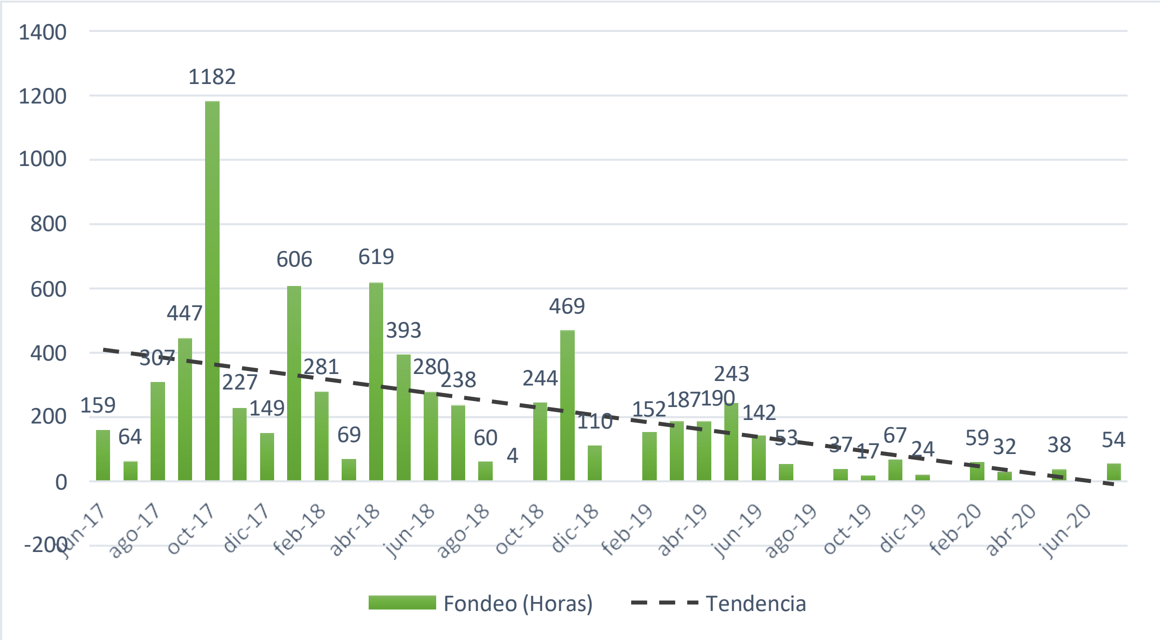
It is expected that an expansion of the capacity of Yilportecu's operations will emphasize the trend of increasing port sea traffic. However, the trend of world sea traffic is oriented towards the use of a smaller number of vessels, but each one of them with a greater loading and transport capacity. Thus, even if sea traffic increases, the number of vessels entering Puerto Bolívar will tend to decrease.

Stay Time and Anchoring Time.

The anchoring time is an indicator of the time a vessel is anchored in waters close to the port. The stay time refers to the permanence of a vessel, berthed at the dock.

While a vessel is in port, either anchored or berthed, it keeps its support systems operational, which results in an increase in emissions, noise and the probability of spills, accidents, etc. For this reason, these indicators should be at acceptable levels.

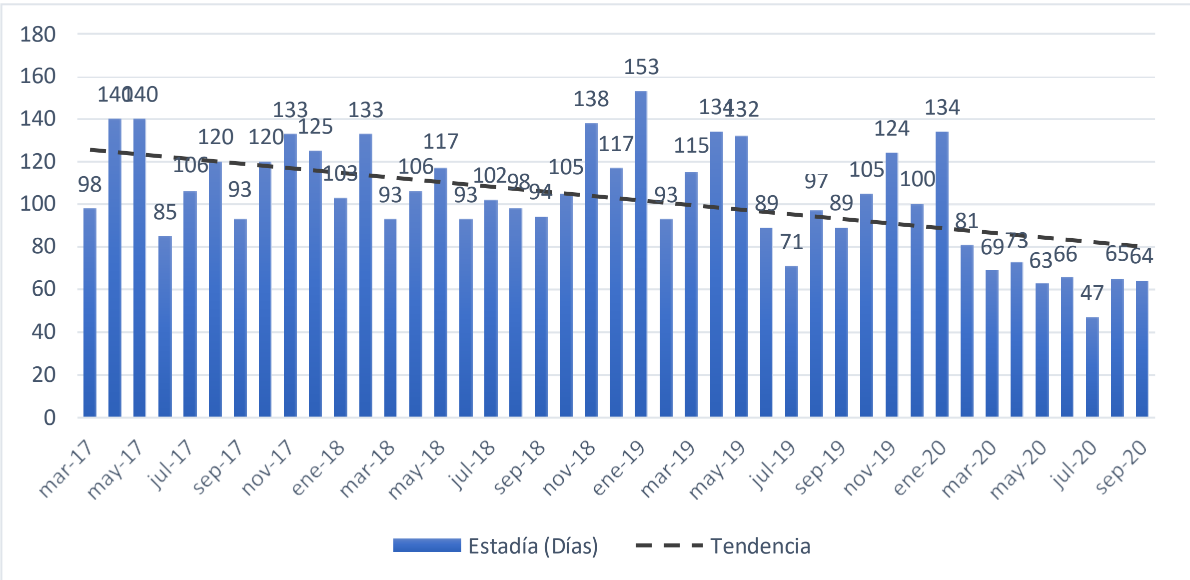
Figure 3. *Total anchoring time of vessels, monthly*



Anchoring time (Hours) **Trend**

Source: Yilportecu S.A.
Compiled by author

Figure 4. *Total stay time of vessels, monthly*

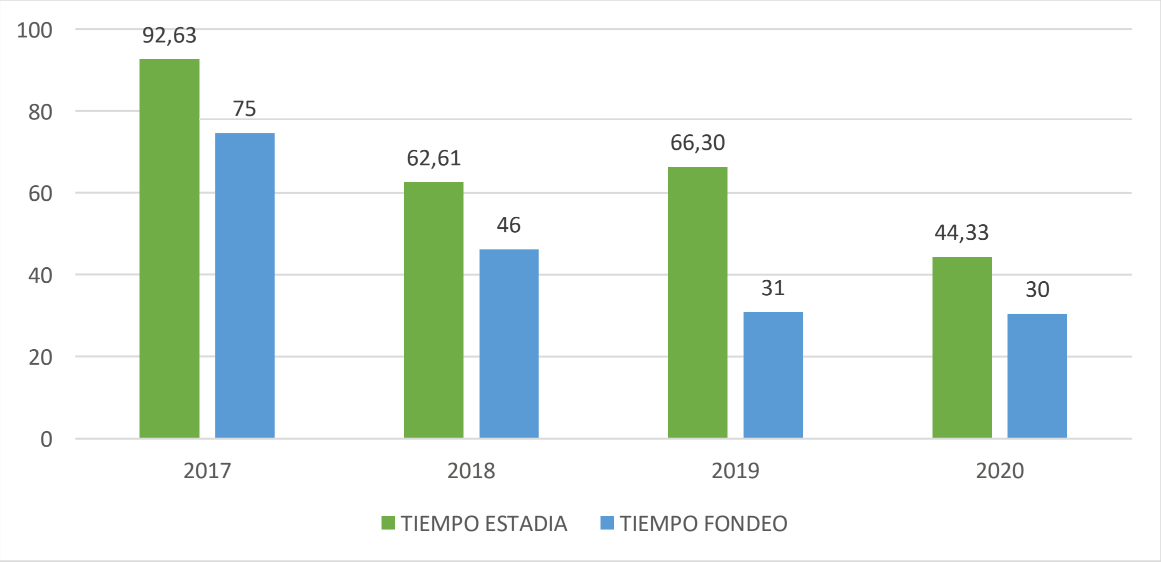


Stay Time (Days) **Trend**

Source: Yilportecu S.A.
Compiled by author

The data show a clear trend towards a decrease in the stay and anchoring times of the vessels, which indicates a greater efficiency in the logistics management of the port.

Figure 5. *Stay and anchoring times of vessels, annual average (hours)*



STAY TIME **ANCHORING TIME**

Source: Yilportecu S.A.
Compiled by author

This significant improvement in the stay and anchoring times can be an advantage in terms of environmental impacts of the port operation, since a decrease in the hours-year of stays of vessels in the vicinity of the port are manifested in fewer environmental impacts, particularly in the air quality of the area of influence.

2.2. Tourist traffic: Puerto Bolívar cabotage pier.

There are two tourist transport cooperatives that operate from the Cabotage Pier: Cooperativa “31 de Julio” and Cooperativa "Rafael Morán Valverde", each one has 15 registered vessels.

These 30 vessels, with capacity for 43 passengers each, carry out the passenger transport to Jambelí Island, taking approximately 40 minutes.

The tours take place throughout the morning, from the Puerto Bolívar cabotage pier to Jambelí Island. In the afternoon, from 3 PM, the tours get back to Puerto Bolívar.

The data on the frequency of trips, provided by Betty Sánchez, Manager of the Rafael Morán Valverde Cooperative, in an interview on November 2, 2020, are shown in Table 1. These data are estimates of the activity of the tourist vessels of two cooperatives in 2019, since, in 2020, due to the health emergency, transport restrictions and capacity limits were imposed and significantly decreased tourist mobilization towards Jambelí Island.

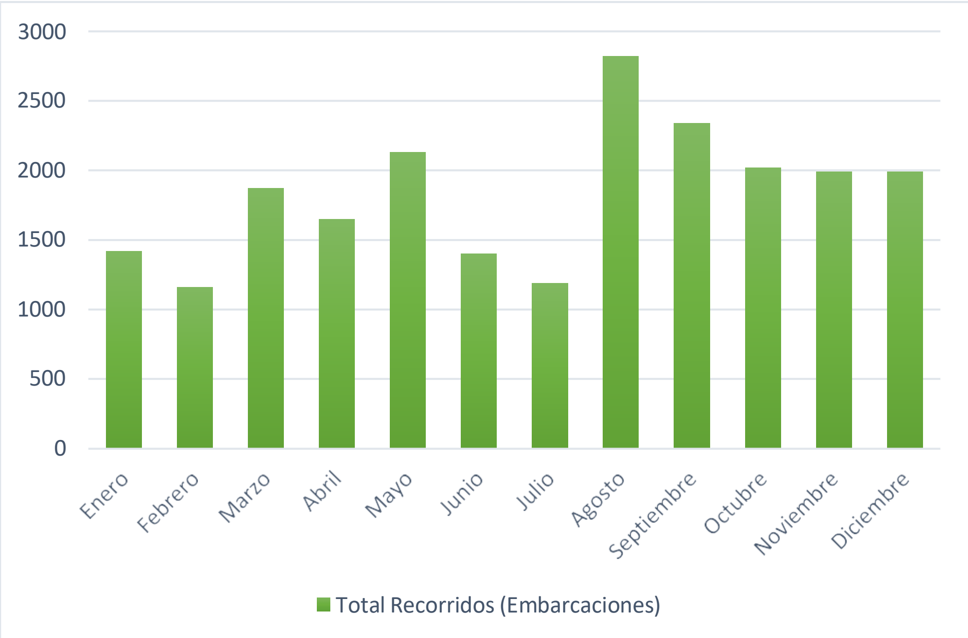
Table 1. Trip Schedule of Tourist Transport Routes, Annual Estimate 2019

	January – March	August – September	April – July October – December
Monday to Friday	10	60	10
Saturday and Sunday	120	120	120
Holidays	240		

Source: Cooperativa Rafael Morán Valverde
Compiled by author

According to the information provided by the tourist transport cooperatives, the annual behavior of this traffic is represented in Figure 6.

Figure 6. *Puerto Bolívar Tourist Traffic, monthly estimate 2019*



Total Number of Trips (Vessels)

Source: Cooperativa Rafael Morán Valverde
Compiled by author

2.3. Fishing traffic: Huaylá estuary and Puerto Bolívar Cabotage Pier.

According to data from the Port Authority of Puerto Bolívar, there are a total of 291 vessels registered in Puerto Bolívar for fishing operations. The vast majority are concentrated in commercial and private docks located in the Huaylá estuary, south of Puerto Bolívar.

However, a vessel count carried out on Sunday, November 1, 2020 from 6:00 AM shows the following data:

Table 2. *Census of vessels in the Huaylá estuary and the Cabotage Pier.*

Type of vessel	Number
Bongo boats	21
Wooden boat	30
Fiberglass boat	943
Industrial vessels	84
Shrimp ‘Faluchos’ (cargo boats)	109
Barges	20
Logistic vessels	13
TOTAL	**1.220**

Source: Ecosambito C. Ltda.
Compiled by author

2.4. Interactions between different types of vessels

Although there is high maritime traffic in the areas surrounding the areas occupied by vessels entering, maneuvering and leaving the Port Terminal, there are no reports of negative interactions between these vessels and vessels engaged in fishing, tourism or other types of transportation.

In the event that private vessels are located in a place that hinders the maneuvering of merchant vessels, the established procedure is as follows:

- In case of irruption or blockage of the access channel or maneuvering area, it will be assisted with the own vessel to communicate to the vessel that it is in a vessel transit zone and request the withdrawal.
- If necessary, the event will be reported to ECU 911, from where the Captaincy of Port Bolivar will be informed for intervention.

3. Land Traffic

It consists of the internal land transport of cargo, in the case of export, from the origin of the cargo to the port, and in the case of import, from the port to its destination. As it is a mainly banana trading port, the cargo comes from different parts of the province, both from banana farms and from collection sites. In addition, there is an important commercial interaction with neighboring provinces in the southern part of the country: Azuay, Loja, and Zamora. Growing mining production further increases cargo movements from neighboring provinces.

Below, the provincial and cantonal road network is described, through which cargo transport is carried out, to and from the Port Terminal.

3.1. Provincial and cantonal road network.

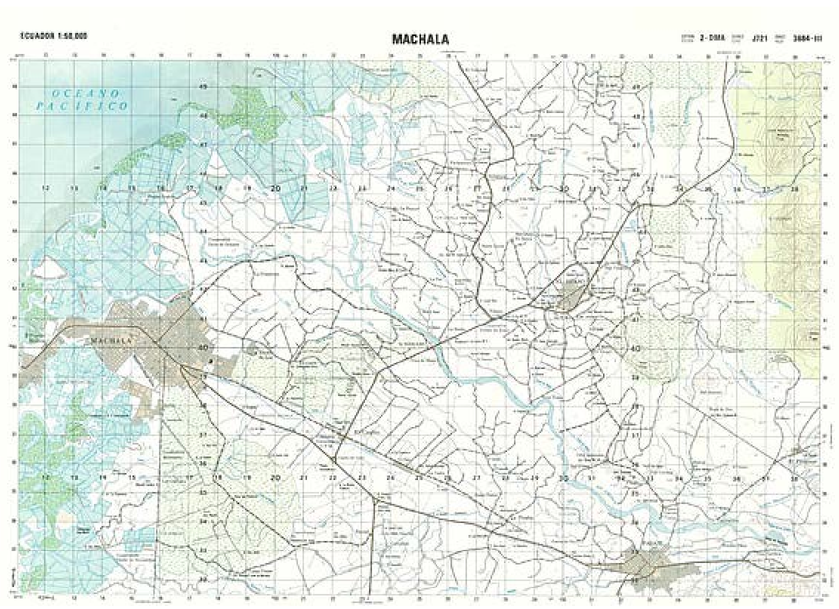
The road network in the province of El Oro is made up of a total of 3,036.70 kilometers, of which 389.88 kilometers correspond to the state road network and 2,646.82 kilometers to local roads. The state road network is, in turn, made up of 212.09 kilometers of arterial corridors and 177.79 kilometers of collector roads (Plan Vial Participativo de El Oro [Participatory Road Plan of El Oro], 2003).

In the arterial corridor axis, 99.43 kilometers correspond to the Troncal de la Costa road that crosses the province from north to southwest, connecting the province to the north with the canton Ponce Enríquez of the Province of Azuay and to the Southwest with Peru.

The Troncal de la Costa road crosses the cantons of El Guabo, Machala, Santa Rosa, Arenillas and Huaquillas; from which there are two secondary axes that link other cantons of the province. The first secondary axis crosses the cantons of Arenillas and Las Lajas, connecting the province with Loja. The second axis crosses the cantons of Santa Rosa (La Avanzada), goes to the Zaracay parish of the canton of Piñas, dividing into two branches, one of which crosses the canton of Balsas and connects with the province of Loja and the other passes through the cantons of Portovelo and Zaruma.

The main cantonal road network (1st order: more than 2 lanes), directly connects the cantons of Pasaje, Santa Rosa and El Guabo with paved roads and average distances of 12 km. The minimum distance is 8 km to Pasaje, followed by 9 km to Guabo and the longest distance corresponds to 22 km to Santa Rosa. The main roads amount to 70 km with asphalt roads. The 2nd order roads amount to an average of 30 km with paved and ballast roads. Depending on the connectivity, the population of the city of Machala shows a gradual growth in road traffic to Pasaje and high potential of traffic growth to Guabo. Furthermore, due to the existing settlements, provincial-level equipment and progressive growth of the city, potential traffic growth is expected to Santa Rosa.

Figure 7. *Machala Topographic Chart.*



Source: IGM

3.2. Access roads to Puerto Bolívar.

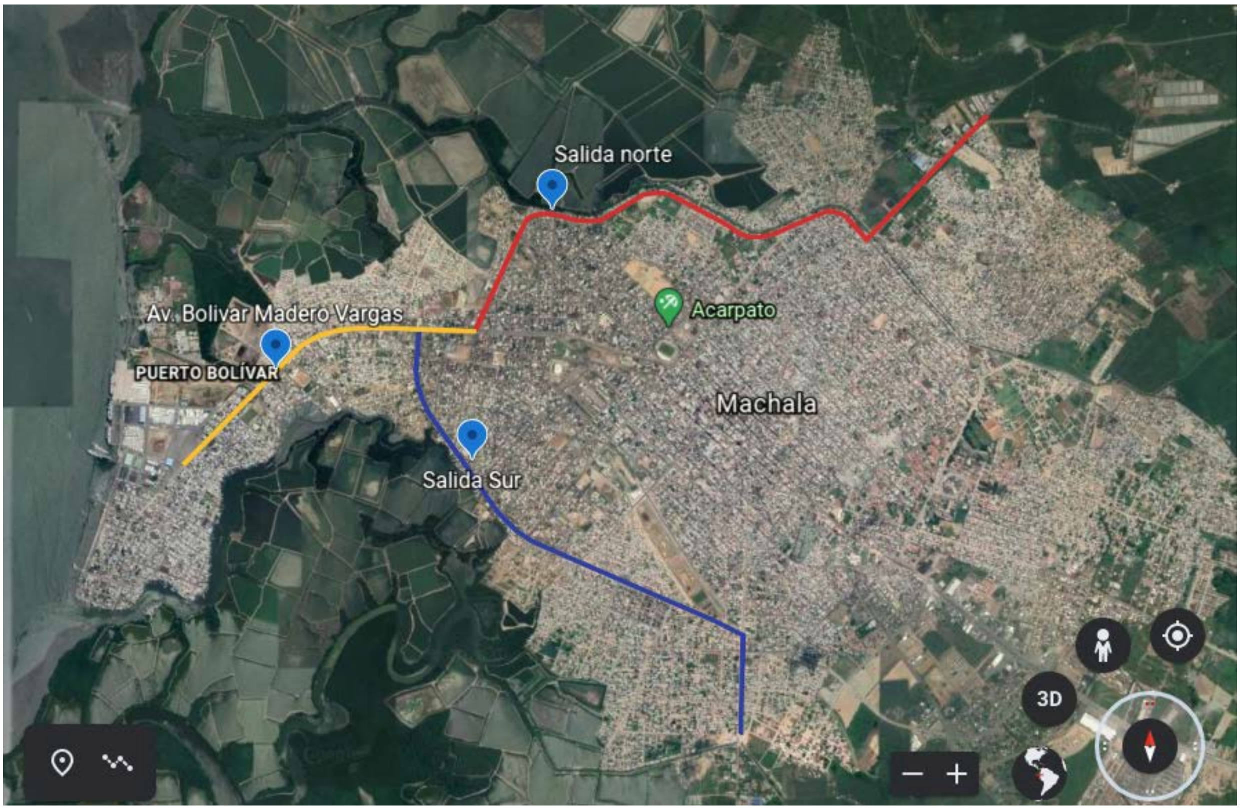
Bolívar Madero Vargas Avenue is the main access road to the urban parish of Puerto Bolívar and the Port Terminal. In addition, urban buses and private vehicles travel through it.

To access this avenue, cargo trucks must take the perimeter access roads to the urban area: 1) The Circunvalación Sur avenue is the most widely used since it connects directly with the eastern access road of the city (Machala – Pasaje road). The Circunvalación Sur connects with the southern part of the province (Balosa – Santa Rosa road).

2) The Circunvalación Norte avenue (2.7 km from the entrance to the port) is the most widely used since it connects directly with the eastern access of the city (Machala – Pasaje road). The Circunvalación Sur (2.3 km from the entrance to the port) connects with the southern part of the province (Balosa – Santa Rosa road).

Please note that both side crossings have two lanes in each direction. However, the urban area is widely consolidated, so that in some sections they can be considered as urban roads. (see Figure 8).

Figure 8. *Access roads to Puerto Bolívar.*

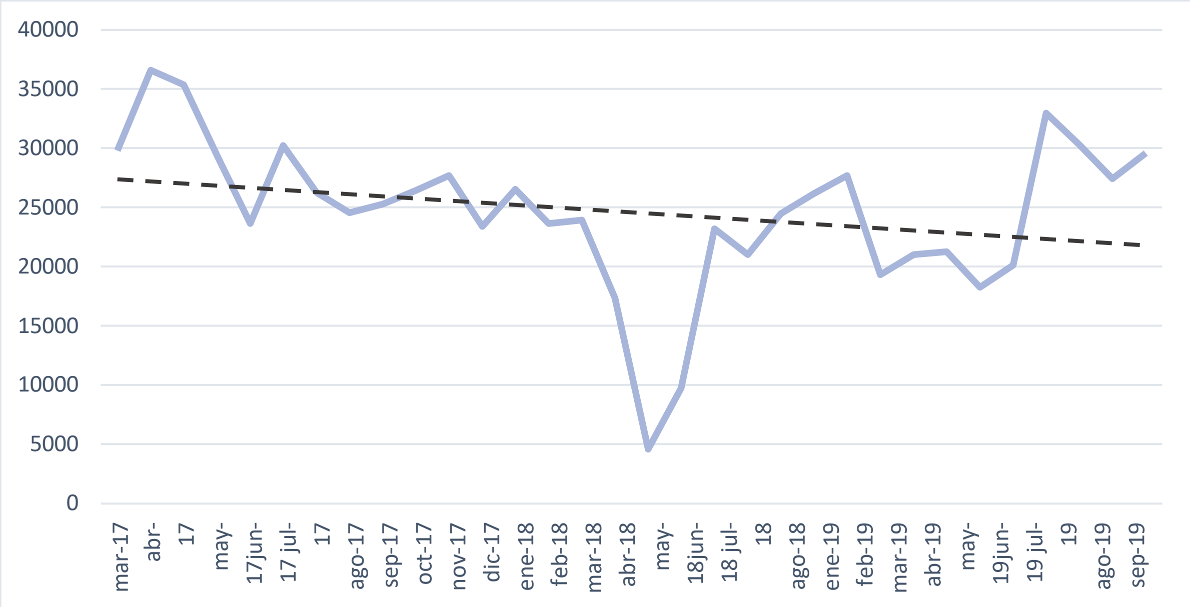


Source: Google Earth, 2020

3.3. Vehicle traffic to the Port Terminal.

The graph below shows the number of cargo vehicles entering the Port Terminal per month, in years 2017 – 2020.

Figure 9. *Port Land Traffic, total entries and exits of cargo vehicles, monthly*



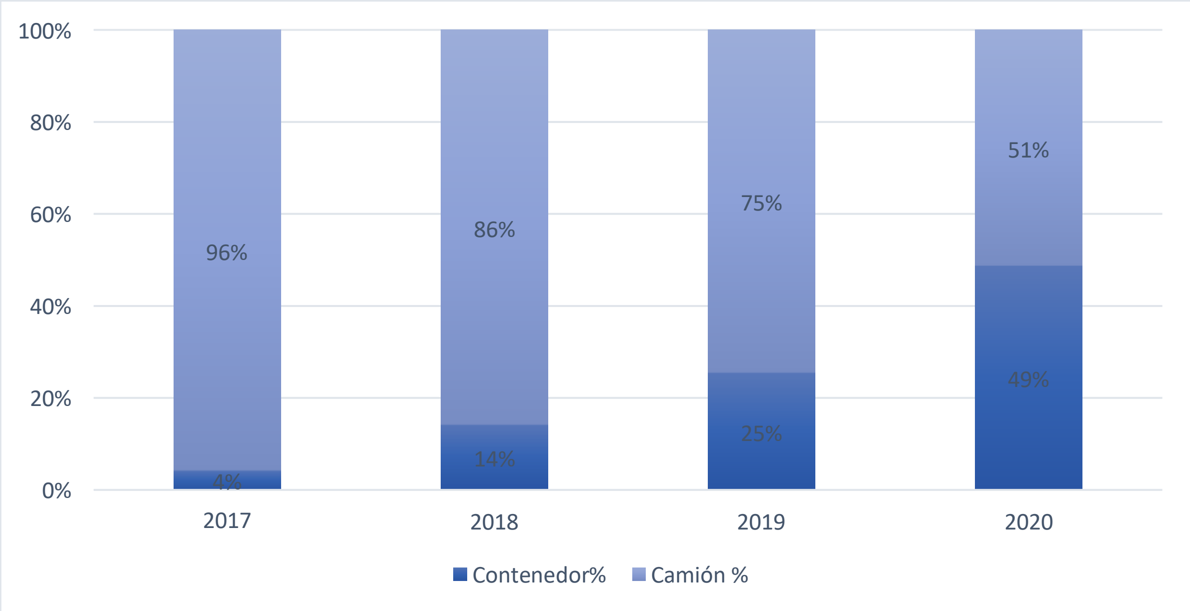
Source: Yilportecu S.A.
Compiled by author

Figure 9 shows a downward trend in port traffic at the Port Terminal (Yilportecu). Although the data show greater movement of cargo vessels, this effect is due to the increase in containerized cargo.

From 2017 to 2020, the entry of containerized cargo has increased from 4% to 49%.

This means that the number of trucks of all sizes, which in the past transported boxes of bananas to the port, is rapidly decreasing, and trucks are being replaced by larger capacity containers pulled only by one head. Thus, the consumption of fossil fuels, oils, etc. has decreased considerably, and the downward trend will continue as there is a transfer to containerization.

Figure 10. *Port Land Traffic, by type of vehicle, annual*

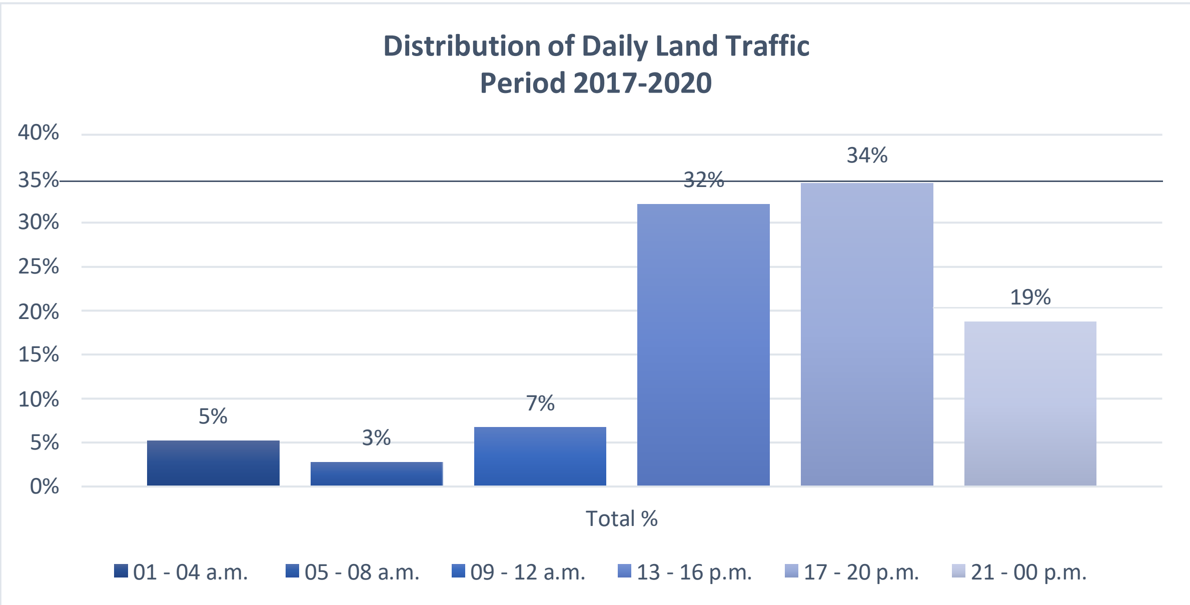


Container % **Truck %**

Source: Yilportecu S.A.
Compiled by author

The behavior of land traffic throughout the day is peculiar, slight in the morning, and increasing from 1:00 p.m. to 8:00 p.m. From 21:00 to 00:00, the traffic is considerable, if we relate it to the background traffic on the city roads.

Figure 11. *Distribution of Daily Land Traffic, Period 2017-2020*



Source: Yilportecu S.A.
Compiled by author

4. Traffic forecasts as of 2030

Forecasts of sea and land traffic caused by port operations will be made for two scenarios:

- Scenario 1: No increase in the port's operational capacity. Forecasts as of 2030 based on sea and land traffic data from 2017 to 2020.
- Scenario 2: With an increase in the operational capacity of the port. Forecasts as of 2024 based on monthly data of the volume of containers in TEUs from 2018 to 2020. The data on the construction of Dock 6 are considered here, i.e., estimates of sea travel (piles, fenders, bitts, ladders) and land travel (mobilization of construction material), during the construction period.

4.1. Scenario 1: No capacity increase

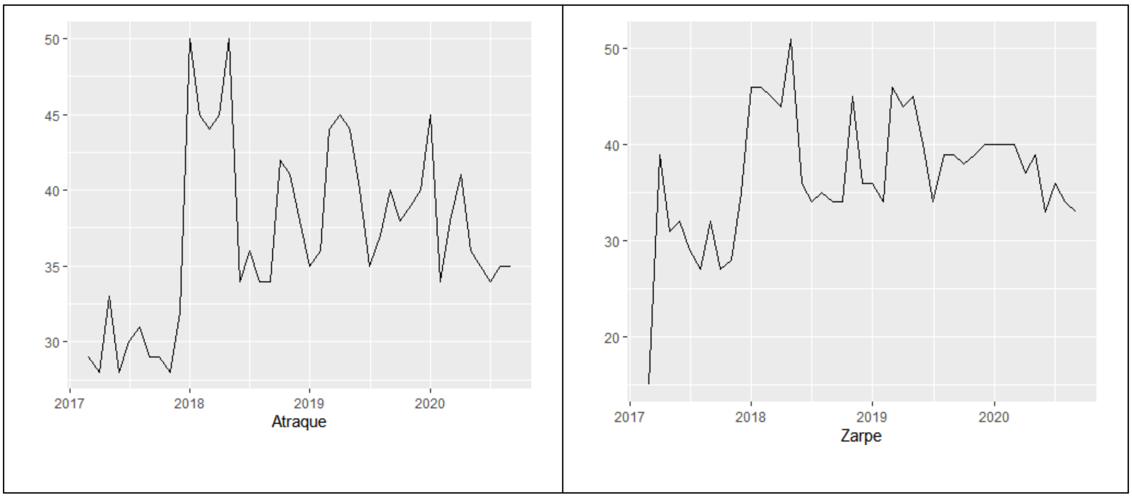
4.1.1. Methodology

To perform a time series analysis using ARIMA (Autoregressive Integrated Moving Average Model) and SARIMA (Seasonal Autoregressive Integrated Moving Average Model) models, the data must comply with seasonality and assumptions of seasonality. Therefore, the necessary transformations were made in the series to meet these assumptions.

4.1.2. Sea traffic

We begin by converting the data set to time series for both the berthing and departure variables. Then, we observe Figure 12 and Figure 13 that contain the series of the historical data of the variables berthing and departure.

Figure 12. *Historical data series of berthing and departure, Puerto Bolívar*

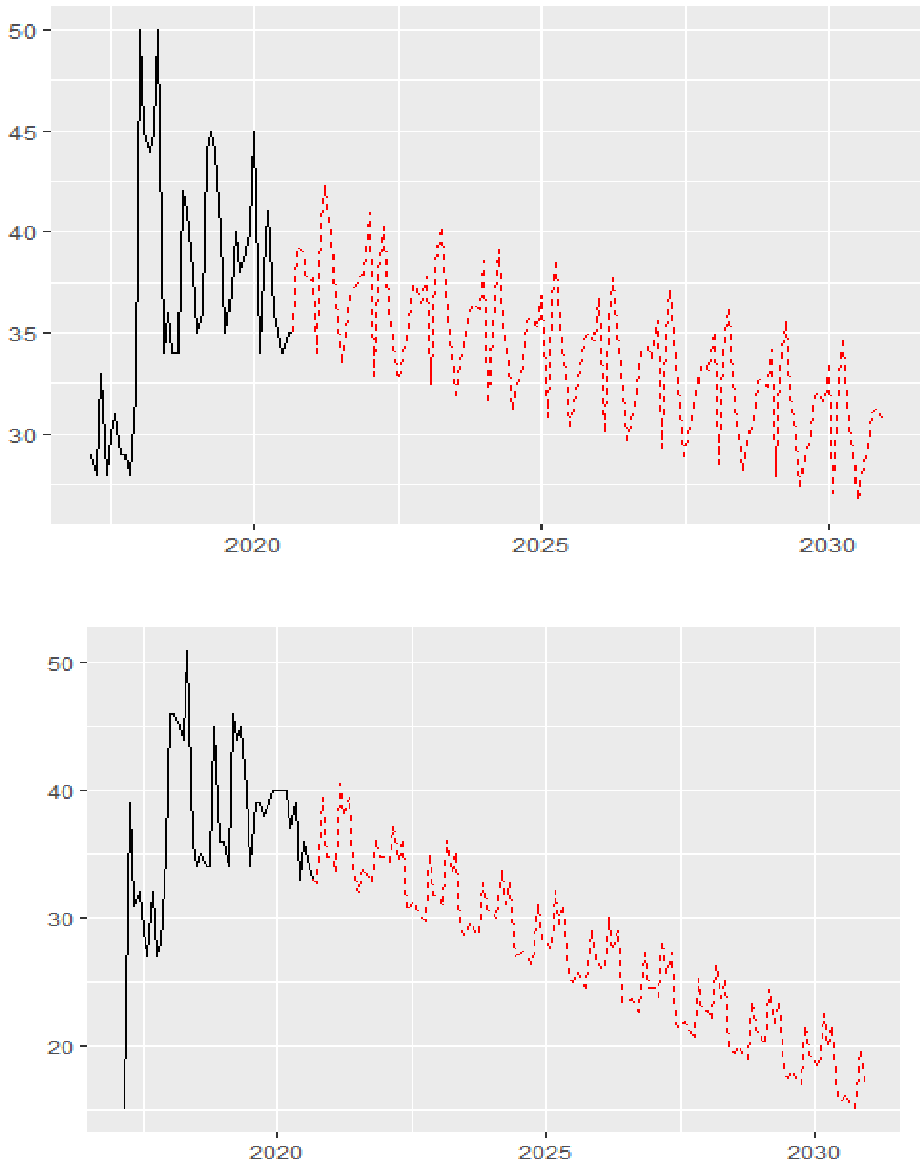


Berthing *Departure*

Source: Yilportecu S.A.
Compiled by author

Various models were adjusted for both series, concluding that the best adjustment was the ARIMA (1,1,0)(1,1,0) model. The model complies with the assumptions of independent and normal residuals.

Figure 13. *Forecast of departure and berthing variables*



Compiled by author

Figure 13 shows the current series in black and forecast in red. In both forecasts, a decreasing trend is observed. This is due to the presence of a trend in the historical data. This trend can also be influenced by the economic crisis derived from the 2020 health emergency.

It is important to emphasize that there is not enough historical data, so caution must be applied in these forecasts.

Table 3.. *Forecast of seaport traffic as of 2030.*

Year	Total, Sea Traffic Forecast	Percentage change as compared to 2020
2020	888	
2021	872	-1.80%
2022	831	-6.42%
2023	805	-9.35%
2024	770	-13.29%
2025	740	-16.67%
2026	707	-20.38%
2027	676	-23.87%
2028	644	-27.48%
2029	613	-30.97%
2030	581	-34.57%

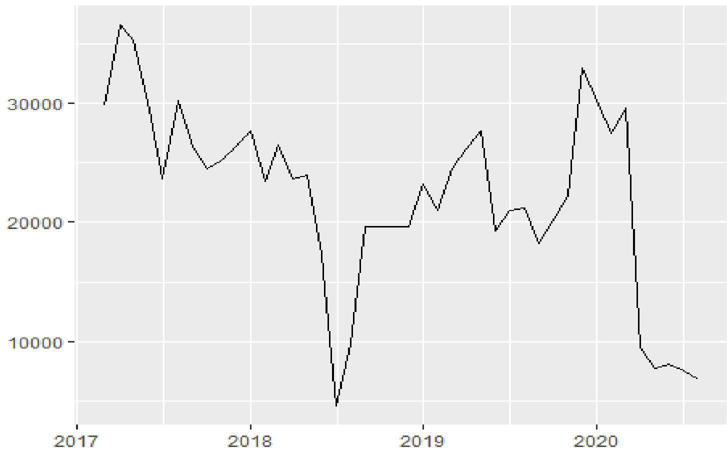
Compiled by author

4.1.3. Land Traffic

For land transport, the same methodology that was used for sea traffic was carried out. However, only one variable containing the total monthly entry and exit of trucks and containers was forecasted.

Figure 14 shows the series of historical data from 2017 to 2020.

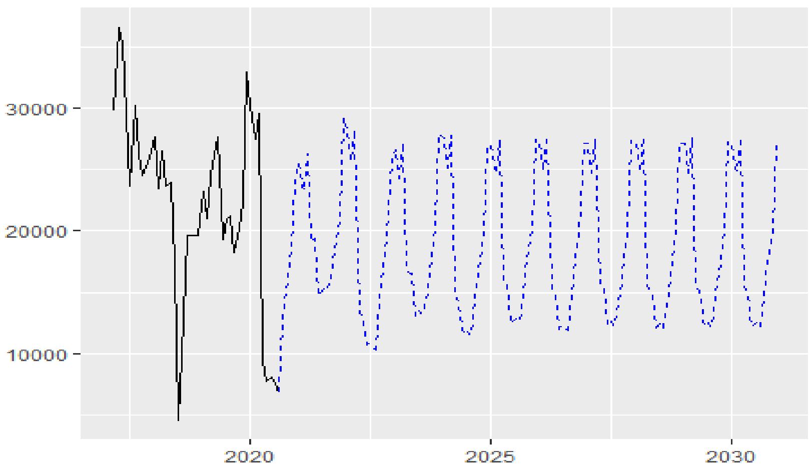
Figure 14. *Historical Data Series of Port Land Traffic in Puerto Bolívar*



Source: Yilportecu S.A.
Compiled by author

ARIMA (1,0,1)(1,1,0) was the most proper model. The forecast was carried out with a Confidence Level of 95%. Figure 15 shows the forecast as of 2030 in blue. It shows that the data will remain constant due to the seasonal characteristic presented by the historical data.

Figure 15. *Forecast of Port Land Traffic in Puerto Bolívar*



Source: Yilportecu S.A.
Compiled by author

Table 4 shows the annual forecasts of land traffic in Puerto Bolívar as of 2030.

Table 4. *Port Land Traffic Forecast.*

Year	Land Traffic (trips)	Percentage change as compared to 2020
2020	231,225	
2021	243,116	5.14%
2022	216,804	-6.24%
2023	232,235	0.44%
2024	223,186	-3.48%
2025	228,492	-1.18%
2026	225,380	-2.53%
2027	227,205	-1.74%
2028	226,135	-2.20%
2029	226,763	-1.93%
2030	226,395	-2.09%

Compiled by author

4.2. Scenario 2: Increased capacity

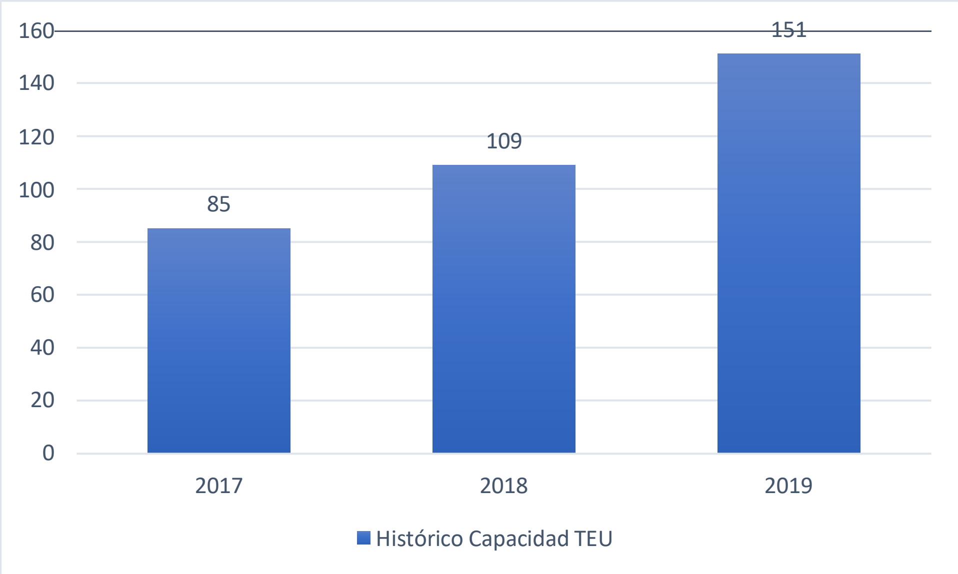
4.2.1. Methodology

A model previously established by the commercial department was used, in which the compound annual growth rate or CAGR of 4.9% from 2019 to 2065 is used.

4.2.2. Forecast of cargo mobilization.

Firstly, an analysis of historical data was carried out, in which a possible seasonality and increasing trend were observed, as can be seen in the figure below.

Figure 16. *Historical Data Container Capacity (TEU)*



Source: Yilportecu S.A.
Compiled by author

Table 5 shows annual forecast data as of 2030, the percentage change compared to 2020 and the annual growth percentage. We observe that the series has an annual growth trend. However, as time passes, the growth percentage will be lower than the previous year.

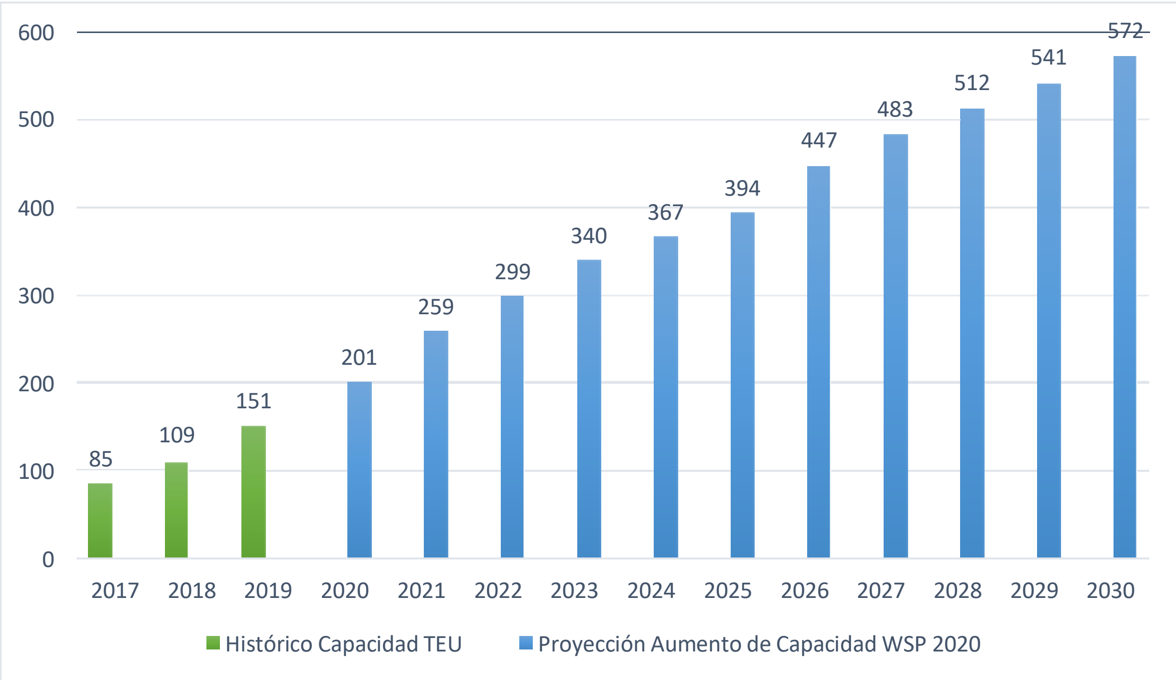
Table 5. *Cargo volume variation forecast.*

Year	Load Capacity Forecast (TEU)	Absolute variation	Percentage
2020	201		
2021	259	28.86	29
2022	299	48.76	15
2023	340	69.15	14
2024	367	82.59	8
2025	394	96.02	7
2026	447	122.39	13
2027	483	140.30	8
2028	512	154.73	6
2029	541	169.15	6
2030	572	184.58	6

Source: Yilportecu S.A.
Compiled by author

Finally, it is concluded that the forecasted volume as of 2030 will have an increasing trend, that is, the load capacity will progressively increase as can be seen in Figure 17, which shows the historical data and the forecasted data.

Figure 17. *Historical and Forecasted Data Container Capacity*



TEU Historical Data **Forecasted Capacity Increase WSP 2020**

Source: Yilportecu S.A.
Compiled by author

4.2.3. Increase during the construction of Dock 6 and Dredging

During the construction phase of Dock # 6 in Puerto Bolívar, it is expected that there will be an increase in land traffic as a result of the mobilization of construction materials and sea traffic due to dredging activities.

Dredging

From March to May 2021 and from November 2021 to January 2022, it is expected to dredge 1.5 million mm^3 to estimate the change that dredging will generate in sea traffic. Data on the number of trips and estimated dredging volume in mm^3 were used from the daily dredging reports in April and May of 2019. With the data collected, the variable amount of dredging per trip was obtained, resulting from the division of the total amount dredged in the day by the number of trips as described by Table 6.

Table 6. *Dredged Volume in 2019.*

Date	Trip	Dredged Volume (m^3)	m^3 per trip (volume/trip)
2019-APR-10	2	10734	5367.000
2019-APR-11	6	34709	5784.833
2019-APR-12	5	48075	9615.000
2019-APR-13	4	29573	7393.250
2019-APR-14	6	52249	8708.167
2019-APR-15	6	48558	8093.000
2019-APR-16	5	37842	7568.400
2019-APR-17	6	45254	7542.333
2019-APR-18	5	37581	7516.200
2019-APR-19	6	38415	6402.500
2019-APR-20	4	15648	3912.000
2019-APR-21	6	33448	5574.667
2019-APR-22	5	27852	5570.400
2019-APR-23	6	60485	10080.833
2019-APR-24	6	62692	10448.667
2019-APR-25	6	53586	8931.000
2019-APR-26	6	53253	8875.500
2019-APR-27	5	36687	7337.400
2019-APR-28	6	64218	10703.000
2019-APR-29	6	68232	11372.000
2019-APR-30	6	70913	11818.833
2019-MAY-01	6	79214	13202.333
2019-MAY-02	6	73082	12180.333
2019-MAY-03	5	63456	12691.200
2019-MAY-04	2	26024	13012.000
2019-MAY-05	4	48261	12065.250
2019-MAY-06	6	52184	8697.333
2019-MAY-07	6	47001	7833.500
2019-MAY-08	6	46151	7691.833
2019-MAY-09	6	44760	7460.000
2019-MAY-10	6	44392	7398.667
2019-MAY-11	6	44100	7350.000
2019-MAY-12	7	50661	7237.286
2019-MAY-13	5	35253	7050.600
2019-MAY-14	6	37518	6253.000
2019-MAY-15	6	44397	7399.500

Date	Trip	Dredged Volume (m^3)	m^3 per trip (volume/trip)
2019-MAY-16	6	61918	10319.667
2019-MAY-17	6	59640	9940.000
2019-MAY-18	5	44339	8867.800
2019-MAY-19	7	80193	11456.143
2019-MAY-20	6	62691	10448.500
2019-MAY-21	6	62566	10427.667
2019-MAY-22	6	63426	10571.000
2019-MAY-23	7	72815	10402.143
2019-MAY-24	6	73698	12283.000
2019-MAY-25	5	47022	9404.400
2019-MAY-26	6	66838	11139.667
2019-MAY-27	6	68690	11448.333
2019-MAY-28	7	79089	11298.429
2019-MAY-29	6	62878	10479.667
2019-MAY-30	7	67949	9707.000
2019-MAY-31	6	59061	9843.500

Source: Yilportecu S.A.
Compiled by author

Then, we obtain the mean of the aforementioned variable, which was 8828.018 $mm^3/ttttttt$. With this data we proceed to estimate the number of trips to carry out the dredging. $\frac{1.5MM}{8828,018} = 170\ tttttttttt$. 170 days are distributed in similar proportions for the 6 dredging months as shown in the table.

Table 7. *Forecast of traffic caused by dredging.*

Month	Number of trips, forecast
March 2021	28
April 2021	28
May 2021	28
November 2021	28
December 2021	28
January 2022	30

Source: Yilportecu S.A.
Compiled by author

Therefore, it can be concluded that the increase in sea traffic due to dredging activities, during the construction of Dock #6, is not significant, when compared to the existing sea traffic in Puerto Bolívar.

Transport of Materials

The construction of the dock will also generate the transfer of construction materials. For this reason, land and sea travel that will influence the traffic forecasts was estimated. The methodology used was to divide the volume of construction materials by the average capacity (11 mm^3 or 31 tons) of a dump truck or (10000 tons) of an export vessel, to obtain the estimate of trips necessary to move the construction materials.

The following table shows an estimate of certain construction materials with their respective quantities, type of transportation and estimated dates of mobilization.

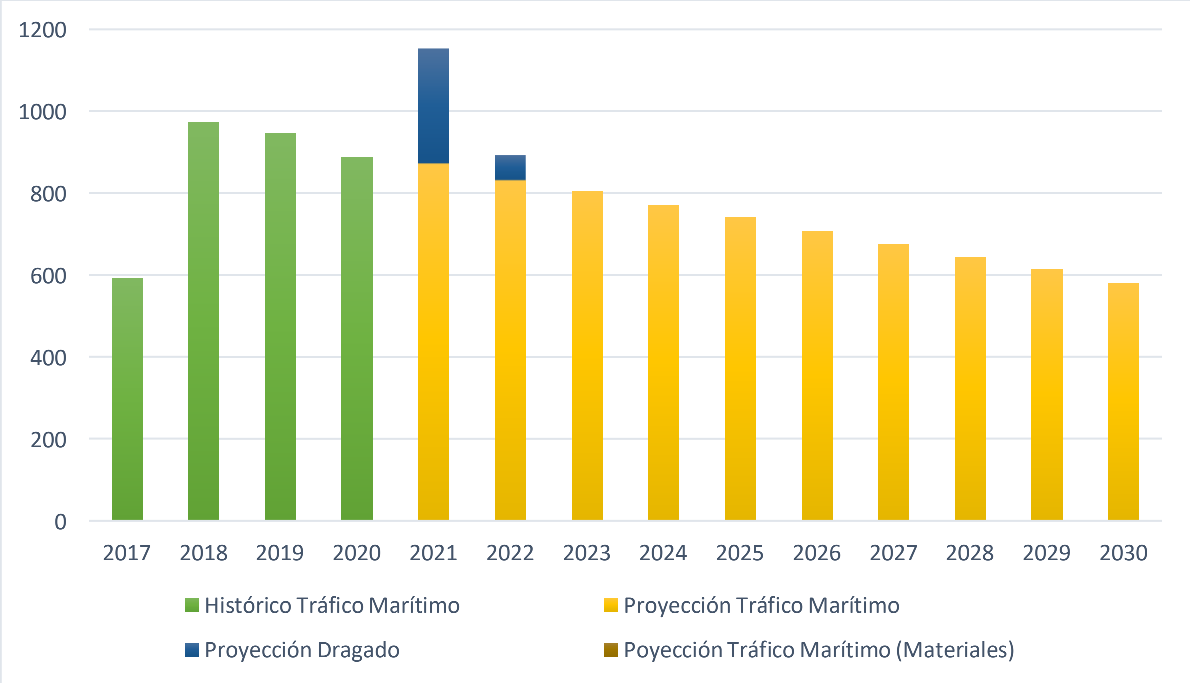
Table 8. *Requirement of construction materials forecasted for Dock 6.*

Dock Construction	Number	Transport Type	Date	Total Trips
Concrete (m^3)	41000	Land	Aug 21 - Aug 22	3727
Steel (tons)	10000	Land		323
Piles (tons)	30000	Sea	Feb 21 - Jun 21	3
Fenders (Parts)	25			
Bitts (Parts)	25	Sea	Aug 22	
Ladders (Parts)	13			1
Pavement				
Concrete (m^3)	30000	Land		2727
Cobblestones (m^2)	120000	Land	Mar 21 - Aug 22	
Subbase material (m^3)	16000	Land		1455

Source: Yilportecu S.A.
Compiled by author

Figure 18 and Figure 19 show the change in forecasted sea and land transport.

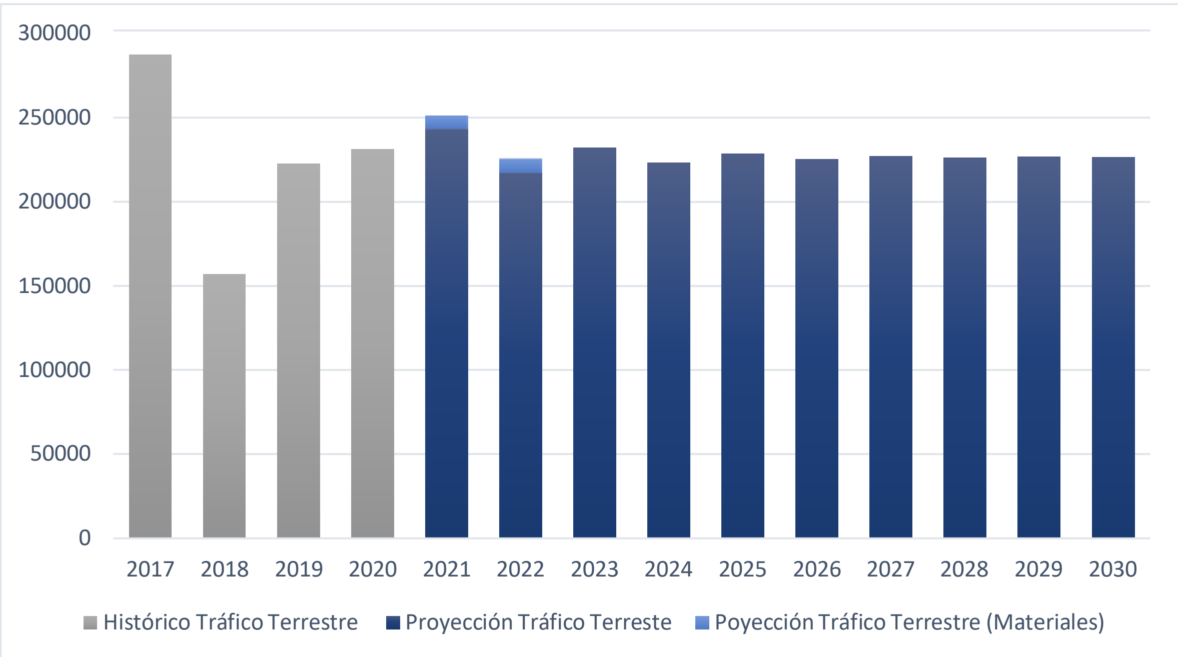
Figure 18. *Historical data and forecasted sea traffic, including mobilization of materials in the construction stage of Dock 6 and dredging.*



Sea Traffic Historical Data **Forecasted Sea Traffic**
Forecasted Dredging **Forecasted Sea Traffic (Materials)**

Source: Yilportecu S.A.
Compiled by author

Figure 19. *Forecasted land traffic, including mobilization of materials in the construction stage of Dock6.*



Historical Land Traffic Data Forecasted Land Traffic Forecasted Land Traffic (Materials)

Source: Yilportecu S.A.

Compiled by author

In conclusion, the sea traffic projected in this scenario will be influenced by dredging and not by the transfer of construction materials. And in relation to land traffic, it is expected that there will be a slight increase concerning the forecast. This is caused by the trips that will be made to move construction materials.

5. Conclusions

The data of the last 3 years of seaport traffic, related to the activity of YILPORTECU, has a slight growing trend. Although in 2020, due to the global economic crisis derived from the Covid 19 pandemic, it begins to show a decrease, which affects the forecasts as of 2030, in the "no increase in capacity" scenario. However, the "increased capacity" scenario shows a growth in cargo movement, which undoubtedly increases the volume of sea and land traffic.

The characteristics of land traffic have undergone an important change. In 2017, the largest value of land traffic corresponded to trucks with bulk cargo, while, at present, the largest value of traffic is related to containers. This has decreased the net land traffic by implementing a more efficient form of transport and the transport of more cargo units per transport unit. Forecasts show that this trend would continue until 2030.

Sea traffic also shows changes in the analyzed period, and less waiting and anchoring time of vessels is observed, showing greater efficiency in port operations.

The construction period of Dock # 6 will have a direct impact on the increase in land traffic, while sea traffic will be slightly influenced by dredging activity in specific months as planned for this activity.

6. Recommendations

It is recommended that road safety and traffic accident prevention measures be established on Bolívar Madero Vargas Avenue at the entrances and exits of the Port Terminal.

Establish a procedure to manage possible interactions of vessels with fishermen or other vessels moving in the maneuvering area and access channel.

ENVIRONMENTAL AND SOCIAL IMPACT STUDY, PUERTO BOLÍVAR PROJECT – PHASE 1

– HEALTH AND SAFETY IN THE COMMUNITY –

Prepared for:

[YILPORT PUERTO BOLIVAR LOGO]

YILPORTECU TERMINAL OPERATIONS, YILPORTECU S.A.

Produced by:

[SAMBITO TOTAL ENVIROMENTAL SOLUTIONS LOGO]

ECOSAMBITO C.LTDA.

December 2020

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ACRONYMS

APPB	Port Authority of Puerto Bolívar
EHA	Environmental Heath Areas
ESIA	Environmental and Social Impact Assessment *(EIAS)*
INEC	National Institute of Statistics and Census
GN	Guidance Note
ND	Performance Standard
HIA	Health Impact Assessment
HSE	Health, Security, and Environment
IFC	International Finance Corporation
MSP	Ministry of Public Health
MASS	Guidelines of the World Bank Group on Environment, Health, and Safety
PAC	Potential Affected Communities

EXECUTIVE SUMMARY

Based on the environmental and social risk and impact assessment developed in compliance with ND1, and to properly identifying aspects that could affect the health and safety of the community. This document has been structured to develop an assessment of the potential impacts on community health related to Yilportecu's activities.

Performance Standard 4 recognizes that the activities, equipment, and infrastructure of a project can increase the potential for the community to be exposed to risks and impacts. While recognizing the role of public authorities in promoting public health and safety, Performance Standard 4 focuses on the Promoter's responsibility to avoid or minimize risks and impacts to community health and safety that may arise from project-related activities, with particular attention to vulnerable groups.

This document identifies, analyzes, evaluates, and prioritizes risks and impacts on community health and safety using internationally recognized methodologies.

Measures have been structured with the results of this analysis that focus on the prevention of risks and impacts on the community, following recommendations set forth in international guidelines.

HEALTH AND SAFETY IN THE COMMUNITY

Performance Standard 4 provides that the activity, equipment, and infrastructure of a project may involve environmental and social risks and impacts that expose the project's area of influence to the community.

The process of identifying environmental and social risks and impacts provides an opportunity to detect, assess, and address the potential impacts and risks of the project to affected communities and to reduce the incidence of accidents, injuries, illnesses, and deaths as a result of project-related activities. Communities are not homogeneous, and therefore, there may be differentiated impacts among various groups such as women, men, youth, elderly people, people with disabilities, and vulnerable groups, which must be taken into account. The scope, depth, and type of analysis should be proportional to the nature and scale of the potential impacts of the proposed project, and the potential impacts on the health and safety of the local community.

The result of this analysis is to implement prevention strategies and mitigation of these impacts through measures that will be determined in the Environmental and Social Management Plan of this study

1. Introduction

Project activities may have a direct or indirect impact on community exposure to environmental-related health risks, such as communicable diseases, changes in food and nutrition, accidents with dangerous equipment and materials, among others. Factors that can contribute to these effects are a sudden influx of job seekers or family members who cause overcrowding in households and increased demand for food, health services, and sanitation, with respective consequences on community health; introduction of infectious diseases, changes in people's mobility, among others.

This type of impact, if not properly managed, can lead to damage to relationships with government communities or institutions, delay project implementation, lead to legal liability, and other additional costs. However, when properly managed, impacts on community health can reduce unnecessary costs (downtime, compensation) and help create positive perceptions. Many health problems can be solved by applying simple and economic methods, such as immunizations, information, education and communication programs, management of surface water drainage, etc.

1.1. Objectives

- Foresee and avoid adverse impacts on the health and safety of Affected Communities during the project, resulting from both routine and unusual circumstances.
- Ensure that the safeguarding of personnel and property is carried out in accordance with the relevant human rights principles and in a manner to avoid or minimize risks to social actors in the project's area of influence.

1.2. Scope

The applicability of this Performance Standard was determined during the process of identifying environmental and social risks and impacts and covers the possible risks and impacts of project activities on Affected Communities during the different stages of the project: Construction, operation, and dredging of the Port Terminal of Puerto Bolívar.

The geographical boundaries of this study cover the urban area of the Machala canton, as the IAS considers a large part of the urban area of this city in determining its area of direct and indirect influence.

The timeline for this study covers 50 years, from granting of the port operation to Yilportecu, starting in 2017.

The proposed prevention and control measures to avoid and counteract the identified risks and impacts will be based on good international industry-recommended practices, such as the World Bank Group on Environment, Health, and Safety (MASS) guidelines or other internationally recognized sources. The implementation of the actions necessary to comply with the requirements of this plan is included in the proposed Environmental and Social Management Plan. The implementation of this Plan will be in charge of the Department responsible for the HSE Department of Yilportecu, in charge of Community Relations.

2. Requirements and regulations

2.1. Requirements

The following are the requirements of IFC Performance Standard 4: Community Health and Safety.

Community health and safety requirements. The risks and impacts to the health and safety of the affected Communities will be assessed throughout the project cycle and prevention and control measures will be determined in accordance with good international industry best practices.

Infrastructure and equipment design and security. The structural elements or components of the project shall be designed, constructed, operated, and deactivated, in accordance with good international best practices for the industry, taking into account the safety risks to third parties or the Affected Communities.

Hazardous Materials Management and Safety. The potential for the community to be exposed to hazardous materials and substances that the project could generate will be avoided or minimized.

Services provided by ecosystems. The project can affect priority services provided by ecosystems, generating risks and adverse impacts on health and safety in affected communities. Where appropriate and feasible, these potential risks and impacts will be identified. Adverse effects should be prevented, but if not, mitigated.

Community exposure to disease. Possible community exposure to water-related, vector-borne diseases as well as communicable diseases that project activities may influence will be avoided or minimized, taking into account the differentiated exposure of vulnerable groups and their increased sensitivity.

Transmission of communicable diseases that may be associated with temporary or permanent migration of the project workforce will be avoided or minimized.

Emergency preparedness and response. Assistance and collaboration will be provided with Affected Communities, local government agencies, and other relevant parties in the preparations for effective emergency response.

Security personnel. In the event that employees or contractors are hired directly to provide security to protect their personnel and property, assess the risks that safety arrangements may entail for those on or off the project site.

2.2. National and international regulations

There are no regulatory requirements in the Ecuadorian territory related to the need for health and safety assessments of this kind. This report is developed as a requirement of international financial institutions.

The activities of the Puerto Bolívar Phase 1 project will fall within the requirements of Ecuadorian health and safety legislation, as well as international treaties to which the country is attached.

- Constitution of the Republic of Ecuador
- Health Code
- Environmental Organic Code
- National Sexual Health and Reproductive Health Plan
- Social Security Law
- Ecuador Transit Law
- Organic Human Mobility Law

International treaties to which Ecuador is attached, in the field of health and sanitation

- Universal Declaration of Human Rights
- American Convention on Human Rights
- Ottawa Charter for Health Promotion

3. Description of the project

This section presents a summary description of the project, reported more extensively in Book I. Presentation and description of the Environmental and Social Impact Study project.

3.1. Location

Phase 1 Puerto Bolivar expansion project, carried out by Yilportecu, is located in the parish of Puerto Bolívar, city of Machala, capital of El Oro province, on the south coast of Ecuador, and covers the Port Terminal of Puerto Bolívar, pier dredging, maneuvering area, and the access channel to the terminal.

The project's area is a consolidated urban area, which has grown and developed based on three main activities: Port activity, fishing, and tourism.

3.2. Key operational aspects

Puerto Bolívar contributed 5% of the total cargo mobilized at the national level, totaling 1,849,655.02 TM (Ministry of Transport and Public Works, 2019).

The vast majority of cargo handled by Puerto Bolívar is banana exports. In order to expand its service offering for the importing and exporting sector, Yilport is therefore developing new services:

- Export of mineral concentrates: Service for the mining sector. Currently, big bags of material are handled which are received, stored, and exported as piece goods on special boats for this type of cargo. In a second phase, it is planned to implement rotainers technology that will allow bulk loading on bulk vessels.
- Solid bulk handling. For storage and distribution of grains, Yilport considers the building of silos, horizontal transport from the ship to silo can be carried out with dump trucks and hoppers, and later, switch to conveyor systems.
  Storage of coal, cement, pet coke, or similar bulk will be open at first, with tarpaulins to cover if necessary. This will evolve into closed, probably dome-like silos when demand requests it.
- Ro-Ro. Reception and storage of vehicles for the southern region of Ecuador.

3.2.1. Existing infrastructure

The concession area is 72 hectares, completely enclosed and delimited, occupied by warehouses, industrial buildings, administrative offices, storage yards, internal circulation routes, parking and maneuvering yards, docks, and other infrastructure.

- 920 meters in berthing line divided into five berths
- 9 patios, totaling 192,186 m^2
- 13 warehouses among open and closed together occupy 26,054$^{m\ 2}$

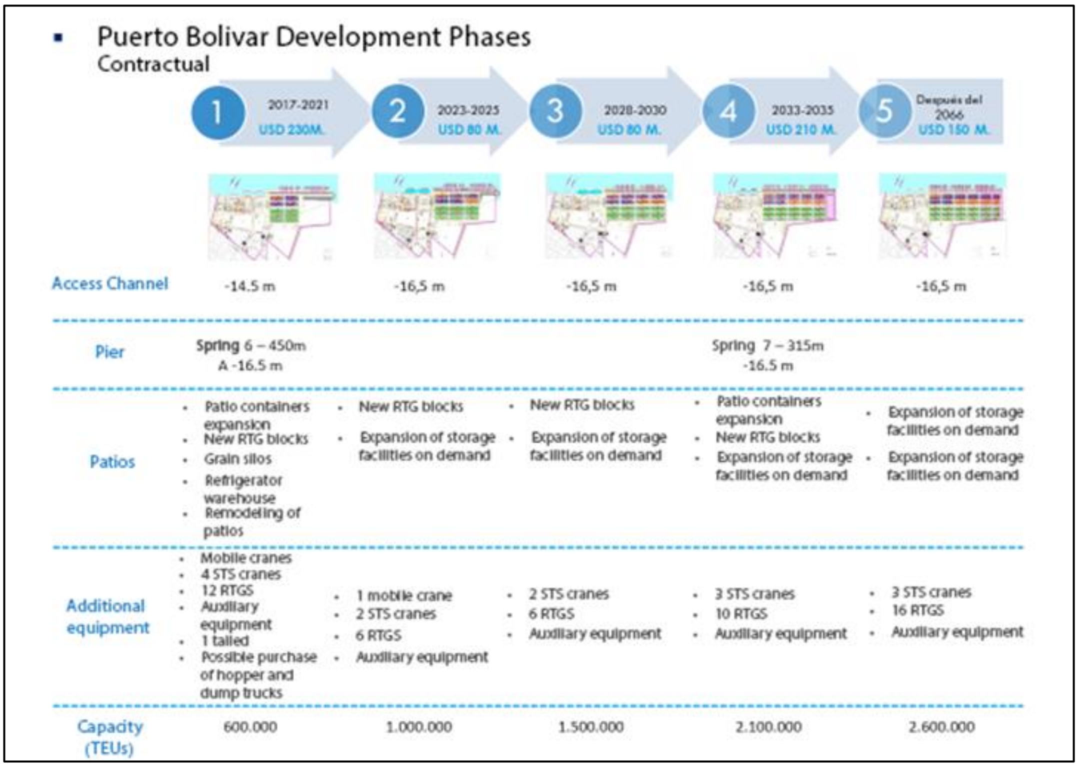
3.2.2. Expansion project

The concession of the port operation from Puerto Bolivar to Yilportecu is 50 years. During this period, the Port Terminal is being expanded in phases. Figure 1 shows the main works and capabilities that they expect to achieve (projections of the growth of cargo movement in TEU), and that will be the “triggers” of the following stages. An operational capacity of 2,600,000 TEUs is expected to be achieved by 2066.

The phase that is immediately planned is Phase 1, which will be developed between 2021 and 2022 and will be operational in March 2023. It includes the construction of a pier 450 meters long, 62 meters wide, and a depth of -16.5 meters below the level of average low tides of syzygy (MLWS), for the berthing of porta-container vessels up to 200,000 tons of deadweight (TPM), a 12 hectares container patio for storage. In addition, 4 STS (“ship-to-shore”) and 12 RTG (“rubber tire gantry”) dock cranes will be equipped to stack containers in the yards. It will have all the basic services, an electrical power system of all the load management equipment, and an emergency electric power generation system. In addition, other cargo segments will be developed, with the construction of infrastructure for cereals or other solid bulk such as cement, clinker, copper, etc.

This phase will increase the reception and handling capacity of Puerto Bolívar containers to 600,000 equivalent 20-foot containers ("TEUs: twenty equivalent units").

Figure 1. Main activities and temporary projections of Puerto Bolívar project



Source: Yilportecu S.A.

3.3. Project access routes

At the local level, Puerto Bolivar is located 10 minutes by road from the city center of Machala. The current system linking the city of Machala and its port with neighboring areas, production centers, neighboring provinces, and the rest of the country is a well-functioning network.

The main access road to the port is Avenida Bolívar Madero Vargas, which, in addition to Circunvalacion Norte and Circunvalacion Sur roads, form a circulation network connecting the Port Terminal with Av. 25 de Junio, and through this with the national road network:

- Guayaquil Axis Road – Machala (Route E40 and Route E25, distance 197 km, 3h17)
- Tumbes Axis Road – Machala (Route E25 and Route E50, distance 185 km, 3h)
- Cuenca Axis Road – Machala (Route E59 and E50, distance 168 km, time 3h17)
- Loja Axis Road – Machala (Route E35, E50, and E25, distance 233 km, time 4h20)

- Quito Axis Road – Machala (Route E25 and E87), distance 521 km, time 9h)
- Puerto Bolívar – Machala – Pasaje – Girón – Cuenca – Paute – Amaluza – Mendez – Puerto Morona Road.
- Puerto Bolívar – Machala – Santa Rosa - Balsas - Chaguarpamba – Loja – Zamora – Yantzatza – El Pangui – Gral. Leonidas Plaza y Méndez Road

The zone of terrestrial influence of the Port Terminal, or its *hinterland*, covers the southern Ecuadorian sector, efficiently serving the provinces of El Oro, Azuay, Loja, Cañar, Zamora, The nearest sector of the provinces of Guayas and Morona Santiago, and the north of Peru.

3.3.1. Vehicular traffic

Regarding traffic generated by cargo transport from and to the port, this is mainly caused by banana transport. The traffic analysis developed as part of the complementary studies of the IAS (Book V.D. Port Traffic Assessment), shows a trend toward the decline of land traffic in the Port Terminal, although the data expose greater movement of cargo vessels. This trend to the decrease in traffic is due to the effect of cargo containerization.

Between 2017 and 2020, the container cargo influx has increased from 4% to 49%. This means that the number of trucks of all sizes, which transported banana boxes to the port in the past, is decreasing rapidly and are being replaced by larger capacity containers pulled by only one header. In this regard, road use, implementation of appropriate signage, disclosure of schedules, training to staff, and other considerations are essential for them to avoid traffic accident risks and/or involving pedestrians or private property in the project's area of influence.

3.3.1. Maritime traffic

In the document Book V.D. Port Traffic Assessment, maritime traffic data between 2017 and 2020 are analyzed, showing a slight increase. It is to be hoped that an increase in the capacity of Yilportecu's operations will accentuate the trend of increasing port maritime traffic. However, the trend in global maritime traffic is oriented toward the use of fewer vessels, but each of them with greater cargo and transport capacity. Thus, even if maritime traffic increases, the number of vessels that will be recalculated in Puerto Bolívar will tend to decrease.

3.4. Operational support

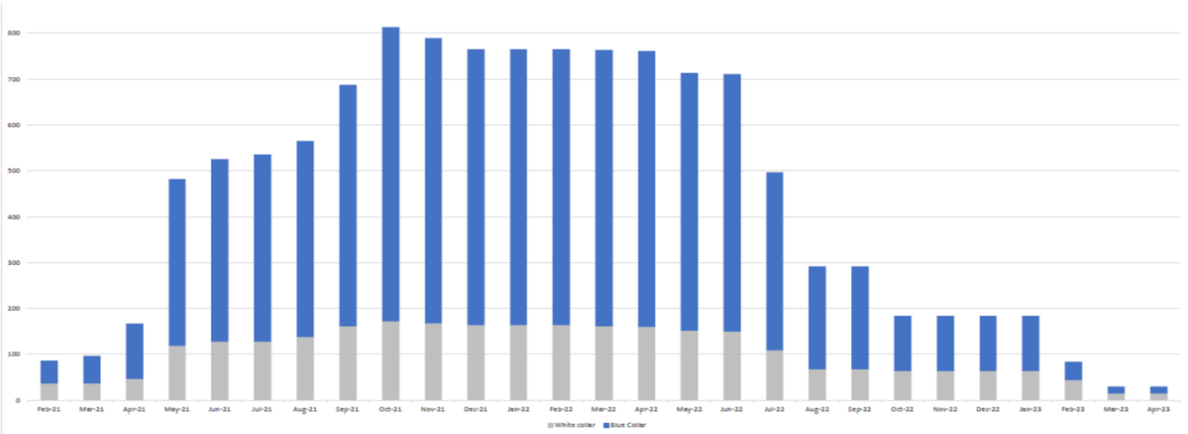
Operation. By granting this international Port Terminal to a multinational company, the presence of foreign personnel has become more pronounced. However, they are operational staff in positions that require high skills and specific experience.

Construction. The Phase 1 expansion will be carried out by an international contractor in partnership with nationals. Details of the methods of work can be found in Book I. Project Presentation and Description, Annex 7.

Some of the necessary services are expected to be provided by local subcontractors, except those who are highly specialized and require hiring personnel from other cities, such as Guayaquil or Quito.

Below is the labor demand expected for this phase. Stacked bars show the number of blue-collar workers (workers), and white-collar workers (technical heads and administrative workers). The peak demand for labor is estimated between May 2021 and July 2022, with between 500 and 800 workers, among extension employees, contractors, and subcontractors

Figure 2. Estimated labor at the Pier 6 construction stage



A camp will be built where there will be offices, cafeterias, and all hygiene services for the construction personnel, in accordance with Ecuadorian legislation. There will be no housing or camps for staff at the workplace.

Local staff will be recruited for labor; however, the foreign staff is expected to be in strategic positions. The foreign staff will be accommodated in the city of Machala, near the project area, where there is sufficient accommodation infrastructure.

3.5. Project timeline

The building of Puerto Bolívar Pier 6 is planned to be completed in 27 months, between 2021 and 2022, in which works will be carried out continuously.

4. Methodology

4.1. HIA within the framework of the project

This report is presented as a supplementary study of the Environmental and Social Impact Study (EIAS) of the Puerto Bolívar Expansion Project Phase 1.

Prevention and mitigation measures that have been carried out based on the risk and impact assessment results are presented at the end of this report and are also part of the EIAS Environmental and Social Management Plan.

4.2. Potentially affected communities

Potentially Affected Communities (PACs) will be a subgroup of the stakeholders and social actors identified in Book IV.C. Social Baseline, developed in the EIAS (chapter 16) and classified by the interest-power and attitude-activity matrix.

4.3. Nature of impacts assessed

This report specifically detects and evaluates the direct and local impacts of project activities on the affected population. They are not considered cumulative impacts on the population.

4.4. Health impacts and risks

The Environmental Health Areas (EHA) methodology will be used to identify health risks and impacts to the community. Within this methodology, the Limited in-country approach will be applied, which does not provide for new data collection within the communities of interest but is based on the review of existing data from various sources. As national statistics established at the National Institute of Statistics and Census (INEC), and other official sources. Methodological steps are:

- Preliminary Assessment: Identification of key aspects to determine the need for an HIA.
- Determination of Scope: Establishment of geographical, spatial, and temporal boundaries, determination of the type of approach for analysis.
- Baseline: Relevant information from Environmental Health Areas (EHA).
- Risk Assessment: Description of potential risks, identification, evaluation, and ranking.
- Action Plan: Prevention and mitigation measures based on identified risks.
- Monitoring and evaluation: Define indicators for data collection.

4.4.1. Risk and impact ranking

The Fundacion Natura matrix (1996) has been used for risk and impact ranking. The probability of occurrence of risk is rated on a scale of 1 to 4, according to the percentage

scale given. Consequences are rated on a scale from A to D, where A corresponds to non-important consequences and D to very serious consequences according to the following definitions:

- Not important: No danger, damage, or subsequent complications

- Limited: Consequences with a punctual, planned, and delimited extension

- Serious: Significant consequences

- Very serious: Severe consequences

Table 1. Risk Rating based on probability and consequences

		Consequences			
		Not important	Limited	Serious	Very serious
Probability		A	B	C	D
4	Greater than 25%	Low	Moderate	High	Very High
3	Between 5 and 25%	Low	Moderate	Moderate	High
2	Between 1 and 5%	Low	Low	Moderate	Moderate
1	Less than 1%	Low	Low	Low	Low

Low	Moderate	High	Very High

Source: Modified from Fundacion Natura, 1996.

Once qualitatively rated, each risk in terms of probability and consequences, the risk category in which it is grouped according to both scores is determined, with categories: Low, Moderate, High, and Very High.

At this point, the range of risks to be managed is decided, in this case, the risks will be Moderate, High, and Very High.

4.4.2. Sectoral impact approach

This section provides a mini-identification of possible aspects that will impact the health of the community. For this purpose, the criteria for accommodation, water supply, sanitation and food, transport, and communication are analyzed for the project.

4.4.2.1. Accommodation

As indicated in 3.4. Operational support, no camps, or any temporary or definitive accommodation, will be built for the project staffing requirement. Labor will be settled close by, and foreign staff will be accommodated in rental housing in the city of Machala.

4.4.2.2. Water, sanitation, and food supply

Water provided through tankers will be used during the construction phase to supply hygienic services and operations. This water is obtained from wells that are part of the city's public supply network.

Water for human consumption of workers will be provided in bottles (20 liters) by distributors of private treating plants in Machala.

Regarding sanitation, the black and gray waters during the construction phase will be sent in tankers to the oxidation lagoons of the city. The city of Machala has little treatment of domestic wastewater.

During operation, the demand for personnel will be significantly lower, so the local drinking water supply will not be impacted. Wastewater during this stage will be connected to the Port Terminal's treatment plant.

In terms of food, Yilportecu has a dining room for its workers; however, when the presence of new construction workers is greater, it will be necessary to implement cafeterias on the work fronts and to hire an express food service.

4.4.2.3. Transportation

Routes will not be expanded or changed during the construction and operation of the Port Terminal. No other means of land, sea, or air transport shall be affected. The reason for the project is the improvement of port services and an efficiency gain that will be reflected in lower flows of land and sea traffic, despite the expected increase in the exported cargo.

4.4.2.4. Communication and distribution of information

Yilportecu, through its Department of Safety, Health, and Environment, and the Department of Projects, makes the publication in the written press, about the starting of construction and dredging works. It also communicates to the competent institutions by written communications.

In addition, regarding environmental permits, Yilportecu has carried out a social participation process prior to the dredging license, while it is in the execution of other socialization processes, through which it is making known the expansion projects.

4.4.3. Environmental health areas

The health areas to be included in the project analysis are then evaluated, with the help of a checklist established in IFC, 2009.

Those HAs that do not meet at least one verification criteria will be left out of the analysis.

Table 2. HIA detection process checklist

	Environmental Health Areas (EHA)	Things to consider	Verification
1	**Vector-related** *malaria, dengue, yellow fever*	○ Are there any of them in the project area?	√
		○ Will the existing road and water distribution patterns change due to the project?	
		○ Will there be an influx of workers from other areas?	√
2	**Respiratory and housing problems:** *acute respiratory infections, pneumonia, tuberculosis; respiratory effects of housing, overcrowding, housing inflation*	○ If there is a construction phase: ○ Will there be an influx of workers?	√
		○ Will there be work fields?	
3	**Veterinary medicine/ zoonotic problems:**	○ Will there be an interaction between the project and local livestock?	

	Environmental Health Areas (EHA)	Things to consider	Verification
	brucellosis, rabies, bovine tuberculosis, avian influenza, etc.		
4	**Sexually Transmitted Infections:** HIV/AIDS, syphilis, gonorrhea, chlamydia, hepatitis B	○ Will the project trigger an influx?	√
		○ Will the project trigger long-distance truck trips?	√
5	**Diseases transmitted by soil and water** *Giardiasis, worms, water access and quality, excrement management*	○ Will the project cause an influx?	√
		○ Will the project change the quality or distribution of water or soil in nearby communities?	
6	**Food and nutrition issues:** *Malnutrition, anemia, micronutrient-related diseases, changes in agricultural and hunting/fishing/harvesting practices, gastroenteritis; food inflation.*	○ Will the project cause an influx?	√
		○ Will the project change agricultural practices or food distribution?	
7	**Accidents/injuries** *road traffic, spills and spills, construction (related to home and project), and drowning*	○ Will the project cause an influx?	√
		○ Will the project trigger changes to existing road/rail/boat/air transport patterns?	√
		○ Will there be a temporary or permanent increase in road transport?	√
8	**Exposure to potentially hazardous materials** *Pesticides, fertilizers, road dust, air pollution (indoor and outdoor, vehicle-related), landfill waste or incineration ash, any other solvent, paint, oil, or cleaning agent related to the project, by-products, or release events*	○ For an existing installation: ▪ Is there a history of air/water/soil spillage? ▪ Have there been any complaints or concerns from the community regarding previous emissions?	√
		○ Will hazardous materials waste be transported to/from the site?	√
		○ Will hazardous material be used at the site?	√
		○ Are emissions expected to air, water, or soil?	√
		○ Are community exposure problems foreseen concerning the construction and operation phases of the facility?	
9	**Psychosocial (social, including key determinants of health):** *resettlement/relocation, violence, safety issues, substance abuse (drugs, alcohol, tobacco), depression, and changes in social cohesion*	○ Will the project cause an influx?	√
		○ Will there be work fields?	
		○ Is resettlement/relocation necessary?	
		○ Will the project change existing subsistence practices, i.e. access to hunting/fishing/agriculture?	
		○ Will temporary or permanent jobs be created for the local population?	√

	Environmental Health Areas (EHA)	Things to consider	Verification
		○ Will the project have any effect on equity or equality?	
10	**Cultural health practices** *role of traditional medical providers, indigenous medicines, and unique cultural health practices*	○ Will the project change the access or conventional health status service providers?	
11	**Infrastructure and capacity of health services** *Physical infrastructure, staffing levels, and competencies, technical capacities of health centers at the district level; program management delivery systems: Project coordination and alignment with existing health programs at the national and provincial levels (e.g., TB, HIV/AIDS), and future development plans.*	○ Will the project cause an influx?	√
		○ Will the project provide all health services to its workers?	
12	**Non-communicable diseases (NCDs):** *hypertension, diabetes, stroke, and cardiovascular disorders, and cancer*	○ Will the project cause an influx?	√
		○ Will there be work fields?	
		○ Will temporary or permanent jobs be created for the local population?	√

Source: Modified from IFC, 2009.

4.5. Impacts on community security

Identification of these impacts has been made based on requirements of Performance Standard 4 and determining which of those aspects are not directly evaluated in the criteria included in the EHA. These requirements are:

- Infrastructure and equipment design and security
- Emergency preparedness and response.
- Security personnel.

These impacts are evaluated in the General Matrix of Environmental Impact Assessment in EIAS (VI.A. Environmental and social impact assessment), through the Modified Leopold Matrix methodology. The segment of this assessment is also presented later in this document.

5. Baseline analysis

This chapter describes the aspects of the Health Areas established in the HIA methodology, based on Performance Standard 4, for the project implementation area. According to Table 2 and Table 3, 10 health areas will be considered in this analysis, excluding Zoonotic Problems and Cultural Health Practices, as they are considered not relevant in the area where the project is developed.

Data from official agencies such as the Ministry of Public Health of Ecuador, the National Transit Agency, and the National Institute of Statistics and Census are included. The data presented are the most current that have been published by these institutions, and are presented for the province of El Oro, given that few health data are disaggregated in more detail.

5.1. Vector-related diseases

In terms of vector diseases, the epidemiological situation of Ecuador is influenced by the distribution and density of the different vector species, especially the arboviruses transmitted by the mosquitoes Aedes aegypti and Ae. Albopictus (Dengue, Zika, Chikungunya, Mayaro), and parasitosis transmitted by mosquitoes Anopheles. (Malaria), phlebotomies (leishmaniasis) and triatomine bed bugs (Chagas disease). The population conditions of the vectors being linked to socio-economic, environmental, and ecological variables, as well as to the provision of basic services and access to timely health care, Condition the occurrence of epidemic rallies, and the maintenance of endemic vector disease transmission (Ministry of Public Health, 2021)

Table 3. Cases of vector-borne diseases in Ecuador.

Event	*2015*	*2016*	*2017*	*2018*	*2019*	*2020**
Dengue fever	42.459	14.159	11.387	3.094	8.416	16.570
Chikungunya	33.619	1.860	196	8	2	1
Zika	1	2.947	2.413	10	0	0
Yellow fever	0	0	3	0	0	0
Malaria	686	1.191	1.380	1.806	2.081	1.946
Leishmaniasis	1.382	1.397	1.654	1.336	1.108	924
Chagas disease	45	44	61	79	167	113
Mayaro	-	-	-	-	5	-

Source: Monitoring System (SIVE-ALERTA)
Produced by: National Department of Epidemiological Monitoring
*Data 2020 for epidemiological weeks 01-53

As shown in Table 3, Chikungunya, Zika, Yellow Fever, and Mayaro, are diseases that have been decreasing their incidence in recent years.

Leishmaniasis is a disease caused by the bite of some Diptera species of the subfamily Phlebotomine (white manta), infected with parasites of the genus Leishmania. In the province of El Oro, 9 cases were reported in 2020.

Dengue is a disease caused by the bite of female Aedes Aegypti and Aedes Albopictus mosquitoes infected with the DENV virus. It can be fatal if no proper clinical care is provided. In El Oro province, 958 cases were reported in 2020. While in the canton of Machala the incidence rate of dengue of 42.3 per 100,000 inhabitants.

Malaria is a disease caused by the bite of some species of female Anopheles mosquitoes, infected with the parasites P.vivax, P.falciparum, P.malariae, and P.ovale. In Ecuador, infections are caused by P.vivax and P.falciparum, the latter being the one that produces the most complications or deaths. In El Oro province, 43 cases were reported in the year 2020

5.2. Respiratory and housing problems

Tuberculosis is a chronic infectious disease caused by the Mycobacterium tuberculosis complex, the most common form being pulmonary; however, it can also affect any other organ or tissue. It spreads through the air, the main source of infection are people with pulmonary tuberculosis who cough, sneeze, or expectorate, and who spread infecting droplets in the air that contain bacilli. Populations with certain health conditions such as people with HIV, in addition to those in custody and under the age of 15, have intrinsic and extrinsic factors that increase the risk of developing the disease.

Ecuador had an occurrence of 43 cases per 100,000 inhabitants (2017), with 6,094 total cases, of which 444 were in El Oro province (7.3 % of the national total).

Influenza is an ENDEMIC disease with a high transmission capacity caused by seasonal influenza viruses. The subtypes circulating in the country are A(H1N1)pdm09, A(H3N2), and type B.

Out of the total number of infections, 10% are considered to have a Severe Acute Respiratory Infection (SARS). The most recent data at the national level are 2018-2019, where 365 cases occurred, with a mortality rate of 2.7% (2018 November 13 - 2019 April 4). Of these, only 1 case was presented in El Oro province in the period described.

Pneumonia is the leading individual cause of infant mortality worldwide. Pneumonia is estimated to account for 15 percent of all deaths of children under the age of 5 worldwide. However, the most affected age group is 65 years and older. In 2020, 89,338 cases of pneumonia were reported in Ecuador, of which 173 occurred in El Oro province.

5.3. Sexually transmitted infections

Estimates by the MSP with UNAIDS technical support indicate that by the end of 2019, 47,206 people are living with HIV in Ecuador, of whom 4,320 were diagnosed in 2019, 257 in El Oro province (5.95%).

5.4. Diseases transmitted by soil and water

Food-borne diseases (ETAS) are generally infectious, toxic, and are caused by bacteria, viruses, or parasites that enter the body through contaminated food or water. The most common clinical manifestation is the appearance of gastrointestinal symptoms, although they can also lead to neurological, gynecological, immunological, and other symptoms.

Table 4. Cases of ETAS reported in Ecuador.

Event	2017	2018	2019	2020*
Other bacterial food poisoning	11861	15439	12203	5890
Hepatitis A	3499	4126	4314	1057
Salmonella infections	2063	2680	1614	1099
Typhoid and parathiphoid fever	1659	1476	1106	766
Shigellosis	560	386	248	112
Cholera**	1**	0	2**	0

Source: Monitoring System (SIVA-ALERTA)
Produced by: National Department of Epidemiological Monitoring
2020* Information obtained up to SE 01 *Data subject to change
**Non-toxigenic strain

Bacterial food poisoning: Bacteria can contaminate food at any time during production or processing. Symptoms include nausea, vomiting, diarrhea, abdominal pain and cramps, and fever. In Ecuador during 2020, 5,890 cases of bacterial food poisoning were reported, of which 70 cases were reported in El Oro province (1.18% of the national total).

Salmonella: Infection with this bacteria can be caused by the ingestion of contaminated animal foods such as eggs and raw derivatives, and meats not fully cooked, as well as by vegetables contaminated with feces or excrement. In Ecuador in 2020, 1,099 cases of Salmonella infections were reported, 49 in El Oro province (4.45% of the national total).

Typhoid fever: Typhoid is an acute disease caused by Salmonella enteric Typhi serovar, and paratyphoid is caused by Salmonella enteric Paratyphi A and B serovar. Transmission is fecal-oral through water and food contaminated with feces or urine from patients or carriers, vectors (flies and cockroaches) posing on foods in which they can multiply, and from person to person. The national total recorded in 2020 was 766 cases, of which 43 were in El Oro province (5.61% of the national total).

Hepatitis A: This is a liver disease caused by the hepatitis A virus (HAV). It is mainly transmitted when an uninfected person ingests something contaminated by feces from a person infected with this virus. This disease is linked to a lack of safe water, poor sanitation, and poor personal hygiene. In 2020, 1,057 cases were reported at the national level; 11 occurred in El Oro province (1.04% of the national total).

Shigellosis: This is an acute invasive enteric infection caused by bacteria belonging to the genus Shigella. It is endemic in most developing countries and is the most important cause of bloody diarrhea worldwide. In 2020, Ecuador recorded only 112 cases of Shigellosis, 4 of them in El Oro province (3.57% of the national total).

Table 5. Diseases at the national level and in El Oro province

Diseases	Total cases			
	Ecuador	El Oro	% of national total	Machala
Vectors				
Leishmaniasis	924	9	0.97%	
Dengue Fever	16570	958	5.78%	42.3/100,000 inh.
Malaria	1946	43	2.21%	
Respiratory and housing problems				
Tuberculosis	43 /100,000 inh.	444	7.30%	
* Influenza	365	1		
Pneumonia	89338	137		
Sexually transmitted infections				
** HIV	4320	257	5.95%	
Diseases transmitted by soil and water				
Bacterial food poisoning	5890	70	1.18%	
Salmonella	1099	49	4.45%	
Typhoid fever	766	43	5.61%	
Hepatitis A	1057	11	1.04%	
Shigellosis	112	4	3.57%	

* Between November 4, 2018 and April 13, 2019
** Data from 2019

Produced by: ECOSAMBITO

5.5. Food and nutrition issues

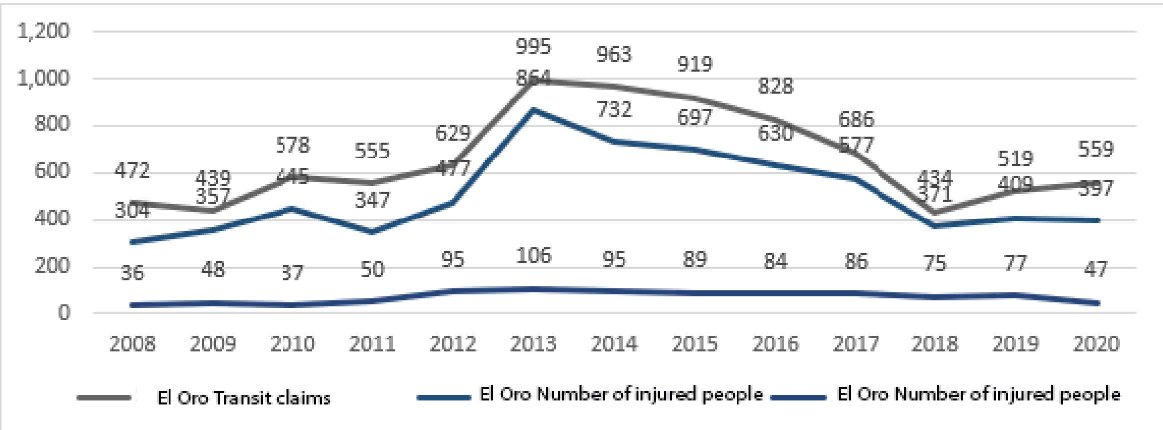
Acute malnutrition: A child with acute malnutrition is characterized by very low weight for height, may be accompanied by a degree of wasting or thinness, this type of malnutrition should be detected, be reported, and managed promptly because in a short time the child can go to a severe degree of acute malnutrition and be complicated by infectious diseases, being the leading cause of deaths among children in malnutrition. ***Moderate acute malnutrition***: Any patient younger than five years whose Z-score of the P/T indicator according to the WHO infant growth patterns may be accompanied by moderate weight loss or thinness.

Severe acute malnutrition: Any patient under 5 years of age whose Z-score of the P/T indicator according to the WHO infant growth patterns is below–3DE may also be accompanied by bilateral edema, severe wasting, and other clinical signs such as lack of appetite.

In 2018, Ecuador reported 3,549 cases of acute childhood malnutrition, of which 161 occurred in El Oro province. Full data are not available for subsequent years.

5.6. Accidents and injuries

Figure 3. Traffic accidents and injuries statistics



Source: National Transit Agency – Directorate of Studies and Projects

Data from the National Transit Agency - Directorate of Studies and Projects, regarding traffic incidents in El Oro province, show that these had a significant increase between 2012 and 2015, from when they begin to decrease. This situation is probably due to the improvement in the quality of road infrastructure, signaling, and improvement of the motor park. A slight increase has been observed since 2018. In 2020, in the province of El Oro, 559 incidents were recorded, with 47 persons killed.

5.7. Exposure to potentially hazardous materials

Toxics are substances capable of producing structural or functional injuries in an organ or system, and even causing death if they are present in the body in sufficient quantities.

Table 6. Cases of toxic and chemical effects, per year

Cases of toxic and chemical effects per type. Ecuador, years 2017, 2018, 2019, 2020, and 2021 (SE 12)					
EVENT	2017	2018	2019	2020	2021*
Pesticide poisoning	689	425	410	216	74
Snake bite	1450	1431	1489	1438	340
Scorpion sting	328	342	433	221	95
Methyl alcohol poisoning	75	5	7	1	0

ECUADOR SIVE-ALERTA TOXIC AND CHEMICAL MONITORING SUB-SYSTEM
Source: Monitoring System (SIVE ALERTA)
Prepared by: National Department of Epidemiological Monitoring
Information obtained up to the week 14 year 2021.
*data subject to changes.

As it can be seen in the statistics, pesticide poisonings are the most common events of exposure to hazardous substances. Out of the 216 national incidents in 2020, 32 occurred in El Oro province.

There are no records that there has been exposed to potentially hazardous materials in Puerto Bolivar or Machala. Industrial development is still recent, and when we talk about hazardous substances, we can identify the storage and marketing of fuels as the main risk in this regard, in addition to the handling of mineral concentrate for export, which includes: Transport, storage, handling, and shipping. This activity could be a new risk to which it is primarily exposed to workers who handle it, as the health risk is caused by prolonged exposure and inhalation.

The internal instructions in force at the Port Terminal and which are a priority part of the operation are: YECU-EHS-113- Instruction Mineral Spill Rotainer and YECU-EHS-SI-04-22-V5- BIG BAG Handling Instruction.

5.8. Psychosocial: Social determinants

For the description of this area of health, information was collected that addresses social aspects: Human Development Index, Poverty, Gini Coefficient and Education; Physical: Violence, Security and Mobility; and Economic: Population Demographics, VAB/PBI, Economic Active Population (EAP), Employment, Underemployment, Unemployment, and Degree of openness).

Table 7. Social indicators of Machala canton

Aspects	Social Determinants	Machala canton
Social	Human Development Index	0.755
	Poverty	8.6%
	Extreme poverty	2.0%
	Gini coefficient	0.411
	Education (illiteracy)	3.6%
Economic	Population demography	286,120.0
	VAB/PBI	3.32%
	Active Economic Population (EAP)	1.96%
	Employment Underemployment Unemployment	1.80% 0.38% 0.08%
Physical	Degree of openness	32.63%
	Security and mobility	73
	Violence (intrafamily, ill-treatment)	25.00%

5.9. Infrastructure and capacity of health services

In El Oro province, according to data from 2019, there are 38 health facilities, between public and private, totaling 1,089 hospital beds, with an occupancy rate of 54.07% (INEC, 2019).

Out of the health facilities in the province, 5 are general hospitals and 23 are basic hospitals.

The table below shows the health infrastructures of Puerto Bolívar parish and Machala canton.

Table 8. Health infrastructure in Machala and Puerto Bolívar.

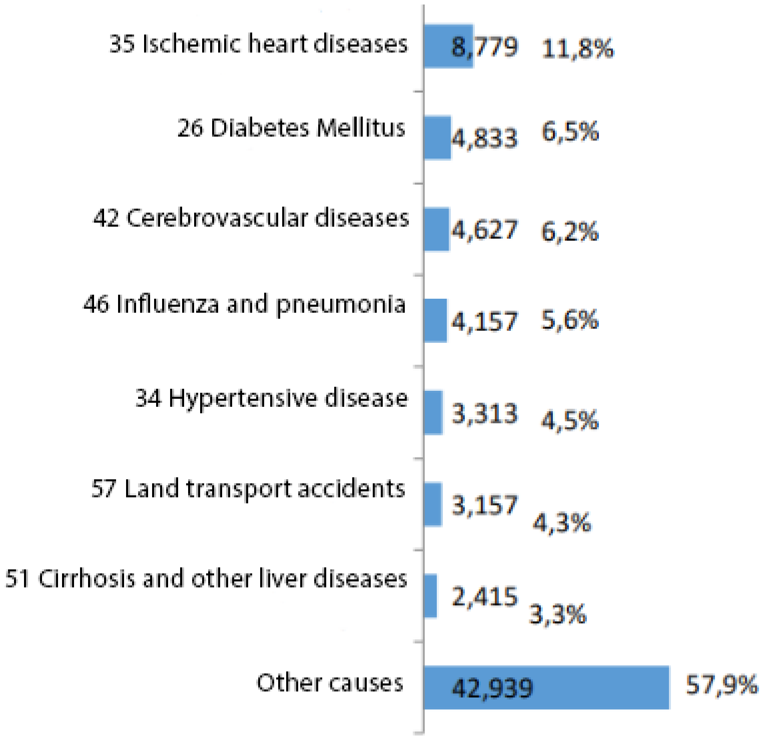
Health Infrastructure	
Puerto Bolivar Parish	**Machala Canton**
▪ Subcentro Amazonas ▪ Subcentro Puerto Bolívar ▪ Epidemiological Monitoring Post	▪ Hospital General Teófilo Dávila ▪ Hospital General Machala (IESS) ▪ Subcentro Patria Nueva ▪ Subcentro Brisas del Mar ▪ Subcentro 18 de Octubre ▪ Subcentro Buenos Aires ▪ Subcentro Venezuela ▪ Subcentro San Martín de Porres ▪ Subcentro Velasco Ibarra ▪ Subcentro Rayito de Luz ▪ Subcentro El cambio La Iberia ▪ Subcentro El Paraíso ▪ Subcentro El Aguador ▪ Subcentro El Retiro ▪ Subcentro El Bosque ▪ Subcentro Dra. Mabel Estupiñán

Source: Ministry of Health, 2017

5.10. Non-communicable diseases

Diabetes, high blood pressure, stroke, cancer, and chronic respiratory diseases cause up to 70% of deaths worldwide. Risk factors include poor nutrition (a diet low in fruits and vegetables, and high in processed products), tobacco and alcohol consumption, and a sedentary lifestyle.

Figure 4. Main causes of general death in Ecuador, 2019



Source: Statistical Registry of Deaths

2016 data from the Ministry of Public Health show morbidity and mortality for Machala and Puerto Bolívar, of the main diseases or non-communicable conditions.

Table 9. Major non-communicable diseases

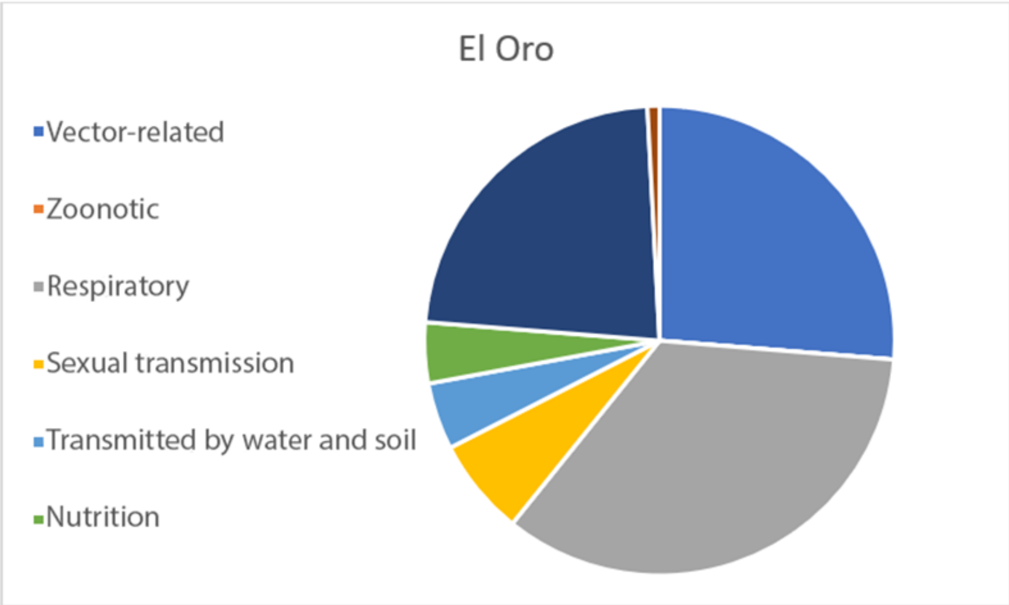
Non-communicable diseases	Machala		Puerto Bolívar	
	Morbidity	Mortality	Morbidity	Mortality
Hypertension	2,668	43	255	5
Diabetes	1,105	103	54	21

Source: Ministry of Health, 2016

5.11. Summary of results

The results for El Oro province, in terms of the main health areas analyzed, are shown in the following figure. In this case, water-borne diseases, vector-borne diseases, and respiratory diseases are the most common.

Figure 5. Representation of cases by health area in El Oro province, 2020



Source: Ministry of Public Health

6. Social actors and stakeholders

The detailed identification of social actors and stakeholders of the Puerto Bolívar project is developed in Book IV.C. Social Baseline, developed in the EIAS (Chapter 16).

Individuals, organizations, institutions, and any other group that may be or may feel affected, or in turn, directly or indirectly affect the development of the project, have been obtained from three sources: 1) Previous social participation processes of the project, 2) Surveys, information workshop, and interviews conducted with part of the primary information survey, 3) Secondary information.

Identified social actors include both potentially affected communities (PACs) for health and safety issues and institutions that play a key role in community health (stakeholders).

Table 10. Stakeholders of Puerto Bolívar project

Category	Name	PAC	Interested parties
Control institutions	Ministry of the Environment and Water		
	El Oro Provincial Government		
	GAD Machala		

Category	Name	PAC	Interested parties
	Government of El Oro Province		
	Fire Corps of Machala Canton		
	National Police - Emergencies		X
	Community Police Unit Puerto Bolívar		
	Attorney's Office in Puerto Bolivar		
	Puerto Bolívar Captaincy		
	Coast Guard Sub Command		
	Port Authority of Puerto Bolívar		
Formal organizations	Shrimp Associations		
	El Oro Fishing associations		
	Tourist transport associations		
	Women's organizations	X	
Educational institutions	Schools, universities		
Neighborhood organizations	Neighborhoods of Puerto Bolivar	X	
Health institutions	Municipal health centers and the Ministry of Public Health		X
Sub-contractors	Contractors and subcontractors	X	
Suppliers	Suppliers		
Financial institutions	Financial institutions		
Employees	Employees	X	
Customers	Customers		

7. Risk analysis

7.1. Health impacts

7.1.1. Aspects that impact health

Typical health impacts are described below.

An influx of people. This impact is linked to a significant migration, caused by project activities, which may include workers, their families, service providers, among others, temporarily or permanently settled in the communities around the project. Interaction between local and imported workers can facilitate the spread of respiratory diseases, which can also affect the community. Another risk is the spread of food-borne diseases that can go between the workplace and the community, and vice versa, via food suppliers and small businesses in the area.

Resettlement and relocation. The health effects of such events can be varied and complex. The Puerto Bolívar project will not cause resettlement or relocation of people.

Water management. During the construction period, the project may lead to the creation of new vector focuses, such as mosquitoes. The accumulation of tires, tanks, and other containers, the formation of temporary puddles, and stagnation of water, can become important mosquito breeding sites, with the consequent increase in the risk of outbreaks of dengue, malaria, and other endemic diseases. This concern is greatest in the rainy season from January to June.

Linear characteristics. Any physical structure (roads, bridges, transmission lines, pipes, river systems, etc.) that crosses and/or connects various ecological or human populations can be considered a linear characteristic. Linear characteristics have the potential to have both positive and negative health consequences, as they facilitate the movement and interaction of various human groups.

Control and disposal of hazardous materials. Inadequate internal management of these materials can cause them to be reused by the population, with unusual consequences (e.g., increased small-scale breeding grounds for dengue mosquito vectors). In addition, waste storage drums that have industrial waste can adversely impact domestic food and water supplies because these containers are often appreciated as cost-effective storage devices.

Changes in revenue and consumer spending. A potential significant impact of projects is that they can positively alter income levels in the community and households, which could lead to an improvement in a community's health performance indicators. On the contrary, projects can trigger significant food or housing inflation, which can adversely affect existing vulnerable groups, with negative consequences on individual and community health performance indicators. Significant and sudden changes in income can have a marked effect on alcohol consumption and consequent gender-based violence. Labor force education and training are key mitigation activities possible.

Infrastructure and facilities. Large projects demand a significant amount of physical structures that can affect the overall human environment (wastewater treatment plants, maintenance yards, administrative office buildings, among others). All of these structures can have a potential positive or negative impact on local communities. It is important to analyze different facilities so that primary design changes can be made to mitigate negative impacts efficiently and cost-effectively.

7.1.2. Identification and assessment of impacts on health areas

The identification of the health impacts to be evaluated is done through a matrix by health areas and considering each of the typical aspects described above.

The assessment, based on the risk analysis described in the methodology, is shown below:

Table 11. Risk analysis of identified impacts.

Health Areas	Impacts	Probability	Consequence	Risk
Vector-related	Increased human parasitic burden (malaria)	1	B	Low
	Creation and displacement of vector breeding areas	2	B	Low
	Creation of domestic breeding sites by reuse/recycling of	1	B	Low
	Creation of breeding grounds due to inadequate drainage and creation of temporary ponds	1	B	Moderate
Respiratory and housing	Overcrowding in community housing	3	C	High
	Housing inflation with overcrowding as a result	1	B	Low
Sexually transmitted infections; HIV/AIDS	A mixture of high and low prevalence groups	1	C	Low
	A mix of men with money and vulnerable women	1	C	Low
Soil, water, and sanitation	Explosive epidemics of food origin	1	C	Low
	Changes in surface water quality	2	C	Low
	Long-term impacts on groundwater	1	C	Low
	Potential reduction of groundwater	1	C	Low
Food and nutrition	The extended family influx and pressure on the family economy	2	B	Low
	Changes in access to local markets	1	B	Low
	Long-term impacts on groundwater	1	B	Low
	Potential reduction of groundwater	2	B	Low
Accidents and injuries	Overcrowding, falls, burns, road traffic	2	B	Low
	Road traffic, increased pedestrian activity	4	C	High
	Unplanned discharges/emissions	3	D	High
Exposure to hazardous materials	Adjacent populations with unplanned discharges	1	D	High
	Truck travel of hazardous materials through the communities to project areas	3	D	High
	Use of project containers for water storage and food	1	B	Low
	Release of contaminants in water bodies used by the community	2	C	Moderate
Social determinants of health	Cultural shock due to rapid social change	1	B	Low
	A mixture of different social/ethnic groups	1	TO	Low
Infrastructure and capacity of health services	Increased outpatient and inpatient service requests	3	TO	Low
	Changes in access	1	B	Low
	Attracting more private providers/increasing insurance membership	1	B	Low
Not Communicable	Changes in diet	1	B	Low
	Change to a sedentary lifestyle	1	B	Low

As stated in the methodology, the risks to be managed by the project are those whose risk rating was Moderate, High, or Very High. For impacts that pass this filter, manageability will also be analyzed qualitatively.

Manageability is the ability to influence risk through risk responses (proactive or reactive) and is given by the following scale.

HIGH: Under the control of the Project Management team. It is possible to control the probability and/or consequence.

MEDIUM: Within the influence of the Project Management team. It is possible to influence probability and/or consequence.

LOW: Outside the influence of the Project Management team. It is only possible to influence the consequence.

Table 12. Health impacts to be managed

Impacts		Risk	Manageability
1	Creation of breeding grounds due to inadequate drainage and temporary ponds	Moderate	High
2	Road traffic, increased pedestrian activity	High	Medium
4	Unplanned discharges/emissions	High	High
4	Adjacent populations with unplanned discharges	High	Low
5	Truck travel of hazardous materials through the communities to project areas	High	Low
5	Release of contaminants in water bodies used by the community	Moderate	Medium

The impacts that will be directly managed by Yilportecu are those of high and medium manageability. For those impacts of low manageability, measures are proposed to minimize their consequences through actions with project partners, such as health care and training.

7.2. Safety impacts

As mentioned in the methodology, the following aspects will be integrated into the analysis, in compliance with ND4, to cover the impacts that project activities can generate on community security:

- Infrastructure and equipment design and security
- Emergency preparedness and response.
- Security personnel.

Impacts are evaluated very similarly in the 3 project phases considered in this study: Construction, Operation, and Dredging.

Table 13. Safety risk assessment.

OPERATION/CONSTRUCTION AND DREDGING					Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	QUALIFI-CATION	HIERARCHY
Medium	Compo-nent	Environmental aspect	Impact Environmental	Description									
Medium	Health community safety	Infrastructure and equipment design and security	Risks to the safety and health of the population due to infrastructure failures.	Includes all risks to which an external person is exposed when entering the infrastructure: physical trauma due to building failure, burns and smoke inhalation in the event of fire, injuries as a result of falls or contact with heavy machinery, alterations of the respiratory system caused by dust, fumes or harmful odors,exposure to hazardous materials.	-1	0,3	3	3	2	0	2	-3	Mild negative
		Health community safety	Health community safety	Some incidents or accidents, depending on magnitude, may affect to varying degrees the community that is related to the project. These emergencies may include explosions, fires, accidental discharge leaks, etc.	-1	0,1	3	2	3	0	2	-1	Mild negative
		Health community safety	Health community safety	The use of security personnel runs the risk of abuse of force, and is contrary to the human rights of the population.	-1	0,1	2	1	1	0	2	-0,6	Mild negative

8. Community Health and Safety Overview.

8.1. Objectives

- Have measures to avoid the risks to the health and safety of the potentially affected Communities, arising from both routine and unusual circumstances.
- Ensure that the safeguarding of personnel and property is carried out in accordance with the relevant human rights principles, avoiding or minimizing risks to the Communities concerned.

8.2. Scope

This Plan contains the measures and actions necessary to prevent and counteract the risks and impacts on the health and safety of communities that may be affected throughout the life cycle of the project.

The guidelines of the World Bank Group on Environment, Health, and Safety (MASS) or other internationally recognized sources have been used to identify appropriate measures to take action on these risks and impacts.

8.3. Responsibilities

The implementation of this Plan will be the responsibility of the HSE Department, and will also be extended to the Expansion Project Contractors, through its General Management and HSE Department.

8.4. Disclosure

This plan should be disclosed to the Communities potentially affected by the project. Where complex health and safety aspects are presented in the different phases of the project, it will be advisable to hire external experts to carry out an independent evaluation. Complementing the process of identifying risks and impacts required by Performance Standard 1 that can be fed and strengthened during the project cycle.

8.5. Proposed measures

8.5.1. Disease control

Vector cleaning and control

Both Yilportecu staff and project contractors, through their departments of Maintenance and Safety, Health and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Routine maintenance of all project areas and work fronts, order control, and cleaning. The accumulation of standing water and trash deposits in the open air should be avoided. Check for clean and clear drains.

ii. Periodic maintenance (at least monthly) of the rainwater drains. During the rainy season, it should be weekly.
iii. Continue periodic inspections of bathrooms, dining room, and restrooms. Cafeterias should receive special attention on disinfection and general hygiene.
iv. Maintain periodic fumigation plan for vector control, at work fronts, warehouses, yards, offices. The frequency will depend on the season of the year and the type of vector to be controlled.
v. Perform a monthly cleaning and disinfection of the areas outside the Port Terminal. To promote their cleansing and ornate through campaigns to sensitize workers not to carry out biological needs abroad, nor as a dump.
vi. Timely management of tanks, drums, and other containers of hazardous and non-hazardous substances through MAAE-authorized managers. Maintain optimal conditions at the Hazardous Waste Collection Center according to NTE INEN 2266, until delivery to the manager. Tanks, drums, and other containers should be drilled in their base, with the aim of preventing them from being collected by villagers in the sector for domestic or commercial use.

Prevention and control of diseases in staff

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Training of staff in preventive measures and good health practices. The following topics should be addressed, with the schedule established by each medical department:
    - Ergonomic care training
    - Cardiovascular health and EKG
    - First Aid Workshop
    - Prevention HIV - AIDS
    - Sexual and reproductive health
    - Prevention of alcohol and drug use
    - Raising awareness to prevent gender-based violence
ii. Continue with the following preventive campaigns:
    - Deworming campaign
    - Vaccination campaign
    - Active break campaign
    - Diabetes prevention campaign
iii. Medical care on-site
iv. Medical follow-up through Pre- and Post-Occupational Health Forms, preventive and special examinations.

Protocols regarding COVID 19

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Adopt the Good Health, Safety, and Hygiene Practices for the Prevention of the Spread of Covid-19 and Other Infectious Diseases (ANNEX 1), in development projects funded by the IDB. The purpose of this Technical Note is to provide safety, health, and hygiene recommendations for the prevention of infectious disease infections and indicate recommendations for preventing infection and managing the situations of personnel infected in these, including possible cases of COVID-19 responsibly.
ii. To continue with the requirement for the submission of COVID-19 tests to contractor and subcontractor personnel and the implementation of the current Biosecurity Plan (YECU-EHS-01-07-V9_BIOSECURITY Plan), and recommendations for best practices from local health authorities and competent multilateral agencies (PAHO/WHO).

8.5.2. Mobility and traffic impact control

Ground traffic impact control

Both Yilportecu staff and project contractors, through their departments of Physical Safety and Health and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Assess existing risks where members of the public will have access to new constructions or structures, including their possible exposure to operational accidents or natural hazards, and will be consistent with the principles of universal access.
ii. The implementation of structural elements that allow universal accessibility (ramps, railings, emergency accesses, others) shall be designed and constructed by qualified professionals and shall be certified or approved by competent authorities or professionals. In the case of mobile equipment on public roads and other forms of infrastructure, measures should be taken to prevent the public from being affected by incidents and injuries related to the operation of such equipment.
iii. Implement with transit authority:
    - Safe pedestrian steps in the areas surrounding the Port Terminal's revenue.
    - Signs on the port access road, indicating the permitted speed limit for cargo vehicles.
    - Use of traffic lights and organization, in the revenue and departure of vehicles in the Port Terminal.
iv. If more than 10 vehicles are expected to be in or out of the Terminal, designate a traffic controller to monitor vehicle progress in groups of 5 units. All other units must remain on standby with the engine off.

v. Implement clean points (waste sorting sites) in the Waiting Area inside the Terminal, so that carriers can dispose of the waste generated on their route properly.

vi. Implement a formal commitment with carriers and their associations to:

- Comply with and follow the guidelines given by the traffic controller in case waiting queues are expected to enter and exit the Terminal.
- Prioritize the use of visible signals such as flashing lights, rather than audible signals. If required, audible signals must not exceed permissible noise limits.
- Correct final disposal of solid waste generated in transport.

vii. Maintain and update feature indicators as:

- Times of permanence and anchorage of vessels in port.
- Waiting time for transport units to enter and exit.

And analyze their developments at least quarterly, to take additional measures if necessary.

viii. When subcontractors carry out transportation-related activities, Yilportecu must use commercially reasonable efforts to influence the safety of these service providers, contractually requiring the analysis of traffic safety risk and the adoption and implementation of driver safety programs. For this, it is important to comply with emergency preparedness and response to road emergencies that address emergency driver and third-party assistance contingencies equally, especially in remote locations or situations with little capacity to cope with emergencies involving traumatic and other serious injuries.

ix. Where new buildings have public access, the design must be consistent with the principles of universal access. The issue of accessibility is one of the key principles of the Convention that should be included in the design and operation of buildings intended for public use. The concept of “universal design” is defined in Article 2 of the United Nations Convention as follows: “the design of products, environments, programs, and services that can be used by all people, to the greatest extent possible, without the need for adaptation or specialized design. The “universal design” will not exclude technical support for particular groups of people with disabilities, when needed.” The concept of “Reasonable adjustments” can be used in situations where Universal Design alone is insufficient to remove obstacles to accessibility. As defined in the United Nations Convention, “Reasonable adjustments” means “necessary and appropriate modifications and adaptations that do not impose a disproportionate or undue burden, when required in a particular case, to ensure enjoyment or exercise by persons with disabilities, on an equal footing with others, all human rights and fundamental freedoms”.

Impact control by maritime traffic

Both Yilportecu staff and project contractors performing water body operations, through their departments of Physical Safety and Health and Environment (SSA, HSE, or other denomination), in the event of impasses with fishing, commercial or tourist vessels, in the maneuvering areas or access channel, you must:

i. In the event of an inrush or blocking of the access channel or maneuver zone, the vessel will be assisted in communicating to the vessel in a ship transit zone and requesting the withdrawal. If necessary, the fact will be reported to ECU 911, from where the Captaincy of Puerto Bolívar is informed for its intervention. If there are any complaints from the occupants of the vessel, proceed in accordance with Measure 7.3. Attention to suggestions, queries, and complaints.

ii. To disseminate this plan to fishermen and their associations, being the main actors in the project's area of influence.

iii. Establish discussion tables with the mediation of representatives of public institutions and/or social facilitators, in case of disputes or claims.

8.5.3. Project infrastructure safety

Infrastructure

During the design stage, to ensure the reduction of possible safety risks, the following measures must be taken into account:

i. Inclusion of a seat belt or other methods of physical separation around the project site to protect the public from the main risks associated with hazardous material incidents or process failures, as well as noise, odor, and other emission-related inconvenience.

ii. Incorporating technical safety criteria and site selection to prevent accidents caused by natural hazards such as earthquakes, tidal waves, wind, floods, landslides, and fires. All buildings must be designed according to technical and design criteria based on site-specific hazards, in particular, but not exclusively, seismic activity, soil stability, wind intensity, and other dynamic loads.

iii. Application of local or internationally recognized building codes and regulations ensures buildings are designed and built under good architectural and engineering practices, including fire prevention aspects and fire emergency plans.

iv. Technicians responsible for the design and construction of facilities, buildings, plants, and other structures must demonstrate proven experience in the design and construction of projects of similar complexity. Qualifications can be demonstrated through the combination of formal technical training and practical experience, or membership in a more formal professional association, national, and international certifications.

v. For complex structures, the need for prior certification and approval of structural elements and engineering safety skills, including geotechnical, structural, electrical, mechanical, and fire specialties, must be established by professionals from national or international professional organizations authorized to perform these tasks, and/or local regulatory agencies that control these matters. Buildings accessible to the public must be designed, built, and operated in full compliance with the local building code(s), fire department standards, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety standard (L&FS[1]).

vi. While major design modifications are not feasible for ongoing projects, risk analysis can be performed to identify opportunities to reduce the consequences of a failure or accident. For example, reduce the likelihood and consequences of accidental leaks, spills, or leaks of hazardous materials by:
    - Improvements in inventory and process management;
    - improvements in operations and control systems;
    - maintenance and inspection activities; and
    - improvements to existing equipment and infrastructure.

Port maritime operation

Both Yilportecu staff and port operators (OPC, OPSC) operating inside the terminal, through their departments of Physical Safety and Health and Environment (SSA, HSE, or other designation) will continue to implement and continuously improve their respective security management systems (SMS) that are capable of effectively identifying and correcting unsafe conditions, including:

i. Procedures for regulating the safe movement of vessels within the port (pilotage, port control, and ship traffic services, navigation aids, and studies of hydrography, among others), actions to protect the general public and surrounding communities from hazards arising from offshore and port activities, and to prevent events that could result in injury to workers and the public, including fishermen and recreational users.

[1] Available at https://www.ifc.org/wps/wcm/connect/3590ce6b-b3ab-42b8-b061-416719168937/Life%26FireSafety.pdf?MOD=AJPERES&CVID=jqeIe4L

ii. Comprehensive emergency preparedness and response plans, which provide a coordinated response based on government, port authority, port users, and community resources needed to manage the nature and severity of the emergency event, Included or complementary to Document YEC-EHS-01-010-V3_Oil Spill Contingency Plan and the National Plan.

Port security

Both Yilportecu staff and project contractors, through their departments of Physical Safety and Health and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Periodic training of port operators on their responsibilities, including international legal and technical obligations, to provide security to passengers, crews, and personnel at the port, in accordance with the provisions of the current PBIP Compliance Statement of the Port Terminal.

8.5.4. Emergency and contingency

Both Yilportecu staff and project contractors, through their departments of Physical Safety and Health and the Environment (SSA, HSE, or other designation) must:

i. Plan and execute, together with the competent authorities, an annual drill involving the community: Public institutions, educational institutions, guilds, and other actors within the area of potential involvement, for fire and explosion events, floods and tsunamis, evacuation.
ii. Develop posters, diptychs, or other information mechanisms to disseminate the emergency and contingency plans of the project to natural and anthropic events that may generate community affectations. This information should contain the main actions to be taken in the event of an emergency.
iii. Provide relevant local authorities, emergency services, and affected communities and other social actors with information on the nature and scope of environmental and human effects that may result from routine operations and unplanned emergencies at the project site.

Information campaigns should describe appropriate behavior and security measures in the event of an incident and actively seek the affected community's views or other social actors concerning risk management and preparedness. Consideration should also be given to the inclusion of the affected Community and other social actors in regular training exercises (e.g. simulations, exercise evaluations, and actual events) in order to familiarize them with appropriate procedures in case of emergency. Emergency plans should address the following aspects of preparedness and response:

- Specific emergency response procedures

- Trained emergency response teams
- Contacts and communication systems/protocols in case of emergency, including notification to authorities, emergency services, and neighboring communities affected or susceptible to compromise.
- Procedures for interaction with local and regional authorities emergency and health
- Permanent emergency equipment and facilities (first aid stations, fire extinguishers and hoses, sprinkler systems)
- Protocols for emergency vehicle services such as auto pumps, ambulances, and others
- Evacuation routes and meeting points
- Drills (yearly or more frequently as needed)

8.5.5. Community Impact Prevention Plan by the Physical Security Services

Both Yilportecu staff and project contractors, through their Physical Security and Human Resources departments, must implement physical security service contracting protocols that include:

i. Conduct reasonable investigations to ensure that security officers have not been involved in past abuses.
ii. Continue with the demand for ongoing training in the proper and proportional use of force (and, where appropriate, firearms), appropriate behavior toward the workers and communities concerned, and respect for applicable law, and good international practices (E.g. the United Nations Code of Conduct for Law Enforcement Officials and the UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials).
iii. In no case shall the use of force be approved, except for preventive and defensive purposes proportional to the nature and extent of the threat.
iv. The complaint handling mechanism of affected employees and communities should also consider the concerns of these groups regarding security arrangements and the actions of security personnel.
v. Consider and, where appropriate, investigate any reports of illegal or abusive acts of security personnel, take measures (or urge the relevant parties to take them) to prevent such acts from recurring, and report such acts to the public authorities.

9. Monitoring and evaluation

The measures established in the Community Health and Safety Plan should be monitored and evaluated to know their status of implementation, adapt existing measures, or design and implement new measures if required.

To do this, the Departments involved in both Yilportecu and the project contractors must report and keep their records and indicators of:

- Diseases and health conditions are found through their periodic monitoring and control reports.
- Statistics of safety incidents with sector dwellers and other actors, whether by road, pedestrian, maritime, or another form of interaction.
- Reports of security incidents, investigations carried out, and corrective actions taken for each reported incident.
- Technical report for building construction that includes the key elements adopted for improving security and accessibility to the general public, certifications achieved, others considered necessary for the design of the respective operational, maintenance, and emergency and contingency plans.

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11. Annexes

Annex 1. Technical Note on Good Health, Safety, and Hygiene Practices for the Prevention of Transmission of Covid-19 and Other Infectious Diseases, in IDB-funded development projects.

I, Miguel Angel Pantoja Shimanskii, certify that the present document consisting of 47 pages in english was translated from its original version in spanish, it's accurate to the best of my capacities as a Sworn Court Certified Translator of the Judicial Council of Ecuador.

Yo, Miguel Angel Pantoja Shimanskii certifico que el presente documento que consta de 47 páginas en ingles fueron traducidas de su versión original en español, son precisas en mis capacidades como traductor calificado y jurado del Consejo de la Judicatura.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PUERTO BOLÍVAR
– PHASE 1 –

- IMPACT ASSESSMENT -

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December 2020

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PUERTO BOLÍVAR – PHASE 1 –

- ENVIRONMENTAL AND SOCIAL IMPACT IDENTIFICATION AND ANALYSIS –

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

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December 2020

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EXECUTIVE SUMMARY

Once the Project's operating activities have been established and its areas of direct and indirect influence and their characteristics, it is then possible to conduct identification and assessment of environmental impacts, either positive or negative, through a semi-quantitative methodology.

Impacts have been identified for operating, construction, and dredging activities in the physical, biotic and social environment. The analysis results show that environmental and social impacts fall, for the most part, into moderate the negative and mild negative categories, although there are also severe negative impacts associated with greenhouse gas emissions, in addition to positive impacts related to employment and economic invigoration generated by the port activity.

In addition, a residual impact assessment has been carried out to determine the result of the environmental and social impact rating once the corrective measures have been implemented. This exercise shows that some environmental impacts significantly decrease in value, and others are nullified, as is the case of those related to waste management.

Regarding the emission of greenhouse gases, which is the impact that maintains the highest values, it is recommended to include actions aimed at changing energy sources in the operations in which YIKPORTECU S.A. has an impact, considering including machinery and vehicles powered by electric energy, or the provision of facilities that use alternative energy sources such as solar or wind power.

IDENTIFICATION AND ANALYSIS OF ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS.

The Environmental Impact Assessment (EIA) allows predicting the environmental and social impacts and risks of a project. To do so, it is necessary to know both the Environmental Baseline and the details of the activities and elements of the project that could cause a measurable change in the environmental components.

In order to identify the environmental impacts caused by the operating activities of Puerto Bolívar Port Terminal on the environmental components, an analysis must be conducted of the environmental characteristics of the studied area; the activities carried out in the Project, the inputs used, the waste produced, their storage and final disposal, and occupational, environmental and social risk factors, which are elements that determine the Project's potential environmental and social impacts on their environment.

The environmental impact assessment is conducted according to a methodology in which the Environmental aspects and Impacts interact. The environmental aspects are elements or components in activities that interact with the environment. Environmental impacts are either positive or negative, that occur in the environment due to the aspect, i.e. the effect produced by a specific human practice on the environment in its different components. The identification of the most significant impacts serves the purpose of establishing procedures to be included within the Environmental Management Plan for controlling and tracking those impacts.

1. IDENTIFICATION AND DESCRIPTION OF ENVIRONMENTAL AND SOCIAL IMPACTS.

This section presents an overview of potential effects on the different environmental components: physical, biotic, and social; it identifies environmental aspects and impacts alike associated with the different project stages: operation, construction, and dredging. Results are shown in Table 1.

Table 1. Identification and description of environmental aspects and impacts by activity

OPERATION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
Physical	Water	General waste production	Inappropriate disposal of general waste that reaches the sea	General, organic or inorganic, recyclable, or non-recyclable waste may be disposed of incorrectly by own or third-party employees and reach the sea, thereby affecting water quality and marine fauna
		Water quality in effluents or accidental discharges	Risk of hazardous substances and hydrocarbon spills into water	The use and storage of hydrocarbons, chemical substances, or other solid or liquid substances that disregard the technical regulation on storage and technical handling could cause spills and discharges that affect water quality.
	Air	Traffic and operation of port machinery	Gas emissions from mobile sources (land and maritime)	Machinery operation, vehicle entry and exit, and vessel emissions will alter the air quality in the project area of influence.
		Traffic and operation of port machinery	Greenhouse gas emissions	The use of fossil fuels in different port operations, particularly in transport operations, will produce greenhouse gases that cause global warming.
		Traffic and operation of port machinery	Particulate matter emissions due to vehicle and machinery operation	Hydrocarbon combustion in internal combustion engines is the main source of particulate matter that alters ambient air quality and can cause health problems when concentrations rise above the recommended limits.
		Traffic and operation of port machinery	Increase in noise and vibration levels due to vehicle and machinery operation	Machinery operation and goods transportation procedures to and from the port increase sound pressure and vibrations, which affects workers inside the port as well as the community that lives and carries out their activities around the port terminal access points.
	Soil	General waste production	Potential inappropriate disposal of general waste	General waste (non-hazardous) could be disposed of incorrectly by own or third-party employees and alter soil quality.
		Storage and use of hazardous materials	Potential inappropriate disposal of	Storage and final disposal of non-hazardous waste must be performed in strict compliance with the

OPERATION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
			hazardous waste	environmental legislation and the technical regulation. Inappropriate handling thereof could cause soil pollution with long-term consequences.
		Storage and use of hazardous materials	Risk of hazardous substances and hydrocarbon spills into soil	Storage and use of materials with corrosive, reactive, explosive, toxic, flammable, and biological-infectious characteristics must be performed in strict compliance with the environmental legislation and technical regulation. Inappropriate handling thereof could cause spills and discharges that alter soil quality permanently.
		Storage and use of hazardous materials	Risk of hazardous substances and/or contaminants percolation into the subsoil	Inappropriate hydrocarbon storage conditions, such as non-watertight tanks, permeable soils, and lack of spill containment basins could cause contamination plumes that percolate through the subsoil and reach bodies of underground water causing permanent alterations in the quality of these components, which are particularly difficult to remedy.
Biotic	Marine fauna	Port traffic	Effects on marine fauna due to collisions with vessels	Vessel traffic may cause occasional collisions with marine mammals or sea turtles.
	Marine coastal flora and fauna	Storage and use of hazardous materials	Effects on marine flora and fauna due to hazardous substances spills	Potential spills of hydrocarbon or other hazardous substances from the port terminal or vessels arriving at sea could cause effects on marine coastal flora and fauna.
	Marine coastal avifauna	Port traffic	Effects on marine avifauna due to gas, noise, and vibration emissions	The operation of large vessels and their gas, noise, and vibration emissions could cause effects on coastal marine avifauna, even though coastal birds that nest in the areas closest to the Project.

	Ecosystem services	Port operation	Variation in food supply (fishery products)	The port operation does not invade fishing areas in bodies of water, nor does it invade pedestrian areas. During the time the port terminal has operated, the fisheries have adapted to the vessel traffic in the area. On the other hand, there is no other type of food production or supply on land that is affected by the port operation.
		Port operation	Variation in ecosystem regulating services: carbon sequestration and water purification provided by mangroves.	The mangrove is very valuable for the regulation services it provides. The port operation will not affect the mangroves, so these ecosystem services will not be affected either.
		Port operation	Variation in cultural services: landscape and recreation.	The port terminal has been part of the landscape in the area of influence for 50 years. No cultural services are expected to be affected by its current or future operation.
		Port operation	Impact on soil formation and primary production.	The mangrove forest will not be affected by the port operation, so neither will the support services it provides to natural processes such as soil formation and primary production.
Social	Occupational	Workforce	Risk of occupational accidents	Occupational accidents are a latent risk in any productive activity. Some risk factors include machinery operation

OPERATION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
				and transit, suspended loads, high-rise work, etc.
		Workforce	Job creation	Port operation is an important source of direct and indirect employment.
	Community health and safety	Port activities.	Effects on community health	Different types of community health problems can be caused by project activities, which have been identified in the Community Health and Safety Assessment, and they include: Creation of breeding grounds for vectors. Road traffic, rise in pedestrian activity Unplanned discharges/emissions Adjacent populations with unplanned discharges Hazardous material displacement by truck. Release of contaminants into bodies of water used by the community
		Infrastructure and equipment design and safety	Risks on population safety and health due to faulty infrastructure	It includes all risks an outside person is exposed to upon entering the infrastructure: physical trauma due to building collapse, burns and smoke inhalation in case of fire, injuries as a result of falls or contact with heavy machinery, alterations in the respiratory system caused by noxious dust, fumes or odors, exposure to hazardous materials
		Emergencies and fires	Effects on the community in the event of emergencies and fires	Based on their scale, some incidents or accidents can affect to different degrees the community associated with the Project. Said emergencies may include: explosions, fires, accidental leaks or discharges, etc.
		Safety personnel	Risks of violation of human rights.	Contracting the services of security personnel entails the risk of excessive use of force and violation of the population's human rights.

OPERATION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
	Community relations	Interaction with social actors	Risk of conflicts with social actors	Port terminal operation raises expectations from the community, which must be proactively oriented by the project management.
	Socio-economic	Commerce and services	Invigoration of the local economy	Banana and shrimp—the province's main productive activity—are exported via this terminal, which directly benefits the local economy,
		Tourism	Tourism incentive in Puerto Bolívar and nearby recreational areas.	Puerto Bolívar modernization and the arrival of larger vessels can stimulate tourism in Puerto Bolívar and adjacent recreational areas, both on the coast and the archipelago.

CONSTRUCTION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
Physical	Water	Sewage water production	Potential temporary alteration of water quality due to inappropriate disposal of sewage water	The activity of several people during pier 6 construction will require adequate sanitary facilities in order to prevent feces from contaminating the water.
		General waste production	Inappropriate disposal of general waste that reaches the sea	From input packaging to food tubs, waste of different sources can reach the sea, even in large amounts, if the necessary steps are not taken to manage general waste properly.
		Storage and use of hazardous materials	Potential hazardous substance spills in offshore works	Storage of hydrocarbons or other chemical substances that disregard the technical regulation on storage and technical handling of these substances may cause spills and discharges that affect water and soil quality.
	Air	Traffic and operation of	Alteration in air quality due to	Construction materials supply and waste evacuation will temporarily

CONSTRUCTION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
		heavy machinery	traffic associated with the supply of construction materials	increase flue gas emissions from different means of transportation.
		Traffic and operation of heavy machinery	Greenhouse gas emissions	Construction materials supply and waste evacuation will temporarily increase greenhouse gas emissions from different means of transport.
		Traffic and operation of heavy machinery, earth-moving	Particulate matter emissions due to earth and aggregate moving operations	Excavations, earth-moving, backfills, and materials transport can temporarily increase particulate matter and dust levels in the environment.
		Traffic and operation of heavy machinery	Noise and vibrations due to heavy machinery operation	Noise and vibration levels will temporarily increase as a result of construction activities. This impact will be limited to the working areas.
	Soil	Storage and use of hazardous materials	Potential hazardous substance and hydrocarbon spills	Storage of hydrocarbons or other chemical substances that disregard the technical regulation on storage and technical handling of these substances may cause spills and discharges that affect water and soil quality.
Biotic	Mangrove flora	Variations in current patterns and sediments	Potential effects on dwarf red mangrove remains or loss thereof	The new pier construction may affect an area of 0.6 ha of mangrove that has developed in the rockfill structures of the coastal area behind the new pier.
	Benthic fauna	Seabed dredging	Alteration in benthic fauna due to offshore dredging and works	Dredging in the intervention areas during pier 6 construction will temporarily affect the fauna developing in this seabed. This impact is specific and temporary.
	Marine mammals	Underwater noise	Effects on marine fauna due to underwater noise as a result of pile driving	Pile driving will cause an increase in ambient and underwater noise. Although underwater noise propagates over long distances, fish can quickly migrate to less affected areas. Marine mammals are affected the most since noise can alter their communication and localization capabilities. This impact will

CONSTRUCTION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
				be limited to the duration of pile driving activities.
	Ecosystem services	Construction	Ecosystem servicesVariation in food supply (fishery products)	The port operation does not invade fishing areas in bodies of water, nor does it invade pedestrian areas. During the time the port terminal has operated, the fisheries have adapted to the vessel traffic in the area. On the other hand, there is no other type of food production or supply on land that is affected by the port operation.
Infrastructure and equipment design and safety	Risks on population safetyand health due to faulty infrastructure	Heavy machinery operation	Risk of occupational accidents	Occupational accidents are a latent risk in any productive activity. Some risk factors include machinery operation and transit, suspended loads, high-rise works, etc.
		Workforce	Job creation	Pier 6 construction will create significant workforce demand, although this positive impact will be temporary.
		Temporary workforce	Lack of job opportunities upon project completion given the temporary nature of the work	As a result of the high labor demand during the construction, medium and long-term employment expectations could be raised concerning Puerto Bolívar project. Therefore, a termination of employment plan for this workforce should be in place.
	Community health and safety	Port activities.	Effects on community health	Different types of community health problems can be caused by project activities, which have been identified in the Community Health and Safety Assessment, and they include: Creation of breeding grounds for vectors. Road traffic, rise in pedestrian activity Unplanned discharges/emissions Adjacent populations with unplanned discharges Hazardous material displacement by truck. Release of contaminants into bodies of water used by the community

				Includes all risks an outside person is exposed to upon entering the infrastructure: physical trauma due to building collapse, burns and smoke inhalation in case of fire, injuries as a result of falls or contact with heavy machinery, alterations in the respiratory system caused by noxious dust, fumes

CONSTRUCTION				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
				or odors, exposure to hazardous materials
		Emergencies and fires	Effects on the community in the event of emergencies and fires	Based on their scale, some incidents or accidents can affect to different degrees the community associated with the Project. Said emergencies may include: explosions, fires, accidental leaks or discharges, etc.
	Community health and safety	Port activities.	Effects on community health	Different types of community health problems can be caused by project activities, which have been identified in the Community Health and Safety Assessment, and they include: Creation of breeding grounds for vectors. Road traffic, rise in pedestrian activity Unplanned discharges/emissions Adjacent populations with unplanned discharges Hazardous material displacement by truck. Release of contaminants into bodies of water used by the community
	Heritage	Excavations	Potential effect on archaeological goods in construction activities	Construction activities may lead to the unexpected discovery of pieces of archaeological value.

DREDGING				
Environ.	**Component**	**Environmental Aspect**	**Environmental impact**	**Description**
Physical	Water	Dredged material disposal at the seabed	Temporary alteration of water quality at the dredged sediment disposal site	Sediments extracted from the dredging areas are disposed of in an offshore sediment basin. When dredged sediments are discharged, water quality is affected, particularly its turbidity. This impact is temporary, whereas suspended solids settle.
	Air	Dredge operation	Alteration in air quality due to gas emissions from the dredge	The dredge performs intensive work during its operational days; therefore there will be an increase in emissionsto the air. This impact is temporary and does not significantly affect emissions produced during the port terminal operation.
		Dredge operation	Greenhouse gas emissions	The dredge performs intensive work during its operational days; therefore there will be an increase in greenhouse gas emissions. However,this impact is temporary.
		Noise and vibration	Noise increase	The dredge will produce noise and vibrations during its operation. The effect will be slightly stronger than on normal terminal operating conditions.
	Soil	Dredged material disposal at the seabed	Temporary alteration in soil quality (seabed) at the dredging disposal site	Sediments extracted from the dredging areas are disposed of at an offshore sediment basin. When the material settles at the seabed, it altersits physicochemical composition by transferring contaminants from the dredged site seabed.
Biotic	Marine fauna	Dredged material disposal at seabed	Temporary impact on marine fauna at the dredging disposal site	Temporary water turbidity due to sediment disposal temporarily affects marine fauna, mainly fish, which will temporarily migrate to higher water quality areas.
	Benthi c fauna	Seabed material extraction	Temporary impact on benthic marine fauna at the dredged areas	Sediment extraction at dredged areas and incorporating these sediments in the disposal site will temporarily alter benthic fauna. Nevertheless, said fauna recovers quickly once the activity that produces the effect ceases.

	Ecosystem services	Extraction of materials from the seabed	Variation in food supply (fishery products)	During dredging operations, the fish near the dredging and bucket area will be moved to more distant areas. However, monitoring has shown that shrimp and fish are abundant in the areas close to the dredged areas.
Social	Occupational	Dredge operation	Risk of occupational accidents	As with any operation involving the use of machinery, there will be a risk of occupational accidents that must be prevented and managed.
		Labor force	Employment generation	The dredging activity will generate employment on a one-time and temporary basis.

Prepared by: Ecosambito, 2020

2. ENVIRONMENTAL IMPACT ASSESSMENT

This assessment will take into account both potential environmental impacts (predictive in nature) and residual impacts (impacts remaining after the expected corrective measures have been implemented).

2.1. Methodology

The environmental impact assessment will be conducted using the Modified Leopold Matrix method. This matrix shows the potential environmental impacts identified for the physical, biotic and human components and determines impact significance. The classification process for environmental impacts considers all project stages, especially those associated with construction activities and their effects on the natural environment as well as on those related to socio-economic aspects within the area of influence.

A series of standard assessment criteria has been prepared so as to evaluate the importance of these effects on the environment, which are presented below:

- Direction (positive or negative)
- Geographical expanse
- Duration
- Magnitude
- Probability of occurrence
- Frequency
- Reversibility

The classification method uses the previously defined environmental assessment criteria, and consists in assigning semi-quantitative parameters established on a relative scale, such that every project activity correlates with the corresponding environmental impact produced. This assessment creates an index reflecting the quantitative and qualitative characteristics of the impact.

On the basis of assigning values within the corresponding ranges, a matrix is generated that determines the significance and hierarchy of the different impacts. Then, by means of a formula that includes all the attributes, a numerical value is obtained that allows for drawing comparisons.

The Environmental Classification for each impact (CA) results from the interaction of each attribute to determine the characteristics of the environmental impacts. The classification is shown in the following equation: CA= D x Po x (M + E+ Du + F + R).

Table 2. *Evaluation criteria and value ranges.*

Symbol	Attribute	Value range
D	Direction	-1 to +1
M	Magnitude	0 to 3
Du	Duration	1 to 3
R	Reversibility	0 to 3
E	Geographical expanse	1 to 3
F	Frequency	0 to 4
Po	Probability of occurrence	0.1 to 1

2.1.1. Environmental Assessment Criteria

The criteria application depends on the environmental assessment being conducted and the environmental sensitivities of the components identified in field and reference studies.

Table 3. *Semi-qualitative analysis of the Environmental Assessment criteria*

DIRECTION (D)		
Negative	-1	Net damage to the resource
Positive	1	Net benefit to the resource
Neutral	0	No benefit or harm to the resource
PROBABILITY OF OCCURRENCE (Po)		
High	1	When the appearance of the effect is known with certainty
Medium	0.9-0.5	Likely, the probability of occurrence is probable
Low	0.4-0.1	Low probability of occurrence
MAGNITUDE (M)		
High	3	Predictable effects exceed the limits associated with potential adverse effects, or cause a detectable change in environmental aspect, beyond the natural variability or social tolerance
Medium	2	The effects are considerably above typical existing conditions, but do not exceed the criteria defined in the allowable limits or cause changes in the economic, social or biological parameters below the ranges of natural variability or social tolerance
Low	1	It is estimated that the disturbance will be slightly higher than the typical existing conditions
None	0	No change is expected
GEOGRAPHICAL EXPANSE (E)		
Regional	3	It extends beyond all sub-regional or administrative limits specified for each indicator, but confined to the region
Sub-regional	2	Extends beyond the directly disturbed areas but is within the limits of the assessed area (generally 1 km or less from the disturbed areas)
Local	1	Confined to the area directly disturbed by the Project.
DURATION (Du)		
Long	3	More than a year
Medium	2	Between 6 and 12 months
Short	1	Less than 6 months
FREQUENCY (F)		
Continuous	3	Will occur constantly
Isolated	2	Confined to a specific period
Occasional	1	Occurs intermittently but repeatedly
Accidental	0	Rarely occurs
REVERSIBILITY (R)		
Irreversible	3	Permanent effects
Reversible in the long term	2	Can be reversed in more than 1 year
Reversible in the medium term	1	Can be reversed in between 6 and 12 months
Reversible in the short term	0	Can be reversed in 6 months or less

2.1.2. Impacts hierarchy

Environmental impacts classified for all the environmental components are assessed according to the significance criteria using the following value ranges:

Table 4. *Significance value ranges*

RANGE	GRADE	COLOR CODE
0 to 15	Positive	Blue
-5 to 0	Mild negative	Yellow
-10 to -5.1	Moderate negative	Orange
-15 to -10.1	Severe negative	Red

Once the impacts have been assigned a value in accordance with these ranges, a "summary matrix" is prepared with the obtained results

3. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The following are the evaluation matrices of potential and residual environmental and social impacts, using the methodology described above. In order to reduce subjectivity in assigning values to each of the qualification criteria, these have been discussed by the multidisciplinary team that participated in the preparation of the Environmental and Social Impact Study.

3.1. Evaluation of potential impacts.

Matrix 1. Assessment of potential environmental and social impacts

	MEDIO	COMPO-NENTE	IMPACT	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	QUALIFICATION	HIERARCHIZATION
OPERATION	Physicist	Water	Poor disposal of common wastes that end up in the sea	-1	0,05	1	1		1		-0,4	Slight negative
			Alteration of water quality due to effluents or accidental spills	-1	0,4						-5,2	Moderate negative
		Air	Gaseous emissions from mobile sources (land and marine)	-1	1		1	1		1	-8	Moderate negative
			Greenhouse gas emissions	-1	1						-15	High negative
			Particulate matter emissions from vehicle and machinery operation	-1	1	1		1		0	-7	Moderate negative
			Increase in noise and vibration levels due to operation of vehicles and machinery	-1	1		1	1		0	-7	Moderate negative
		Soil	Possible poor disposal of common waste	-1	0,1	1	1	1		1	-0,6	Slight negative
			Possible improper disposal of hazardous waste	-1	0,1						-1,2	Slight negative
			Risks of spills of hazardous substances and hydrocarbons on the ground.	-1	0,25						-3	Slight negative
			Risk of infiltration of hazardous substances and/or contaminants into the subsoil.	-1	0,1						-1,2	Slight negative
	Biotic	Marine fauna	Impact on marine fauna due to collision with vessels	-1	0,1	1		1	1		-0,8	Slight negative

MEDIO	COMPO-NENTE	IMPACT	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	QUALIFICATION	HIERARCHIZATION
	Coastal marine flora and fauna	Impact on marine flora and fauna due to hazardous substance spills	-1	0,3	1					-3,3	Slight negative
	Coastal marine avifauna	Impact on marine avifauna due to gas emissions, noise and vibrations.	-1	0,3	1				1	-3	Slight negative
	Ecosystem services	Variation in food supply (fishery products)	0	0	0	0	0	0	0	0	No impact
		Variation in regulating ecosystem services: carbon sequestration and water purification provided by mangroves	0	0	0	0	0	0	0	0	No impact
		Variation in cultural services: landscape and recreation.	0	0	0	0	0	0	0	0	No impact
		Impact on soil formation and primary production	0	0	0	0	0	0	0	0	No impact
Social	Laboral	Risk of occupational accidents	-1	0,1		1		1		-1,1	Slight negative
		Employment generation	1	1					1		Positive
	Community health and safety	Community health impacts: Vectors, traffic, accidental discharges, etc.	-1	0,5			1	1		-5	Moderate negative
		Risks to the safety and health of the population due to infrastructure failures	-1	0,2				0		-2	Slight negative
		Impact on the community, in the event of emergencies and fires	-1	0,1				0		-1	Slight negative
		Risk of human rights violations.	-1	0,1		1	1	0		-0,6	Slight negative

	MEDIO	COMPO-NENTE	IMPACT	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	QUALIFICATION	HIERARCHIZATION
		Community relations	Risk of conflicts with social actors	-1	0,5						-6	Moderate negative
		Socioeconomic	Dynamism of the local economy	1	1							Positive
			Encouraging tourism in Puerto Bolivar and nearby recreational areas	1	0,6						8,4	Positive

3.2. Results of the ranking of potential impacts.

Following the development of the environmental impact assessment, it is concluded that there are impacts categorized as severe, moderate, and mild negative. Severe and mild negative impacts will have priority in the preventive, control, and mitigation measures of the Environmental and Social Management Plan.

Other impacts categorized as mild negative are less significant impacts which can be included in Management Plans insofar as internal or external requirements are in place or as long as there is interest from the parties involved to do so, without said impacts sharing the same level of management urgency as those within more severe categories.

Table 5. *Hierarchy of environmental impacts of YILPORTECU*

PORT OPERATION	IDENTIFIED
Greenhouse gas emissions	-15
Gas emissions from mobile sources (land and maritime)	-8
Particulate matter emissions due to vehicle and machinery operation	-7
Increase in noise and vibration levels due to vehicle and machinery operation	-7
Risk of conflicts with social actors	-6
Alteration in water quality due to effluents or accidental discharges	-5.2
Effects on community health: Vectors, traffic, accidental discharges	-5
Effects on marine flora and fauna due to hazardous substance spills	-3.3
Risk of hazardous substance and hydrocarbon spills into soil	-3
Effects on marine avifauna due to gas, noise, and vibration emissions	-3
Risks on population safety and health due to faulty infrastructure	-2
Potential inappropriate disposal of hazardous waste	-1.2
Risk of hazardous substances and/or contaminants percolation into the subsoil	-1.2
Risk of occupational accidents	-1.1
Effects on the community in the event of emergencies and fires	-1
Effects on marine fauna due to collisions with vessels	-0.8
Potential inappropriate disposal of general waste	-0.6
Risk of human rights violations.	-0.6
Inappropriate disposal of general waste that reaches the sea	-0.4
Variation in food provisioning (fish products)	0
Variation in ecosystem regulating services: carbon sequestration and water purification provided by mangroves	0
Variation in cultural services: landscape and recreation.	0
Impact on soil formation and primary production.	0
Tourism incentive in Puerto Bolívar and nearby recreational areas	8.4
Job creation	12
Invigoration of the local economy	14

CONSTRUCTION	IDENTIFIED
Greenhouse gas emissions	-13
Alteration in air quality due to traffic associated with the supply of construction materials	-8
Particulate matter emissions due to earth and aggregate moving operations	-7
Temporary alteration in benthic fauna due to offshore dredging and works	-5
Effects on community health: Vectors, traffic, accidental discharges	-5
Increase in noise and vibration levels due to heavy machinery operation	-5
Potential effects on dwarf red mangrove remains or loss thereof	-4.5
Lack of job opportunities upon project completion given the temporary nature of the work	-4
Potential hazardous substance spills in offshore works	-3.9
Hazardous substance and hydrocarbon spills	-3.3
Potential effect on archaeological goods in construction activities	-3.3
Risks on population safety and health due to faulty infrastructure	-3
Inappropriate disposal of general waste that reaches the sea	-1.1
Effects on the community in the event of emergencies and fires	-1
Risk of occupational accidents	-0.9
Potential temporary alteration of water quality due to inappropriate disposal of sewage water	-0.6
Risks of violation of human rights.	-0.6
Variation in food supply (fishery products)	0
Job creation	12

DREDGING	IDENTIFIED
Greenhouse gas emissions	-12
Noise and vibration	-7
Temporary alteration in water quality at the dredging disposal site	-5
Alteration in air quality due to gas emissions from the dredge	-5
Temporary alteration in soil quality (seabed) at the dredging disposal site	-5
Temporary impact on marine flora and fauna at the dredging disposal site	-5
Temporary impact on benthic marine fauna at the dredged areas	-5
Variation in food supply (fishery products)	-1.2
Effects on the community in the event of emergencies and fires	-1
Risk of occupational accidents	-0.8
Job creation	7

3.3. Evaluation of residual impacts.

Residual environmental impacts are those that remain despite the environmental measures designed to mitigate them.
The same matrix used for the evaluation of potential environmental impacts will be used for this evaluation, but considering the following particularities:

1. Direction: When a corrective measure is applied, the direction will be 1 (benefit for the resource). If there is no corrective measure, the value of this criterion will be 0.
2. Magnitude: The magnitude of the benefit of the measure will be considered, instead of the detriment of the impact.
3. Reversibility: the possibility of nullifying the beneficial effects of the corrective measure by some action or omission, or the possibility of returning to the conditions prior to the application of the measure.
4. For the rest of the evaluation criteria: geographic extension, probability, duration and frequency, the assessment is made considering the value of the corrective measure in relation to the corresponding environmental impact, therefore, these values must be less than or equal to the potential impact evaluated.
5. The coding of the applicable Program and/or Plan is included, PMS if it is from the Environmental Management Plans in force in the respective environmental licenses (Operation, Dredging, and Pier 6), and PGAS if the measures correspond to the Environmental and Social Management Plan of this study (see Book VII).

The residual impact will result from the subtraction between the potential environmental impact and the environmental impact after the applied corrective measures.

The results of this analysis are shown in the following matrix:

Matrix 2. Residual environmental and social impact assessment

	MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
OPERATION	Physicist	Water	Poor disposal of common wastes that end up in the sea	-0,4	PMA Operation PMD-01	1	0,05	1	1		1	1	0,35	-0,05	Slight negative
			Alteration of water quality due to effluents or accidental spills	-5,2	PMA Operation PPM-02 PMS-02 PMS-02	1	0,2		1			1		-3,2	Slight negative
		Air	Gaseous emissions from mobile sources (land and marine)	-8	PMA Operation PPM-01 PMS-01 PMS-01	1	1	1	1	1	1	1	5	-3	Slight negative
			Greenhouse gas emissions	-15	Carbon Neutral Certification	1	1							-4	Slight negative
			Particulate matter emissions from vehicle and machinery operation	-7	PMA Operation PPM-01 PMS-01 PMS-01	1	1	1		1		0		-1	Slight negative
			Increase in noise and vibration levels due to operation of vehicles and machinery	-7	PMA Operation PPM-01 PMS-01 PMS-01	1	1		1	1		0		-1	Slight negative
		Soil	Possible poor disposal of common waste	-0,6	PMA Operation PMD-01	1	0,1	1	1	1		1	0,6	0	No impact
			Possible improper disposal of hazardous waste	-1,2	PMA Operation PMD-02	1	0,1						1,2	0	No impact
			Risks of spills of hazardous substances and hydrocarbons on the ground.	-3	PMA Operation PPM-03PGAS (8)	1	0,25	1	1		1	1	1,75	-1,25	Slight negative

MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
		Risk of infiltration of hazardous substances and/or contaminants into the subsoil.	-1,2	PMA Operation PPM-03PGAS (8)	1	0,1	1	1			1	0,8	-0,4	Slight negative
Biotic	Marine fauna	Impact on marine fauna due to collision with vessels	-0,8	PGAS (9.4.)	1	0,1	1	1	1	1	1	0,5	-0,3	Slight negative
	Coastal marine flora and fauna	Impact on marine flora and fauna due to hazardous substance spills	-3,3	PMA Operation PMD-02 PMS-02 PGAS (8, 9, 14)	1	0,3	1	1			1	2,1	-1,2	Slight negative
	Coastal marine avifauna	Impact on marine avifauna due to gas emissions, noise and vibrations.	-3	PMA Operation PPM-01	1	0,3	1	1			1	2,4	-0,6	Slight negative
	Ecosystem services	Variation in food supply (fishery products)	0	PGAS (9.3.4.4., 9.3.4.6.)	0	0	0	0	0	0	0	0	0	No impact
		Variation in regulating ecosystem services: carbon sequestration and water purification provided by mangroves	0	PGAS (9.5., 9.3.4.6.)	0	0	0	0	0	0	0	0	0	No impact
		Variation in cultural services: landscape and recreation.	0		0	0	0	0	0	0	0	0	0	No impact
		Impact on soil formation and primary production	0		0	0	0	0	0	0	0	0	0	No impact
Social	Laboral	Risk of occupational accidents	-1,1	PMA Operation PEC-01	1	0,1		1		1		0,9	-0,2	Slight negative

	MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
			Employment generation			0	1					1	0		Positive
		Community health and safety	Community health impacts: Vectors, traffic, accidental discharges, etc.	-5	PMA Operation PEC-01 PRA-01PGAS (13)	1	0,5		1	1	1	1		-2	Slight negative
		Community health and safety	Risks to the safety and health of the population due to infrastructure failures	-2	PMA Operation PEC-01 PRA-02PGAS (13.5.3.)	1	0,2		1		0	1	1,2	-0,8	Slight negative
		Community health and safety	Impact on the community, in the event of emergencies and fires	-1	LDC Operation PEC-01 PRA-03PGAS (13.5.4.)	1	0,1		1		0	1	0,7	-0,3	Slight negative
		Community health and safety	Risk of human rights violations.	-0,6	PGAS (13.5.5., 14)	1	0,1		1	1	0		0,6	0	No impact
		Community relations	Risk of conflicts with social actors	-6	PMA Operation PRC-01PGAS (6., 17.)	1	0,5					1	5	-1	Slight negative
		Socioeconomic	Dynamism of the local economy			0	1						0		Positive
		Socioeconomic	Encouraging tourism in Puerto Bolivar and nearby recreational areas	8,4		0	0,6						0	8,4	Positive
CONSTRUCTION	**Physicist**	Water	Possible temporary alteration of water quality due to improper sewage disposal	-0,6	PMA Pier 6 PPMI-C-03PGAS (12.4.)	1	0,1	1	1	1		0	0,5	-0,1	Slight negative
CONSTRUCTION	**Physicist**	Water	Poor disposal of common wastes that end up in the sea	-1,1	PMA Pier 6 PPMI-C-02, PMD-C-01 to 04, PMD-O-01 to 04PGAS (12.5.)	1	0,1	1	1			1	0,7	-0,4	Slight negative

MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
		Possible spills of hazardous substances in offshore works	-3,9	PMA Pier 6 PDC-C-01 PDC-C-04PGAS (12.8.)	1	0,3	1	1			1	2,4	-1,5	Slight negative
	Air	Alteration of air quality due to increased traffic for the supply of construction materials.	-8	PMA Pier 6 PPMI-C-04, PPMI-O-02	1	1	1	1	1		0	5	-3	Slight negative
	Air	Greenhouse gas emissions	-13		0	1	0				0	0	-13	High negative
	Air	Particulate matter emissions from earth and aggregate movements	-7	PMA Pier 6 PPMI-C-04, PPMI-O-02	1	1	1	1	1		0	5	-2	Slight negative
	Air	Elevated noise and vibration levels due to heavy machinery operation	-7	PMA Pier 6 PPMI-C-04, PPMI-O-02PGAS (12.7.)	1	1	1	1	1		0	5	-2	Slight negative
	Soil	Spills of hazardous substances and hydrocarbons	-3,3	PMA Pier 6 PDC-C-01	1	0,3	1	1				2,4	-0,9	Slight negative
Biotic	Flora-mangrove	Possible impact or loss of remnants of dwarf red mangroves	-4,5	PGAS (9.5.)	1	0,5		1		1		4,5	0	No impact
Biotic	Benthic fauna	Temporary alteration of benthic fauna by dredging and offshore work	-4		0	1	1	1	1		0	0	-4	Slight negative
Biotic	Marine mammals	Impact to marine fauna by underwater noise due to pile driving	-4	PGAS (12.7.1.)	1	0,5	0	1	1	1	0	1,5	-2,5	Slight negative
Biotic	Ecosystem services	Variation in food supply (fishery products)	0	PGAS (9.3.4.3., 9.3.4.4., 9.3.4.6.)	0	0	0	0	0	0	0	0	0	No impact
Social	Laboral	Risk of occupational accidents	-0,9	PMA Pier 6 PPMI-C-05, PPMI-O-03	1	0,1	1	1			1	0,7	-0,2	Slight negative

	MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
			Employment generation		PMA Pier 6 PRC-C-01	1	1	1	1	1		1			Positive
		Community health and safety	Community health impacts: Vectors, traffic, accidental discharges, etc.	-5	PMA Pier 6 PMD-O-02 PRC-C-02PGAS (6.)	1	0,5	1		1	1			-1	Slight negative
			Risks to the safety and health of the population due to infrastructure failures	-3	PMA Pier 6 PDC-C-03, PDC-O-03PGAS (13.5.3.)	1	0,3	1			0		2,4	-0,6	Slight negative
			Impact on the community, in the event of emergencies and fires	-1	PMA Pier 6 PDC-C-03, PDC-O-04PGAS (13.5.4.)	1	0,1	1			0		0,8	-0,2	Slight negative
			Risk of human rights violations	-0,6	PGAS (13.5.5., 14)	1	0,1		1	1	0		0,6	0	No impact
		Temporary workforce	Shortage of job opportunities due to the temporary nature of the work, once the project has been completed.	-4	PGAS (16.)	1	0,5	1	1			1		0	No impact
		Patrimonial	Possible impact on archaeological properties in construction activities	-3,3	PGAS (10.)	1	0,3		1		1			-0,3	Slight negative
DRAGADO	**Physicist**	Water	Temporary alteration of water quality in dredging reservoir area	-5	PMA Dredging PPM-02 PMS-02	1	0,5	1	1	1		0	2,5	-2,5	Slight negative
		Air	Alteration of air quality due to gas emissions from the dredge	-5	PMA Dredging PPM-01 PMS-01	1	0,5	1	1	1		0	2,5	-2,5	Slight negative
			Greenhouse gas emissions	-12		0	1			1			0	-12	High negative
			Increase in noise and vibration levels due to	-7	PMA Dredging PPM-01	1	1	1		1		0		-1	Slight negative

MEDIO	COMPO-NENTE	IMPACT	POTENTIAL IMPACT	ENVIRONMENTAL ACTION	Address	Probability	Magnitude	Extension	Duration	Frequency	Reversibility	IMPACT THEN MEASURES	RESIDUAL EFFECT	HIERARCHY
		operation of vehicles and machinery												
	Soil	Temporary alteration of soil quality (seabed) in dredge deposit area	-5	PMA Dredging PMS-03	1	0,8	1	1	1		0		-1	Slight negative
Biotic	Marine fauna	Temporary impact on the marine flora and fauna in the dredging deposit area.	-5	PMA Dredging PPM-05 PMS-06 PMS-07 PMS-08 PMS-08	1	0,8	1	1	1		0		-1	Slight negative
	Benthic fauna	Temporary impact on the benthic marine fauna in dredged areas.	-5	PMA Dredging PPM-05 PMS-06 PMS-07 PMS-08 PMS-08	1	0,8	1	1	1		0		-1	Slight negative
	Ecosystem services	Variation in food supply (fishery products)	-1,2	PMA Dredging PPM-04 PCC-02 PMS-03 PMS-04	1	0,1		1	1		0	0,6	-0,6	Slight negative
Social	Laboral	Risk of occupational accidents	-0,8	LDC Dredging PCC-01 PEC-01 PSS-01	1	0,1	1	1	1			0,7	-0,1	Slight negative
		Employment generation			0	1		1	1		1	0		Positive
	Community health and safety	Impact on the community, in the event of emergencies and fires	-1	PMA Dredging PCC-02 PRC-01 PRC-02 PMS-09	1	0,1	1			0		0,8	-0,2	Slight negative

3.4. Results of the ranking of residual impacts.

The results of the ranking of residual impacts are shown below, where many of the impacts for which corrective measures have been designed, significantly decrease their value.

Table 6. Hierarchy of residual environmental impacts of YILPORTECU S.A.

PORT OPERATION	POTENTIAL IMPACT	RESIDUAL EFFECT
Greenhouse gas emissions	-15	-4
Alteration of water quality due to effluents or accidental spills	-5,2	-3,2
Gaseous emissions from mobile sources (land and marine)	-8	-3
Community health impacts: Vectors, traffic, accidental discharges, etc.	-5	-2
Risks of spills of hazardous substances and hydrocarbons on the ground.	-3	-1,25
Impact on marine flora and fauna due to hazardous substance spills	-3,3	-1,2
Particulate matter emissions from vehicle and machinery operation	-7	-1
Increase in noise and vibration levels due to operation of vehicles and machinery	-7	-1
Risk of conflicts with social actors	-6	-1
Risks to the safety and health of the population due to infrastructure failures	-2	-0,8
Impact on marine avifauna due to gas emissions, noise and vibrations.	-3	-0,6
Risk of infiltration of hazardous substances and/or contaminants into the subsoil.	-1,2	-0,4
Impact on marine fauna due to collision with vessels	-0,8	-0,3
Impact on the community, in the event of emergencies and fires	-1	-0,3
Risk of occupational accidents	-1,1	-0,2
Poor disposal of common wastes that end up in the sea	-0,4	-0,05
Possible poor disposal of common waste	-0,6	0
Possible improper disposal of hazardous waste	-1,2	0
Variation in food supply (fishery products)	0	0
Variation in regulating ecosystem services: carbon sequestration and water purification provided by mangroves	0	0
Variation in cultural services: landscape and recreation.	0	0
Impact on soil formation and primary production	0	0
Risks of human rights violations.	-0,6	0
Encouraging tourism in Puerto Bolivar and nearby recreational areas	8,4	8,4
Employment generation		
Dynamism of the local economy		

CONSTRUCTION	POTENTIAL IMPACT	RESIDUAL EFFECT
Greenhouse gas emissions	-13	-13
Temporary alteration of benthic fauna by dredging and offshore work	-4	-4
Alteration of air quality due to increased traffic for the supply of construction materials.	-8	-3
Impact on marine fauna by underwater noise due to pile driving	-4	-2,5
Particulate matter emissions from earth and aggregate movements	-7	-2
Elevated noise and vibration levels due to heavy machinery operation	-7	-2
Possible spills of hazardous substances in offshore works	-3,9	-1,5
Community health impacts: Vectors, traffic, accidental discharges, etc.	-5	-1

CONSTRUCTION	POTENTIAL IMPACT	RESIDUAL EFFECT
Spills of hazardous substances and hydrocarbons	-3,3	-0,9
Risks to the safety and health of the population due to infrastructure failures	-3	-0,6
Poor disposal of common wastes that end up in the sea	-1,1	-0,4
Possible impact on archaeological properties in construction activities	-3,3	-0,3
Risk of occupational accidents	-0,9	-0,2
Impact on the community, in the event of emergencies and fires	-1	-0,2
Possible temporary alteration of water quality due to improper sewage disposal	-0,6	-0,1
Possible impact or loss of remnants of dwarf red mangroves	-4,5	0
Variation in food supply (fishery products)	0	0
Risk of human rights violations	-0,6	0
Shortage of job opportunities due to the temporary nature of the work, once the project has been completed.	-4	0
Employment generation		

DRAGADO	POTENTIAL IMPACT	RESIDUAL EFFECT
Greenhouse gas emissions	-12	-12
Temporary alteration of water quality in dredging reservoir area	-5	-2,5
Alteration of air quality due to gas emissions from the dredge	-5	-2,5
Increase in noise and vibration levels due to operation of vehicles and machinery	-7	-1
Temporary alteration of soil quality (seabed) in dredge deposit area	-5	-1
Temporary impact on the marine flora and fauna in the dredging deposit area.	-5	-1
Temporary impact on the benthic marine fauna in dredged areas.	-5	-1
Variation in food supply (fishery products)	-1,2	-0,6
Impact on the community, in the event of emergencies and fires	-1	-0,2
Risk of occupational accidents	-0,8	-0,1
Employment generation		

4. CONCLUSIONS

An environmental and social impact assessment has been conducted, which first identified potential impacts based on the current and future activities and operations of YILPORTECU S.A. while considering the distinctive features of its area of influence.

The results of the evaluation of potential impacts show that, for the most part, the impacts identified are rated moderate and slight. Severe negative impacts are related to greenhouse gas emissions due to their cumulative and irreversible nature and their global expanse.

Other high impacts are those related to emissions caused by transportation and machinery operation, which affect air quality. Also, there are positive environmental and social impacts associated with creating jobs and the invigoration of the economy as a result of an international port operation in the area of influence.

The evaluation of residual environmental impacts shows that the vast majority of environmental and social impacts significantly decrease their value, leaving all of them in the category of slight negative in all phases of the project, since preventive and corrective measures are in place. In some cases the impacts can be easily nullified with the implementation of corrective measures, as in the case of common and hazardous waste management, or reduced to almost zero, as in the case of occupational accidents, spills of hazardous substances, or other types of emergencies.

Regarding the emission of greenhouse gases, which is the impact that maintains the highest values, it is recommended to include actions aimed at changing energy sources in the operations in which YILPORTECU S.A. has an impact, considering including machinery and vehicles powered by electric energy, or the provision of facilities that use alternative energy sources such as solar or wind power.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
PUERTO BOLÍVAR – STAGE 1

– IDENTIFICATION AND ASSESSMENT OF CUMULATIVE IMPACTS –

Prepared for:

[Yilport Puerto Bolívar logo composite mark]

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A

Prepared by:

[Sambito logo composite mark]

ECOSAMBITO C.LTDA.

December 2020

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EXECUTIVE SUMMARY

Cumulative impact assessment and management (EGIA) is conducted in accordance with the requirements set forth in Performance Standard 1: Assessment and management of environmental and social risks and impacts of the International Finance Corporation, which acknowledges the urge to manage increasing and systemic risks such as climate change, biodiversity loss and environmental services decline, among others.

Puerto Bolívar Expansion Project Stage 1, as is the case with most port projects, is carried out in a location where several undertakings converge, many of which will benefit from the logistic advantages and international business opportunities that these regional impact structures offer. These activities, that have been taking place and increasing in number and level of impact and which have drastically changed the Project area of influence throughout at least 5 decades, have contributed to the current state of environmental quality. Current and future projects, including that which is the subject of this assessment, will cumulatively contribute to the deterioration of the environmental quality of this region, hence the need for identifying each of their individual contributions to potential future alterations in the ecosystem so as to avoid causing irreversible damages to the environmental and ecological balance.

A limited spatial scope was defined for the development of EGIA in relation to the Area of Direct and Indirect Influence set out in the Environmental and Social Impact Assessment, as well as a 50-year time frame which encompasses the entire term of Yilportecu’s operating license to the Port Terminal. The current state of Environmental and Social Components (CASs) identified in the environmental impact analysis of the Environmental and Social Impact Assessment (EIAS) is revised and described in subsequent steps, and the contributions of the interested parties are included for validation purposes. Preexisting, current and future undertakings carried out in the project vicinity are identified and, by means of an interaction matrix, an estimate of the contribution of each project or undertaking—both new and with incremental tendency—to the CASs is calculated, thereby establishing the Valued Environmental and Social Components (VECs). Finally, the significance and hierarchy of the cumulative impacts of said undertakings on the defined VECs is assessed.

Results show that Puerto Bolívar Expansion Project Stage 1 has a limited contribution to the cumulative impacts on VECs since their effects are localized and their expansion does not pose any significant threats to biodiversity. This assessment shows that preexisting activities such as mining and aquaculture are undergoing an escalation phase, undertakings which contribute in a proportionally higher degree to affecting VECs in the assessed area.

Assessment of cumulative impacts associated with Puerto Bolívar Expansion Project Stage 1

1. Introduction

According to the text “Guía para evaluar y gestionar los impactos y riesgos para la biodiversidad en los proyectos respaldados por el Banco Interamericano de Desarrollo” (Watkins et al, 2015), cumulative impacts are the product of combined effects on the essential characteristics of biodiversity (or on valuable components of the ecosystem to which they are related) of all previous, current and reasonably foreseeable projects.

Said authors maintained that the cumulative impact assessment is usually overlooked during projects and the fact that these are difficult to mitigate is partly to blame, since the program or client may consider that the management of said impacts is the regional or national government responsibility. Although it may be more effective to address such impacts at the local, regional or national level, clients must include—through strategic environmental assessments or regional planning programs—a cumulative impact assessment in the global EA process.

A more straightforward definition for understanding cumulative effects/impacts is that of Hegmann et al. (1999), who states that “cumulative effects are defined as changes in the environment caused by an action in conjunction with other past, current and future actions”.

Cumulative impacts are contextual and cover a wide range of impacts at different spatial and temporal levels. Cumulative impact assessments must be centered around the combined and incremental effects of the project and other undertakings, programs or activities on the quality of the natural environment.

Puerto Bolívar Expansion Project Stage 1 is directly related to Estero Santa Rosa marine coastal environment and its open sea outlet through Canal de Jambelí, until the dredged sediment disposal basin (approximately 13.75 miles from the sea buoy), where intermittent and specific effects associated with the performance of dredging activities would be produced. However, from an ecological perspective, delimitations in the areas of influence constitute practices limited to the physical dynamics of local currents and their reach within a given time frame, e.g. so as to take precautions concerning the outcomes of chemical events, provided these are produced in the jurisdictional water surface or maneuvering areas facing the port, or otherwise caused by port tugboats.

The environment in which the project is carried out, i.e. the continental margin of Estero Santa Rosa and Canal de Jambelí, serves as an overview of cumulative impacts since colonial times, when the city of Guayaquil was officially founded on 25 June 1537, year in which the indigenous Machala settlement was discovered and subsequently named Cantón Machala on 25 June 1824, and whose natural border towards the sea was formed by the area that is now known as Puerto Bolívar. Development throughout decades of port activity and other important productive activities (undertakings), as well as the pressure exerted by population growth, which currently reaches around one third of a million residents in the area of influence, together with the lack of wastewater treatment systems, result in a highly altered environment.

2. Scope and goals

This cumulative impacts report covers all activities associated with Puerto Bolívar Port Terminal Expansion Project and other activities performed within its area of direct and indirect influence during a 50-year time frame.

This report expects to reach the following goals:

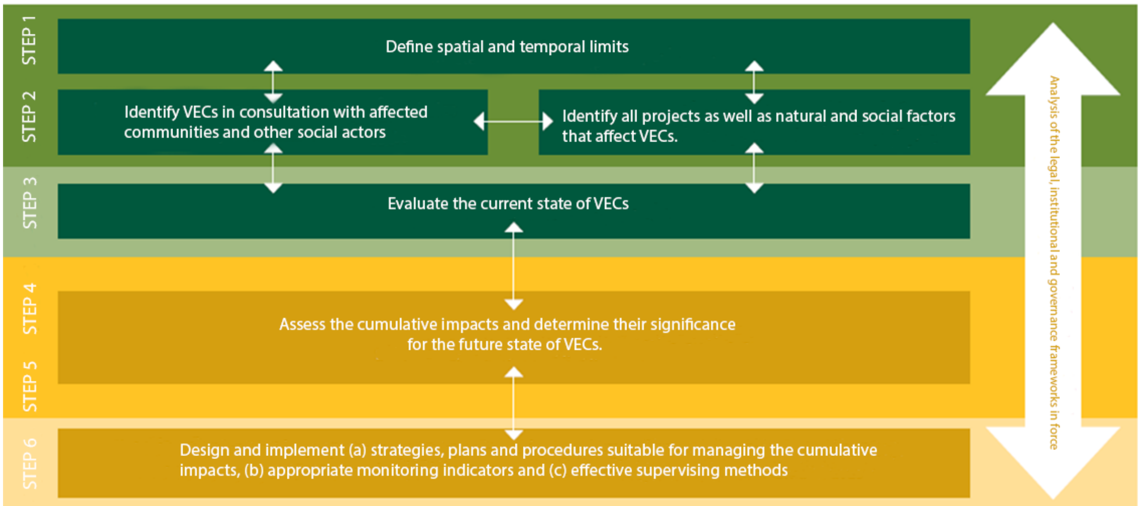
- Identify VECs that take cumulative impacts within the spatial and temporal boundaries of the assessment while ensuring that the concerns and interests of social actors are being taken into consideration.
- Asses potential risks and impacts of the project and other undertakings within the area of influence on each VEC.
- Determine the contribution to cumulative impacts of previous and future undertakings on each VEC.
- Based on the nature and scale of cumulative social and environmental impacts produced by the undertakings, implement practical measures aimed at preventing, minimizing and mitigating those impacts.

3. Methodology.

This report adheres to the guiding document: Good practice manual, Assessment and management of cumulative impacts: A guide for the private sector in emerging markets, digital publication of the International Finance Corporation of the World Bank Group (IFC, 2015). Said guideline is based on a methodology of 6 steps or main assessments, which are as follows:

- **Step 1:** Identify the Valued Environmental and Social Components (VECs), in consultation with social actors. Define spatial and temporal limits
- **Step 2:** Determine whether there are other past, present or in-development activities within the area or time frame stipulated for the assessment.
- **Step 3:** Determine the current state of or baseline for VECs.
- **Steps 4 and 5:** Assess the cumulative impacts and determine their significance for the future state of VECs; and lastly,
- **Step 6:** Design and implement: a) strategies, plans and procedures suitable for managing cumulative impacts; b) appropriate monitoring indicators, and c) effective supervising methods.

Figure 1. Logical framework for a quick EGIA



Source: IFC, 2015

A hindrance for developing this methodology in Puerto Bolívar Expansion Project Stage 1 lies in that the information relative to the cumulative impacts of undertakings in the Machala-Puerto Bolívar conurbation is scattered, and represents a sensitive issue for the corporate image of undertakings and institutions which do not wish to be associated in the collective unconscious with a harmful activity to the natural environment. Moreover, there is hardly any information at hand and/or publicly available which allows for assessing and subdividing the cumulative impacts of undertakings, particularly in areas regarded as strategic by the Ecuadorian government, nor have any rigorous monitoring procedures been performed in relation to particular or sector-specific cumulative impacts in the area of influence.

4. Definition of preliminary geographical and temporal limits for EGIA

4.1. Definition of spatial limits

The geographical limits are defined in the areas of direct (AID) and indirect influence (AII) of Puerto Bolívar Expansion Project Stage 1, and specified in the chapter devoted to areas of influence. The project areas of influence were established based on the interactions between components, aspects and potential environmental impacts, elements on which the identification of valued socio-environmental components is grounded. Therefore, it is reasonable to conclude that all the VECs assessed in this document are within the geographical limits.

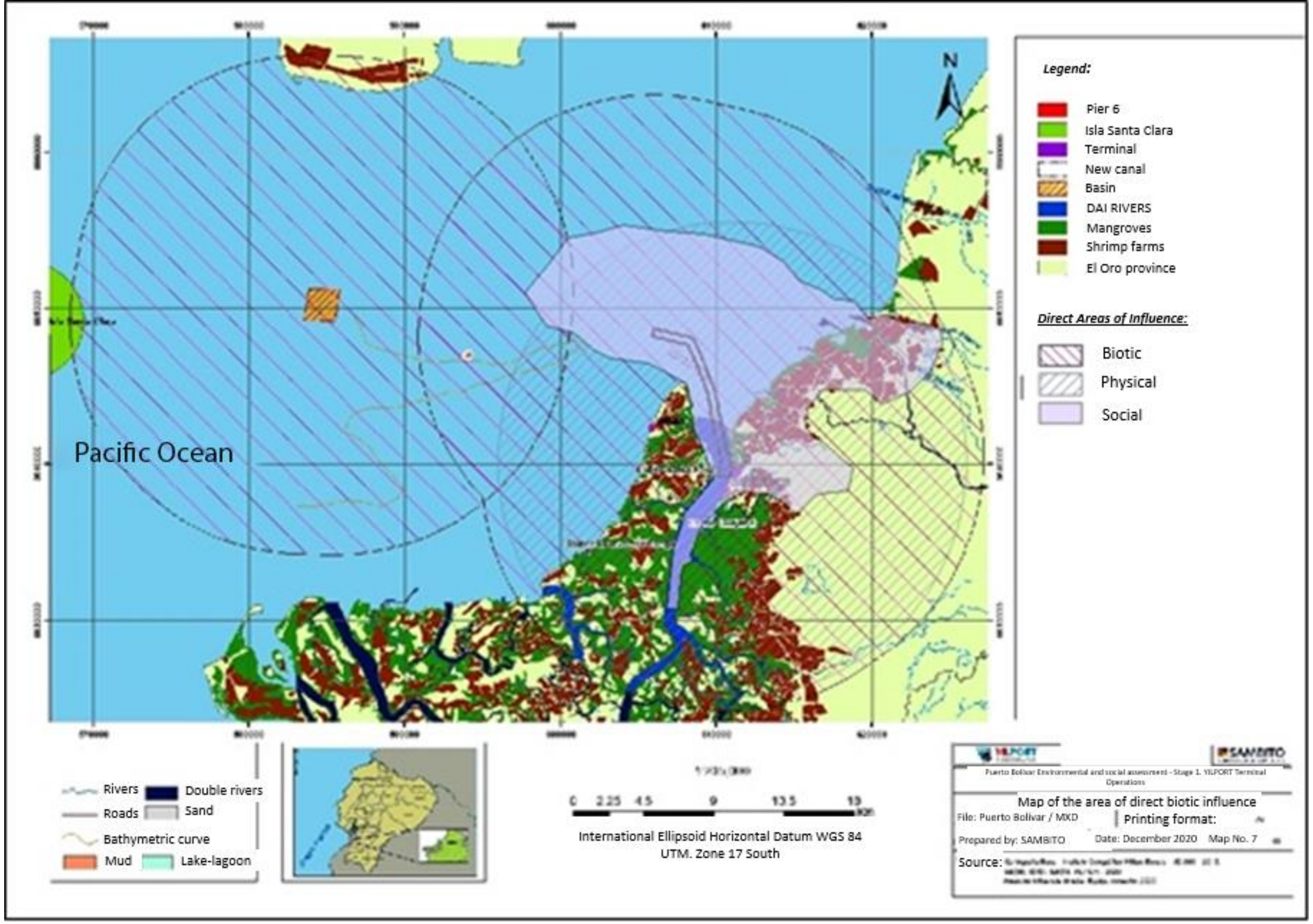
Since port activities have a major role in the marine coastal environment, the areas of influence were defined according to oceanographic criteria, physical and biological aspects. It was calculated that local tidal drag in relation to a local “syzygy” or “spring tide” would have an estimated surface drag displacement of 13.34 km, the same that is based on the descriptions of approaching surface speeds to Puerto bolivar outlined in Publication 125 “*Sailing directions* *(enroute) West Coast of South America*", Fifteenth edition (2017) of the United States National Geospatial-Intelligence Agency. This calculation was rounded off to a 15 km buffer as water drift from vertices georeferenced as AID in bodies of water, while also taking into consideration the biological connectivity of marine regions with similar depth levels and intertidal influence towards the continent until reaching the internal borders in the remnants of mangrove forests which have not been replaced by shrimp farming ponds.

The area of indirect influence includes a strip of 5 km around the AID in bodies of water, and of 1 km in land due to the geographical barriers in the continental area (associated with coastal plains' main lands). The AII spatial limits encompassing most of the area pertain to the project biophysical area of influence, and are placed in the terrain by:

North: Canal de Jambelí and Isla Puná (Guayaquil-Guayas).
South: Estero Jumón and Estero Pital (Cantón Santa Rosa and Arenillas in El Oro province).
East: Estero San Ramón (Cantón Guabo and Pasaje in El Oro province).
West: The Pacific Ocean and Isla Santa Clara

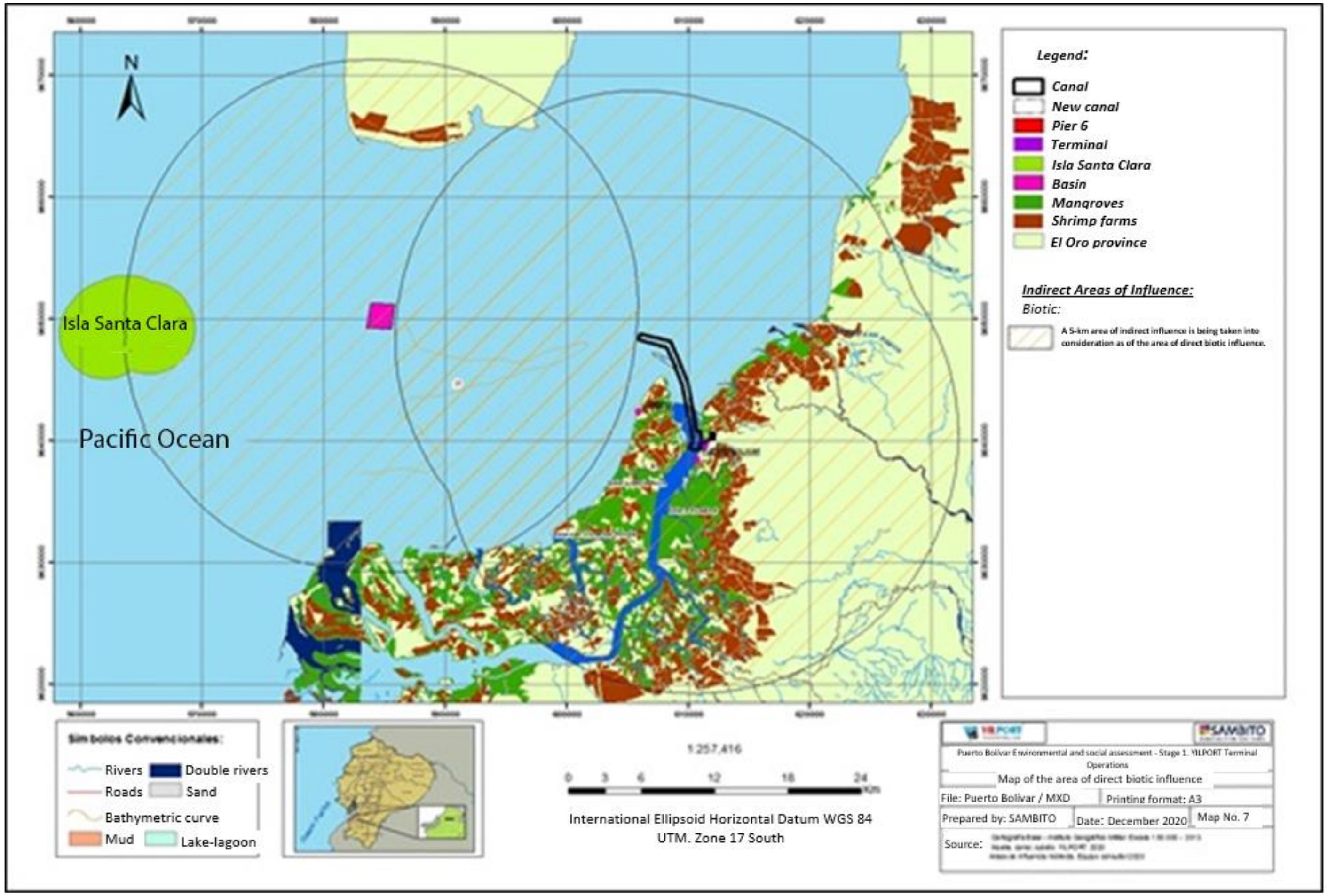
The detailed representation of the physical, biotic and social areas of influence in Puerto Bolívar Project is shown in Figures 2 and 3.

Figure 2 Map of the areas of direct influence in Puerto Bolívar project



Prepared by: Ecosambito, 2020

Figure 3. Map of the areas of indirect influence in Puerto Bolívar project

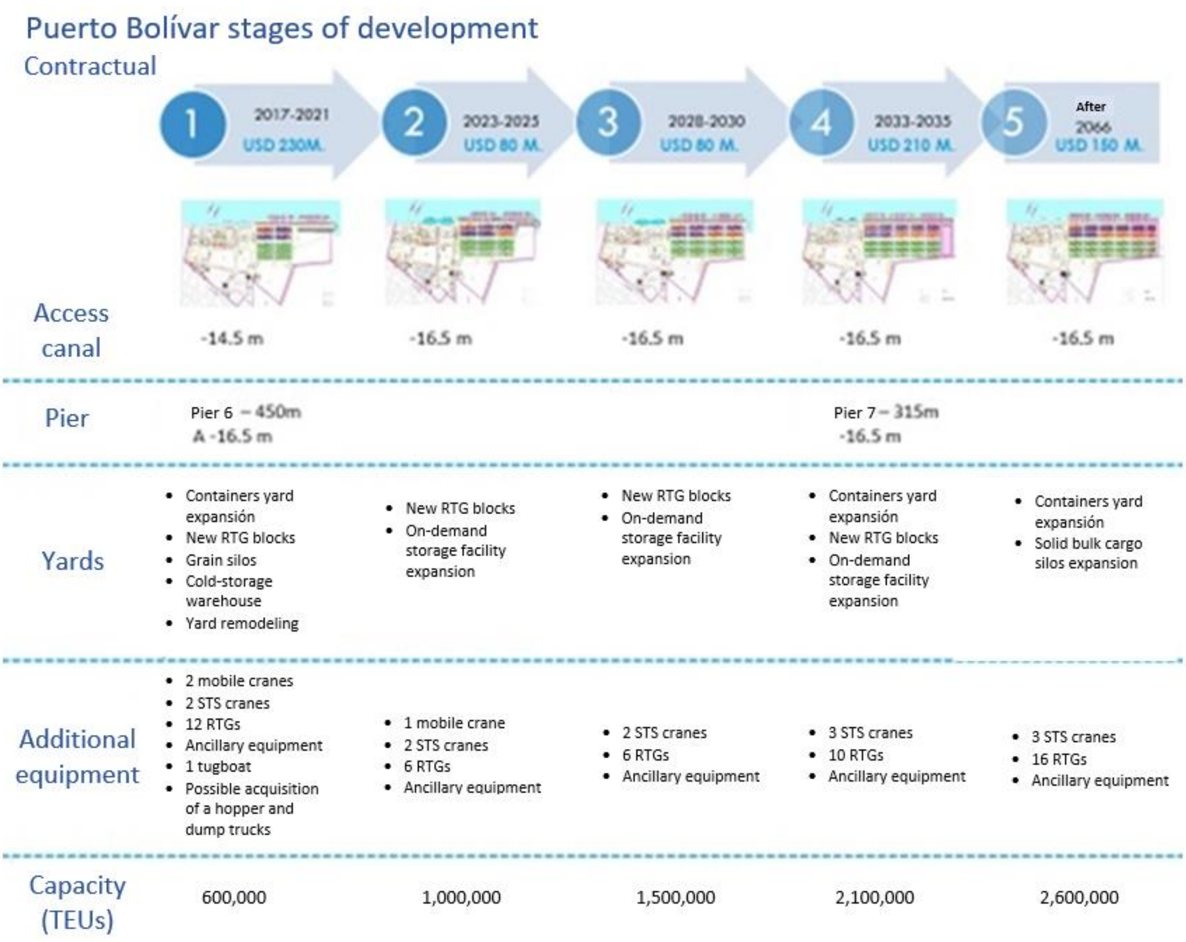


Prepared by: Ecosambito, 2020

4.2. Definition of temporal limits

As to the project temporal limits, the duration of Yilportecu's port operating license to Puerto Bolívar is 50 years. During said period, the Port Terminal is envisioned to undergo a five-stage expansion. Figure 4 shows the main works and capacities that are expected to be accomplished (prospects of growth in TEU load handling) and which will serve as "triggers" for the next stages. It is expected that by the year 2066 the operating capacity will have reached 2,600,000 TEU.

Figure 4. Main activities and temporal projections of Puerto Bolívar project



Source: Yilportecu S.A.

5. Definition of VECs

VECs are environmental and social attributes that are considered significant in impact and risk assessments, and may be:

- physical characteristics, habitats, wildlife populations (e.g. biodiversity),
- environmental services,
- natural processes (e.g. Water and nutrient cycles, microclimates),
- social conditions (e.g. Health, economy), or
- cultural aspects (e.g. spiritual or traditional ceremonies).

Although VECs may be directly or indirectly affected by a specific undertaking, they may also be affected on a regular basis by cumulative effects produced by other undertakings. VECs are the integrated recipients of cumulative impacts because they are generally located at the end of ecological processes.

The first action in order to identify VECs is to perform a preliminary identification in which the Environmental Components obtained from the EIAS Environmental Impact Assessment are studied, followed by the observation of Environmental Components which, according to the social actors, would potentially be affected by the project. The definitive VECs will be a subassembly of the ones identified in the EIAS and those which are also a matter of concern to the community.

5.1. Identification of Environmental Components

In the Environmental Impact Assessment of the Project EIAS, aspects and impacts have been identified for every stage. Environmental aspects are regarded as those elements of the activity, product or service that interact with environmental elements (water, air, community, etc.), causing changes or alterations in the socio-environmental component.

Table 1. Identification of VECs from the Environmental Impact Assessment.

Environmental Element	Environmental Aspect	Identified Socio-environmental Component
Water, soil	General waste production	Water and sediment quality
Water, soil	Sewage water production	Water and sediment quality
Water, soil	Water quality in effluents or accidental discharges	Water and sediment quality
Water, soil, biotic (marine and coastal flora and fauna)	Storage and use of hazardous materials	Water and sediment quality
		Soil quality
		Biodiversity
Air, Social (community health and safety)	Land traffic and port machinery operation	Air quality
		Noise
		Land traffic
		Community health and safety
Air, biotic (marine fauna)	Port traffic	Biodiversity
		Air quality
		Maritime traffic
Social (occupational)	Workforce	Economy
Social (occupational)	Temporary workforce	Economy

Environmental Element	Environmental Aspect	Identified Socio-environmental Component
Social	Interaction with social actors	Community relations
Social (community health)	Port activities	Community health and safety
Social (economy)	Trade and services	Economy
Social (economy)	Landscape quality	Tourism
Biotic (Mangrove)	Variations in current patterns and sediments	Biodiversity (mangrove)
Biotic (benthic fauna)	Seabed dredging	Water quality
		Biodiversity
Biotic (marine mammals)	Underwater noise	Biodiversity
Social (community health and safety)	Community health and safety	Community health and safety
Social (Cultural heritage)	Excavations	Cultural heritage
Water, Soil, biotic (marine fauna), Social (economic)	Extraction and disposal of seabed dredged material Dredge operation Fishery	Biodiversity
		Fisheries

Prepared by: Ecosambito, 2020

Impacts affect several aspects or portions of the Environmental Components; these have been grouped into 12, as listed below:

1. Water and sediment quality
2. Air quality and noise
3. Soil quality
4. Land traffic
5. Maritime traffic
6. Biodiversity
7. Community health and safety
8. Community relations
9. Economy
10. Tourism
11. Cultural heritage
12. Fisheries

5.2. Environmental Components identified through consultation methods.

In November 2020, during the Social Baseline survey conducted in the area of influence, 84 people from different neighborhoods and social organizations in Puerto Bolívar were interviewed, including residents of the neighborhoods adjacent to the Project and the presidents of associations Cuevas del Huayco, Puerto Nuevo and Asociación de Mujeres Estero Porteño. Upon consulting which project activities are of greater concern to the interviewees, the most relevant aspect was the issue involving the dredging of the access canal to Puerto Bolívar. The advantages and disadvantages identified by the interviewees are summarized in Table 2.

Besides the interviews, an informational workshop was held during the same month with representatives of Unión de Organizaciones de Producción Pesquera Artesanal de El Oro (UOPAO), Cooperativa de Producción Pesquera Artesanal Vikingos del Mar, and Organización Comunitaria de Servicios Turísticos La Playita. The main focus of the comments and observations made therein was the potential harm of dredging activities.

Table 2. Interested parties' criteria regarding the project advantages and disadvantages.

Interviews with residents	
Advantages	**Disadvantages**
• Creates more jobs • Increases tourism • Improves the canal • Improves the access to Jambelí • Boosts commerce • Minimizes bad odors • Entry of large vessels • Improvement in boat traffic • Increased productivity and trade • Greater recognition of Puerto Bolívar • Economic growth in the parish	• Harmful to nature • Detrimental to fishermen • Damages the ecosystem • Affects the species • Heavy swell • Dispels marine species • Disappearance of shrimps • Busy traffic in the area • Seabed damage • Imbalance in animal life • Environmental impact
Workshop with Fishermen Associations	
Advantages	**Disadvantages**
• Development	• Lack of socialization with the fishery industry • Impact on mollusks and shrimp fishing • Impact on fish and fish migration • Restrictions on fishing areas due to dredging activities • Suspended sediments on water, nets covered in mud.

Prepared by: Ecosambito, 2020

Some of the interested parties' perceptions are specific, while others are more general. Table 3 shows how those perceptions relate to their equivalent environmental components.

Table 3. Identification of VECs from a social perspective.

Citizen views (project advantages and disadvantages)	Identified social and environmental component
Creates more jobs	Economy
Increases tourism	Tourism
Improves the canal	Maritime traffic
Improves the access to Jambelí	Maritime traffic
Boosts commerce	Economy
Minimizes bad odors	Odors
Entry of large vessels	Maritime traffic

Citizen views (project advantages and disadvantages)	Identified social and environmental component
Improvement in boat traffic	Maritime traffic
Increased productivity and trade	Economy
Greater recognition of Puerto Bolívar	Economy and tourism
Economic growth in the parish	Economy
Harmful to nature	Biodiversity
Detrimental to fishermen	Fisheries
Damages the ecosystem	Biodiversity
Affects the species	Biodiversity
Heavy swell	Maritime traffic
Dispels marine species	Biodiversity
Disappearance of shrimps	Biodiversity and fisheries
Busy traffic in the area	Maritime traffic
Seabed damage	Biodiversity
Imbalance in animal life	Biodiversity
Environmental impact	Water and sediment quality, biodiversity
Development	Economy
Lack of socialization with the fishing industry	Fisheries
Impact on mollusks and shrimp fishing	Biodiversity
Impact on fish and fish migration	Fisheries
Restrictions on fishing areas due to dredging activities	Fisheries
Suspended sediments on water, nets covered in mud.	Water and fishery quality

Prepared by: Ecosambito, 2020

Once again, the Environmental Components identified by the community repeat. As a result, Table 3 is summarized in the following Environmental Components:

1. Tourism
2. Economy
3. Odors
4. Biodiversity
5. Fisheries
6. Maritime traffic

The above list is a subassembly of Environmental Components identified and assessed in the EIAS, with the exception of odors, which could be included in the air quality component; however, besides having been regarded as a positive impact, it has not been previously evaluated as such, which is why it is not included in the assessment.

5.3. Determination of the current state of Environmental Components.

The aforementioned components were described using the information gathered in the EIAS baseline survey as well as the environmental assessments and monitoring procedures of the project environmental tracking.

5.3.1. Water and sediment quality

A record of 15 reports is kept on marine waters and sediments within the project area of direct influence. Monitoring procedures are performed quarterly in the following locations, and monthly during the months in which dredging activities take place:

1. In front of Puerto Bolívar Port Authority (APPB)
2. In front of Naval School
3. Isla del Amor
4. Entrance to El Coco
5. Punta El Faro
6. Entrance to Jambelí

Marine water quality.

<u>Dissolved oxygen:</u> This variable is kept within the range laid down in the environmental legislation. Overall, the closer the stations are to the sea access, the higher the oxygen level, which is expected given the conditions of Estero Santa Rosa inner waters. A reduction of oxygen is observed in the second dredging period.

<u>Oxygen saturation:</u> this criterion correlates to the oxygen reduction seen during the performance of dredging activities; but saturation values above 90% are detected nonetheless, which *a priori* is interpreted as good water quality.

<u>Total suspended solids:</u> This variable shows an increase near mangrove areas with higher mean values towards the Isla Jambelí region.

<u>Ammonium-N</u>**.** This variable is associated with organic enrichment and shows its highest values in the sample near the APPB pier dated August 2019. Said variable, identified in literature as one of the main impacts of dredging activities, does not show an increase during dredging stages. In general, its values are far below the limits laid down in the environmental legislation.

<u>Ammonia-N:</u> From a sector-specific perspective, this variable shows a higher concentration at Isla Jambelí sites, although the highest measurement was recorded in station P1, as was the case with ammonium, in August 2019.

<u>Biochemical oxygen demand:</u> most values are set as <2 mg/L except those in August 2019. There are no Maximum Allowable Limits (MALs) laid down for marine waters in the environmental legislation.

<u>Chemical oxygen demand:</u> Overall, this variable shows a value of <5 mg/L, far below the established MAL of 50 mg/L.

<u>Fecal coliforms:</u> This variable increased during the second dredging period, but the data of August 2019 show an abnormal increase ascribed to an urban effluent performing discharges near the Naval school.

<u>Arsenic:</u> this metal increased during dredging maneuvers, although the overall averages were similar on dates with and without dredging maneuvers.

<u>Cadmium:</u> MALs were never exceeded.

Copper: This compound must be closely observed in the future since it is the most transported cargo from the Port Terminal. The presence of this metal has not increased as a result of dredging operations.

Chromium: Does not exceed the established MALs.

Iron: This compound regularly exceeds the national standard and is, alongside aluminum, the most abundant metal in the coast of Ecuador.

Mercury: The detection limit of the assessment is above the environmental legislation, hence the failure to abide by the established MALs.

Sediment quality. According to two-year monitoring data of seabed sediment quality gathered in line with the Monitoring and Tracking Plan (PMS) of the updated Environmental Management Plan in force associated with the dredging project, tests are carried out to determine the presence of heavy metals (arsenic, cadmium, copper, total chromium, iron, mercury, lead), total petroleum hydrocarbons (TPH) and pesticides (organochlorine, organophosphorus, organonitrogen and carbamate compounds).

The following list was compiled based on the recorded measurements in the project area of influence:

Total Petroleum Hydrocarbons (TPH): is always kept below the MALs, with the exception of the baseline monitoring procedure (performed in May 2017), where all monitored points are well above the MALs; and the monitoring procedure performed in May 2020 in point 7 (earth sedimentation basin), where a high parameter value was detected which pertains to waste discharges by illegal residents in the area.

Arsenic: is present on a regular basis in the monitored points, with values above the Canadian legislation in all points (from P1 to P7), and above the national legislation in two points; however, the same occurs regardless of whether dredging activities are performed or not. In this regard, it is worth noting that arsenic can be found in underground water inflows associated with natural geochemical processes, as a recurring element in marine and estuarine waters where continental water inflows and local variations in salinity, redox gradients and temperature can restrict the entry of arsenic from the mainland into the sea, and in drainages and leachates stemming from mining activities (Lillo, 2005); that it is a component in arsenical pesticides (Reigart & Roberts, 1999); and that there is evidence of its accumulation in Estero Santa Rosa seabed, as supported by the presence of bioaccumulated arsenic in the pustulose ark (*Anadara tuberculosa*) in Estero Huaylá, which exceeds the established allowable limits for consumption under the Australian and New Zealander legislations (Collaguazo, Ayala, & Machuca, 2017).

Copper: values above the Canadian and Ecuadorian legislations were reported at all points, with marked variations between maximum and minimum values informed throughout the year. Once again, this occurs regardless of whether dredging activities are performed or not. In this regard, studies on the assessment of the distribution of total and bioavailable heavy metal content, including copper, found that copper concentrations in Estero Santa Rosa fluctuated between 5.42 mg/kg and 39.17 mg/kg, with an average value of 21.85 mg/kg, of which bioavailable copper makes up an average 9.5% of total copper (Senior, Valarezo, Yaguachi, & Marquez, 2015).

Mercury: Analysis show approved quantifiable limit values (<0.1) conforming to the MALs laid down in the local legislation, which are therefore deemed compliant with the standard since the exact concentration of quantifiable limit values is known to be below the reported value.

Cadmium, total chromium, lead and iron: show remarkable stability and are generally kept below the MALs laid down in the assessed legislations, with the exception of iron which lacks an established MAL.

Pesticides (organophosphorus, organonitrogen and carbamate compounds, and every other pesticide within these groups): their results appear as a constant value that is consistent with the approved quantifiable limit values; and which does not exceed the MALs, should there be any.

The above observations allow for concluding that these results may be associated with anthropic activities unrelated to dredging works (on the basis that the first dredging period took place by the end of March 2018), among which are aggregates and metal mining, and that they have an already reported impact on Estero Santa Rosa sediment quality.

5.3.2. Marine water quality in the sediment basin

Tributyltin (TBT): This parameter was monitored inside and outside of the offshore sediment basin in December 2020, and its corresponding results report is shown in Annex 5.a, Book IV of the Environmental and Social Impact Assessment (EIAS). This report informs values below the 0.2 mg/kg detection limit. With no local regulation laying down MALs for TBT, and taking as reference values those proposed by the National Institute for Coastal and Marine Management (RIKZ), which establishes the standard value for sediment quality at one MAL = 0.0007 mg/kg and a negligible value of 0.000007 mg/kg (for a standard sediment with 10% organic matter, or its equivalent 5% with organic carbon) (Stronkhorst & van Hattum, 2003), it is concluded that the TBT present in samples P1 and P2 exceed the reference value, although by a lower margin compared to other monitored locations at a national and global level.

The obtained results may be associated with the dredging and transportation of sediments from Puerto Bolívar pier aprons and maneuvering area, considering that traditional hull cleaning and painting works have been conducted in this port since last century's 1980s until 2017, year in which this activity was forbidden inside the Port Terminal.

5.3.3. Air quality and noise

Air quality and noise in the project construction area has been monitored for two years, often on a quarterly basis, through laboratories duly accredited by the Ecuadorian Accreditation Organization, pursuant to the provisions in the Environmental Management Plans.

The air quality monitoring point is located in the APPB piers (610951, 9639819), and the measured air quality parameters are as follows: Carbon monoxide (CO), Nitrogen Oxides (NOx), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2), Ozone (O3), Particulate Matter PM10 and PM2.5. During this time frame, all measured parameters ABIDE by the environmental legislation.

As for ambient noise, the monitoring points are located within the Port Terminal, namely: Point 1. Pier #1 (610941 , 9639369). Point 2. APPB Administrative Area (611136, 9639401) Point 3. Pier #5 (611014 , 9640135) Point 4. Puerto Bolívar Cabotage Pier (610892, 9639050). Results show that some points exceed the allowable limits for soil use (Ministerial Resolution 097-A, Annex 5: Maximum Noise Emission Levels and Methodology for measuring stationary sources and moving sources, Table 1: Maximum E levels).

5.3.4. Soil quality

In addition to accidental leaks of chemical substances and liquid waste, the main threat to soil quality is the inappropriate disposal of solid waste. The city of Machala lacks a comprehensive waste management system. The management performed is limited to street sweeping, collection and final disposal at a poorly planned and barely mechanized landfill. Waste is not sorted out at the source in a formal manner, and the only recycling solution is reached via private management plans from companies that see an opportunity for profiting from this activity.

The landfill of the city of Machala is located at the Ceibales area, 8 km southwest from the city. Its surface spans 20.20 hectares and has two macro-cells which are nearing the end of their useful lives. According to the local waste removal company, 116,000 tons of waste were collected in 2018, most of it being organic solid waste.

The main productive activities conducted in the city and province, besides transportation and healthcare facilities, produce hazardous waste (used oils, batteries, waste soaked in hazardous substances, anatomopathological waste, etc.), and special waste (electronic waste, tires, rubble) for which the city does not have any kind of management. As is the case with recyclable waste, companies with environmental regularization processes in place and which implement their Environmental Management Plan in a responsible manner carry out the storage and final disposal of hazardous waste within the framework of the legal regulation through environmental managers qualified by the Environmental Authority, while most producers dispose of this waste via sewerage systems, bodies of water, wastelands or areas surrounding the city, thereby producing a decline in environmental quality and threatening residents' health.

5.3.5. Land traffic

El Oro province road network spans a total of 3,036.70 kilometers, of which 389.88 kilometers belong to the state road network, and the remaining 2,646.82 kilometers to local roads.

The arterial road corridor consists of 99.43 kilometers pertaining to Troncal de la Costa roadway which passes through the province from the north to the southwest, thereby connecting it to the north with Cantón Ponce Enríquez in the Azuay province and to the southwest with Peru. The canton's main road network (1st order: more than 2 lanes), directly connects cantons Pasaje, Santa Rosa and Guabo with paved roads and at average distances of 12 km.

Avenida Bolívar Madero Vargas is the main access road to Puerto Bolívar urban parish and the Port Terminal. Urban buses and private vehicles also pass through it. In order to access this avenue, cargo trucks must take the perimeter access road to the urban area: 1) Avenida Circunvalación Sur is the most widely used, since it connects directly to the city's east access road (Vía Machala – Pasaje). Circunvalación Sur connects to the province's southern region (Vía Balosa – Santa Rosa). 2) Avenida Circunvalación Norte (at 2.7 km from the port entrance) is the most widely used, since it connects directly to the city's east access road (Vía Machala – Pasaje). Circunvalación Sur (at 2.3 km from the port entrance) connects to the province's southern region (Vía Balosa – Santa Rosa). Both ring roads have two lanes in each direction; nonetheless, the urban area is well established, therefore some sections may be considered urban roads, yet the traffic flows through them effortlessly.

With regard to land traffic as a result of port activities, the average number of cargo vehicles entering the Port Terminal is 2,500. Pursuant to Book V.D. on Maritime Traffic Assessment in the project EIAS, even though the data show heavier cargo vessel traffic, a tendency towards port traffic reduction in the Port Terminal is observed due to a rise in containerized cargo.

Between 2017 and 2020, the arrival of cargo in containers has increased from 4% to 49%. This means that the number of trucks of all sizes which previously carried banana boxes to the port is rapidly decreasing and being replaced by higher capacity containers hauled by a single truck, which has reduced consumption of fossil fuels, oils, etc., by a considerable amount, and this tendency continues insofar as the shift towards containerization does the same.

5.3.6. Maritime traffic

Estero Santa Rosa, between Estero Huaylá and the access canal to the Port Terminal, is undoubtedly the province's busiest maritime traffic area.

There are 3 entrance and exit points for vessels to and from Puerto Bolívar through Canal Santa Rosa:

<u>Puerto Bolívar Port Terminal (YILPORTECU).</u> The Port Terminal has 5 piers totaling 920 meters of mooring lines, which allow for mooring up to 5 merchant vessels at a time. Maritime traffic data pertaining to cargo vessels in Puerto Bolívar show an increase in the number of maneuvers as of 2017, yet the projections carried out by YILPORTECU point to stability and a tendency towards a reduction in trip frequency as a result of bulk cargo being replaced by containerized cargo and due to the arrival of higher capacity vessels.

<u>*Cabotage Pier.*</u> This pier Is located 0.2 km south of the Port Terminal and has 3 types of uses:

- Mooring and operational area for cooperatives involved in tourist maritime transport to the Jambelí resort.
- Mooring and operational area for the Navy.
- Mooring and operational area for tugboats that render services to the Port Terminal.

According to the information provided by tourist transport cooperatives, almost 500,000 tourists head for the nearby beaches in Jambelí each year. In terms of vessel trips, this represents between 1,200 and 2,800 monthly trips, which are made by boats with a capacity for 40 passengers.

Estero Huaylá. Its mouth is located 1 km southeast of the Port Terminal. Throughout the years, tens of private piers have been built in this marsh, which serve as mooring points for over 1,200 vessels rendering transportation and supply services to shrimp and traditional fishing farms.

The Ecuadorian Navy catalogs 540 active vessels (less than 10 GRT[1]) in Puerto Bolívar, 43% of which are registered for fishing, 54% for cargo and passenger transport, whereas the remaining 3% pertains to sports, recreational and passenger vessels. Most of them are gathered in commercial and private piers located at Estero Huaylá, south of Puerto Bolívar.

However, a vessel count conducted on Sunday, 1 November 2020 from 6 a.m. Shows the following data:

Table 4. Vessel census in Estero Huaylá and the Cabotage Pier.

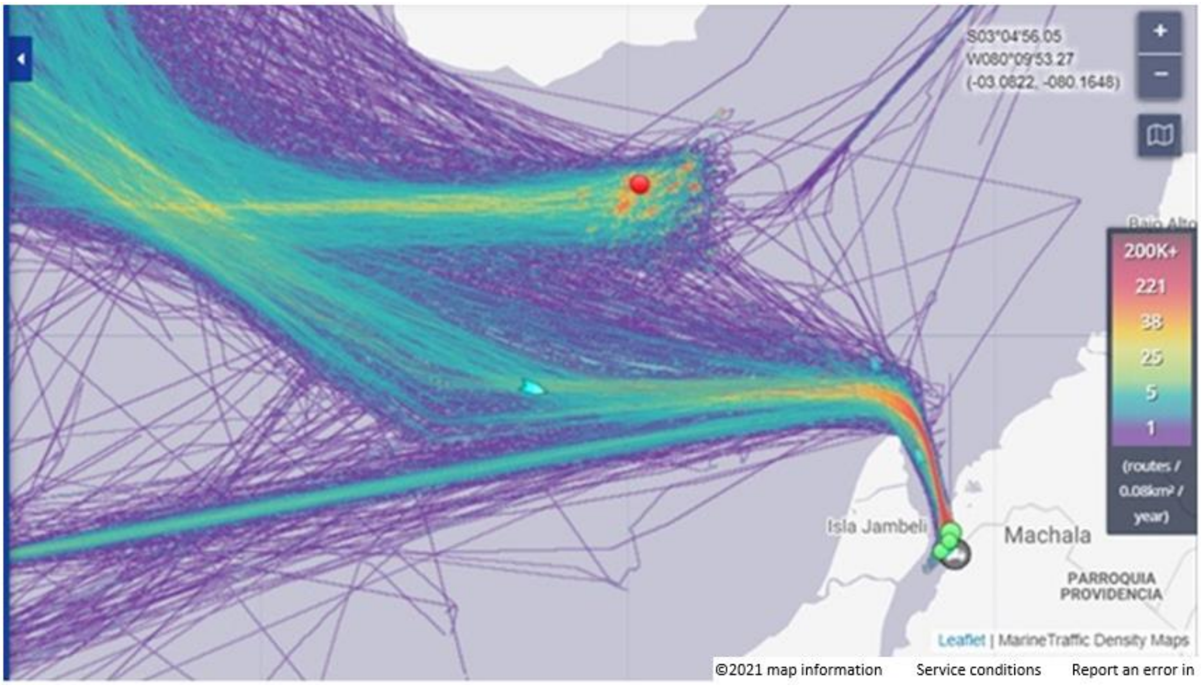
Type of vessel	Number
Fishing canoes	21
Wooden boat	30
Fiberglass boats	943
Industrial boats	84
Shrimp fishing feluccas	109
Barges	20
Logistic vessels	13
TOTAL	**1,220**

Prepared by: Ecosambito, 2020

Figure 1Figure 5 [*sic*] shows vessel traffic density recorded in the area of influence during the 2019 period retrieved from the freely available database www.marinetraffic.com, without distinction in relation to vessel type.

[1] Gross registered tonnage, total volume of a vessel intended and used for the carriage of passengers and goods.

Figure 5. Vessel traffic density in Canal de Jambelí and Estero Santa Rosa in 2019



Retrieved from www.marinetraffic.com

5.3.7. Marine coastal biodiversity

During the 2018-2020 period, qualitative and quantitative sampling methods were employed within the project area of direct influence to confirm a total of 191 phytoplanktonic species, 54 types of zooplankters larger than 300 micrometers, 59 zooplankters larger than 500 micrometers, 79 soft-bottom subtidal benthic species, 69 infauna species from sandy and muddy beaches; in addition, 72 fish species were captured and the presence of 12 marine beings protected by international agreements was observed; these pertain to the only aquatic beings categorized as vulnerable by IUCN's REDList.

Although no specific bird tracking endeavors were conducted, bibliographic reports from previous studies show 104 recorded species (Francisco Sornoza, 2013); taking into consideration both mangroves and areas near the coast of Isla Santa Clara in 2013; moreover, in the vicinity of Puerto Bolívar project, specifically in mangroves, the study of Orihuela - Torres et al., 2016, identified the presence of 50 bird species.

Table 5 shows in detail the main species richness estimation groups in the area of influence of Puerto Bolívar Expansion Project Stage 1.

There is a significant relation between biodiversity and its exploitation by fisheries and tourism in marine coastal areas; to illustrate this, take rockfill structures built in front of Playa Jambelí as an example, which have not only turned the latter into a calm water area suitable for recreational activities aboard smaller rowing vessels, but also gathered bigger fish, thus becoming a perfect location for sport fishing, as shown in the photograph below.

Photographic record 1 Snook Centropomus sp caught using the pole-and-line fishing method in Playa Jambelí artificial rocky outcrops.

Table 5. Estimated species richness in the area of influence

Phytoplankton	**Zooplankton larger than 300 micrometers**	**Zooplankton larger than 500**	**Benthic community subtidal**	**Beach infauna**	**Ichthyofauna**	**Protected marine beings**
Bacillariophyta 123 species	*Crustacea* 22 types	Crustaceans 21 types	Crustaceans 12 species	Crustaceans 15 species	Fish 72 species	Marine mammals 4 species
Miozoa 43 species	*Chaetognata* 3 types	*Chaetognata* 3 types	*Scaphopoda* 1 species	*Bivalvia* 23 species		Reptiles 1 species
Protozoa 14 species	*Polychaeta* 7 types	*Polychaeta* 6 types	*Bivalvia* 18 species	Gastropods 7 species		Fish 7 species
Cyanophyta 10 species	*Larvacea* 1 type	*Larvacea* 1 type	Gastropods 12 species	*Echinodermata* 4 species		
Charophyta 1 species	Urochordata 4 types	*Urochordata* 3 types	*Echinodermata* 3 species	*Polychaeta* 12 species		
	Cnidaria 5 types	*Ctenophora* 1 type	*Cnidaria* 1 species	*Cnidaria* 1 species		
	Mollusca 3 types	*Cnidaria* 6 types	*Nemertea* 1 species	*Brachiopoda* 1 species		
	Echinodermata 1 type	*Mollusca* 3 types	*Polychaeta* 28 species	*Platyhelminthes* 1 species		
	Fish 8 types	*Echinodermata* 3 types	Sipunculida 1 species	*Nemertea* 1 species		
		Fish 12 types	*Priapulida* 1 species	Sipunculida 1 species		
			Platyhelminthes 1 species			
191	54	59	79	66	72	12

Prepared by: Ecosambito, 2020

Mangrove. As of 2019, El Oro province has 19,318.39 ha of mangroves, 15,636 of which have been handed over in the form of Mangrove Sustainable Use and Custody Agreements

(AUSCM) to 23 associations (UTPL, 2019), thus covering 81% of the existing mangroves in the province.

The mangrove area coverage estimate made through GIS systems in November 2020 was 7,611.80 ha in the area of direct influence. According to the land zoning and development plan document of Cantón Machala in its 2018 update, in 2014 there were 4,011.44 ha of mangroves in this canton.

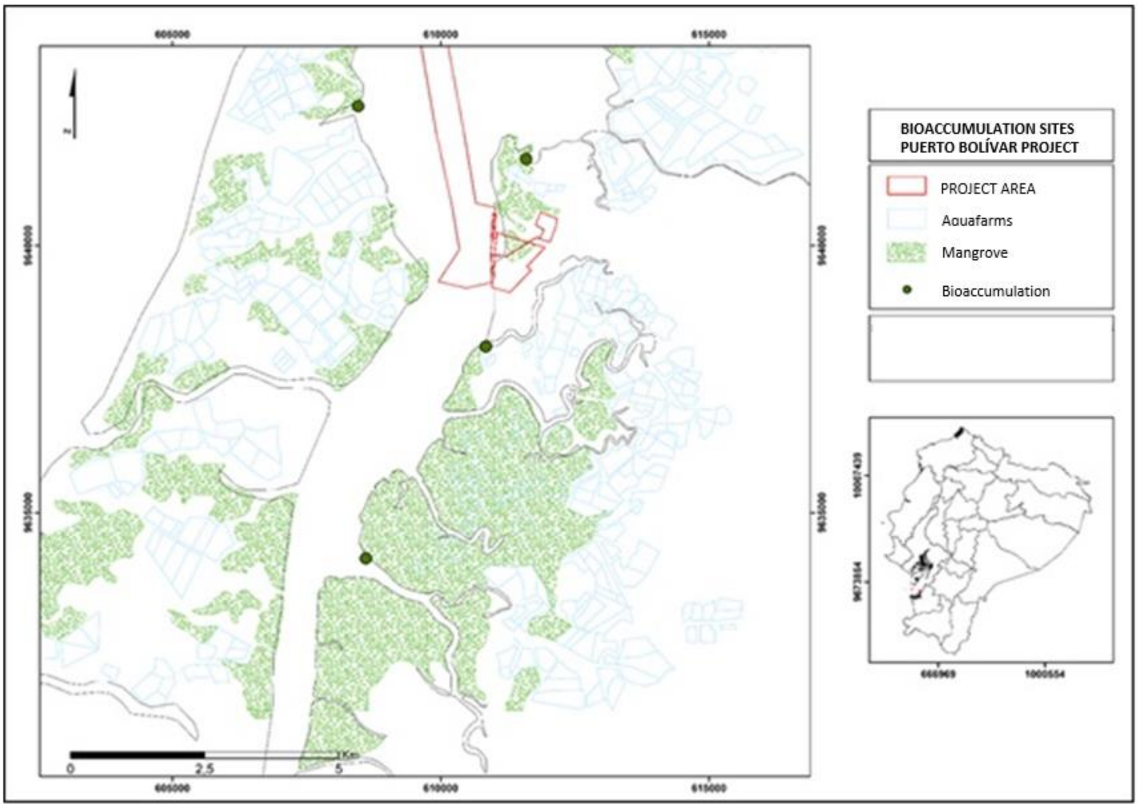
The legal instrument in force by which mangrove areas are handed over to ancient or traditional communities of users for their sustainable exploitation is referred to as Mangrove Sustainable Use and Custody Agreement, or AUSCM, whereby the government grants a 10-year co-management license once the beneficiary group approves a management plan which will have periodic assessments. There are 3 AUSCM near Puerto Bolívar Expansion Project Stage 1, which have maintained productive activities from 2018 to 2020, particularly in the extraction of shells and crabs at the georeferenced regions described in the Environmental Services chapter. The most productive USCM with regard to mangrove fishery resources is referred to as “Vikingos de Mar”, with mangroves located in the marsh at the entrance to the Jambelí resort.

The predominant species which populate these forests are *Rhizophora mangle*, *R. racemosa*, *R. x harrisonii, Laguncularia racemosa var. racemosa*, *L. racemosa var. glabriflora* and *Avicennia germinans* (Cornejo, 2014).

There are documents that emphasize bird diversity in El Oro mangroves, particularly in the area of direct influence, which are described in the Biodiversity chapter.

Chemical quality assessments in mangrove regions within the area of direct influence are rare; for that reason, in November 2020, 4 samples were collected in 4 mangrove areas, which are shown in Figure 6.

Figure 6 Shell and sediment sampling sites locations in mangroves, November 2020



Prepared by: Ecosambito, 2020

The samples consisted of pustulose ark *Anadara tuberculosa* specimens of two size ranges, collected by 4 local gatherers who extracted shells in each site for an hour. Also, sediment samples of the surface's first 3 cm were gathered in shell-collecting areas (mangrove sediments), as well as in the subtidal surface layer at the site where sample collectors disembarked. The samples were taken to a duly accredited laboratory that determined their contents were 20 metals and metalloids, which enabled the analysis of 8 shell samples (two size ranges per site) and 8 sediment samples, so as to monitor the changes in metal and metalloid contents between the sampling sites; 2 sampling sites were located at less than 2 km from Puerto Bolivar port complex, and 2 stations at a distance from the complex and the urban influence.

The results and assessments of said study are attached to this report.

5.3.8. Community health and safety

Records show that Cantón Machala has 245,972 residents and the number of beds for their healthcare is 693, i.e. 25.9 beds per every 10,000 residents. In line with that, Cantón Machala has a shortage of 4.1 beds per every 10,000 residents in order to provide for its entire population. There are 3 healthcare facilities within Puerto Bolívar Parish.

Diabetes and hypertension have constituted the main causes of death at the provincial and regional level in the last 20 years.

As for morbidity, the main causes for seeking medical attention in the parish are those related to urinary tract infections, acute rhinopharyngitis (common cold), intestinal parasite infection without further specifications, unspecified acute pharyngitis, cervicitis, diarrhea and gastroenteritis of presumably infectious nature, streptococcal tonsillitis, among others. The leading health problem in 2020 is the COVID-19 pandemic, a respiratory disease caused by the SARS-CoV2 virus. Its global dissemination has had a dramatic impact on morbidity, mortality and health services ability to respond accordingly.

5.3.9. Economy

This Environmental Component groups socio-environmental components that are generally influenced in a positive way by the project, such as commerce and services supply and demand.

The region's economy is based on the farming and export of shrimp and banana, the production of which takes place at the peri-urban and rural area. The Port Terminal is a key element that supports and drives this production – exploitation dynamics, and invigorates the province's economy.

According to the Central Bank of Ecuador, El Oro province constitutes just over 3% of the national value-added production, thus it cannot be regarded as an industrial development area.

The primary sector in El Oro province constitutes, as of 2014, 26.6% of the entire province's economy (with the exception of the oil industry). On the other hand, services are established in the most dynamic economic sector, reaching 63.1% of the Gross Value Added. Therefore, the sum of the primary and service sectors' GVA adds up to a value of 89.7% of El Oro's GVA, thereby evidencing that these sectors produce an immense added value in the province, whereas the manufacturing industry, with barely 4.7% of the GVA, is of secondary importance (Capa et al., 2018).

5.3.10. Tourism

Some communities and social groups benefit from tourism due to Canal Santa Rosa and Archipiélago de Jambelí landscape resources.

Puerto Bolívar promenade is a traditional recreational area for Machala citizens, who visit it not only for its landscape quality but also for its cuisine.

Jambelí and El Faro beaches are widely visited throughout the year by locals and tourists alike, and in particular by residents of provinces in the country's southern mountainous region.

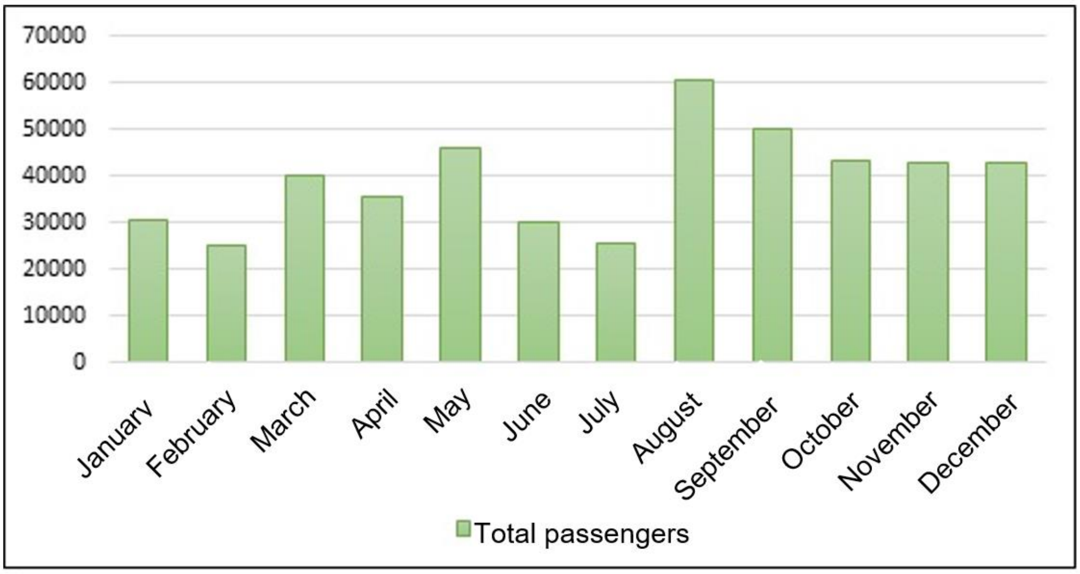
A significant flow of visitors and tourists is observed from the Cabotage Pier to Jambelí, El Faro and La Playita resorts, where the Ecuadorian government has made investments in tourism protection and promotion (the most recent ones being rockfill walls in Jambelí and a floating pier in La Playita), and which have enabled an increase in the area's biodiversity and the development of recreational activities such as line-caught fishing of big fish.

It is worth noting that both the access mangroves to Playa Jambelí and the surroundings of La Playita and El Faro are part of the licensed areas mentioned in the above paragraph.

According to the Port Traffic Assessment conducted for this project, there is a large number of tourists circulating from the Cabotage Pier to the Isla Jambelí beach.

Due to the anomalies caused by the COVID-19 pandemic, data from 2019 were collected which were gathered by leaders of maritime transport companies who provided this service. These data reveal that around 470,000 people travel to Isla Jambelí each year. For this reason, there are approximately 40 vessels devoted to these tours.

Figure 7. Passengers traveling to Playa Jambelí.



Prepared by: Ecosambito, 2020

International cruise ships have reached the Port Terminal, for instance, the *Silver Explorer* in 2016 carrying 130 passengers, and the Seabourn Quest in 2019 with 400 tourists on board, who took part in tours around the different tourist attractions offered by El Oro province, such as the Puyando Petrified Forest and Arenillas and Buenaventura ecological reserves. This activity, which is halted due to the pandemic, is expected to resume and increase in the coming years.

5.3.11. Cultural heritage

Due to ethnohistoric references and archaeological investigations in the south coast of Ecuador, the remains of pre-Hispanic settlements have been reported which date back from the Formative Period (Valdivia culture), to the Regional Development Period (Jambelí) and the Integration Period (Milagro – Quevedo). Towards the north and east of Puerto Bolívar Port Terminal, vestiges of late pre-Hispanic settlements can still be seen, although most of them have been affected and destroyed by modern human communities, formal and informal settlements, civil infrastructure works in addition to crops, generally combined with the natural processes they have undergone through time (cultural and natural transformation processes; Schiffer 1987).

In the vicinity of the assessed area (at a distance of approximately 6 km) the following archaeological sites have been reported:

Table 6 Archaeological sites

Site	Type	Culture
Estero Chivería 2	Residential	Jambelí
Estero Chivería 1	Residential	Jambelí
La Puntilla	Residential	Jambelí
La Primavera	Residential	Jambelí
Los Vergales	Residential	Jambelí

Prepared by: Ecosambito, 2020

5.3.12. Fisheries

Fisheries associated with the Project AID are traditional for the most part, and involve four main modalities: The traditional pedestrian fishing (PAP) focused on the collection of marine invertebrates (*bivalvia* and crustaceans) and having an uninterrupted activity in Estero Santa Rosa beaches and mangroves; the still passive arts fishing (PAF) which is regulated and focused on smaller crustaceans and fish; non-motorized traditional coastal fishing that is clearly decreasing and being performed exclusively in smaller bodies of water with mangrove presence; and lastly the motorized traditional coastal fishing in which most fishers who live in the vicinity of Puerto Bolívar are involved and that is focused in the extraction of crustaceans and fish.

The estimated number of fishers aboard vessels was updated at Puerto Bolívar in November 2020, and it maintains previous estimations conducted in 2013, the assumption being that they operate in the area of direct influence of Puerto Bolivar Expansion Project Stage 1, and it is predicted that there will be around 1,250 smaller vessels which will require the work of 3,000 fishermen.

Table 7. Traditional fishing fleet and seamen in the area of influence of Puerto Bolívar Expansion Project

Cove	Estimated vessel number			2013* estimate	2013** National Fishing Institute (INP) estimate	Current assessment
	Fishing canoes (1.5 fishermen)	Wooden boat (2 fishermen)	Fiberglass boats (2.5 fishermen)			
Puerto Bolívar	17	28	943	2,820*	1,825	2,439
*La Puntilla***	*25***	*15***	*9***	*101**	*100*	*101**
*Bajo Alto***	*50***	*120***	*5***	-	*414***	*414***
Tendales	*20***	*14***		-	*120***	*120***
Playa Jambelí	-	-	-	*50**	-	*50**

Total	17	28	963	2,870	1,825	2,489

Prepared by: Ecosambito, 2020

Table 7 only includes seamen aboard vessels; therefore, in order to make an accurate estimate of users of fishery resources, the estimated number of shellfish gatherers (PAP) operating in mangroves and beaches near Puerto Bolívar needs to be added as the author considers that said number would fluctuate between 150 and 200 shellfish gatherers operating on a daily basis.

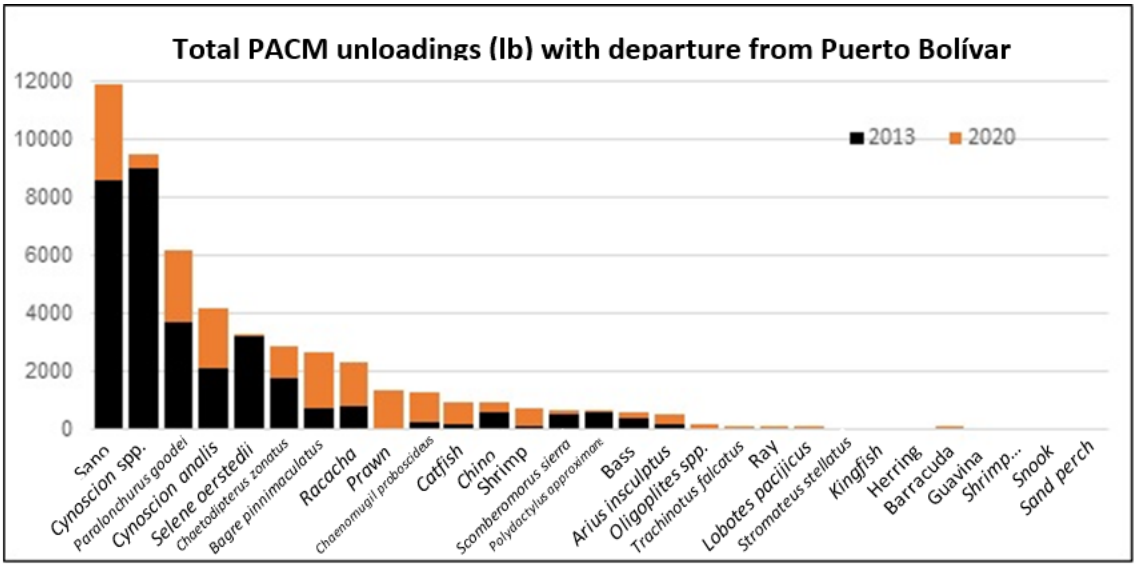
PACM include at least 60 resources captured in the Project area of direct influence, being net capture the most common capture practice in the area, whose descriptions are shown in table 8 and figure 8 respectively, and where 250 fishing records analyzed during November 2020 are compiled.

Table 8. Fishing variables associated with the main arts employed in the project area of influence

Variable/fishing art	Mono 2 ¾"	Mono 3"	Mono 4"	Mono 4.5"
No. of records	145	52	23	30
Time outside the port	9.96± 1.55	10.14± 1.70	10.54± 3.32	10.78± 1.90
Average capture (lb/fishing trip)	71.37± 58.52	87.22± 59.28	84.81± 77.63	70.39± 55.11
CPUE (lb/fishing time)	19.18± 18.86	19.90± 15.45	21.46± 28.09	12.95± 9.02
Profit (Us$/vessel/fishing trip)	30.57± 20.46	66.21± 64.54	44.78± 30.74	63.42± 60.60

Prepared by: Ecosambito, 2020

Figure 8 Main fishery resources exploited in the area if influence of Puerto Bolívar project



Prepared by: Ecosambito, 2020

Photographic record 2: "Bowling" capture type, 8 meshes sized 2"3/4, 20´ away from Puerto Bolívar

6. Other activities and external factors

6.1. External natural factors

Several external factors may cause "natural" damages to the Environmental Components, of which the main identified external factor that will alter the coastal border of the Project areas of direct and indirect influence is sea level rise or SLR; this is addressed in further detail in the Critical Habitats document.

According to the studies of Leonor Vera (2004) from 1970 to 2002, sea level would have increased by 16 cm in Puerto Bolívar. Since 2012, this process has forced the Ecuadorian government to invest in the construction of rockfill retaining walls at the most highly-trafficked resorts such as Playa Jambelí and Bajo Alto; moreover, this is evidenced by the significant reinforcement of coastal structures, mainly coastal shrimp farms located in mangrove internal bodies of water.

Other natural phenomena that could potentially affect fisheries is the occurrence of El Niño and La Niña events, the former being associated with a reduction in ocean productivity, thereby reducing fisheries productivity while increasing the occurrence of HABs[2] that have been recorded in previous years in the vicinity of the dredged sediment disposal basin, as a bloom of *Noctiluca scintillans in 2018, when no dredging maneuvers were taking place, although it was mistakenly related to these maneuvers or to a far-reaching salp bloom recorded in the vicinity of Isla Santa Clara in 2015.* These events depend on harsher oceanographic conditions in open waters, yet are influenced in inner waters by other inland undertakings, and in the mangroves mentioned hereafter.

[2] Harmful Algal Blooms

6.2. Identification of relevant nearby undertakings

6.2.1. Preexisting undertakings

Identification of past activities allows for determining the conditions of the environmental components in the project area, the types of damages suffered and their duration, and whether these damages are still being inflicted.

The three undertakings described below are interrelated: Campo Amistad, Termogas Machala power plant, and Bajo Alto natural gas liquefaction plant were planned and built in order to harness the natural gas in the Gulf of Guayaquil during a period known as a shift in the productive infrastructure of Ecuador, which is still taking place. They are described below:

Campo Amistad (Block 6 Petro Ecuador). Within the marine environment, the single coexisting undertaking near Puerto Bolívar area of influence is the flow of natural gas from Campo Amistad to Bajo Alto town, where it is supplied by Termogas Machala combined cycle power plant and the Natural Gas Liquefaction Plant run by Petroecuador. Even though the drilling record dates back to 1970, the commencement of operations took place in 2003. It consists of 17 drilled wells, 4 production wells, 70 km of 12-inch gas pipelines, a dehydration plant (Bajo Alto) and a Logistics Base (pier). In addition, it has campaigns adding up to 196 km2 of 3D seismic and 1,510 km2 of 2D seismic (Block 6). By 2018, gas production reached 38 MMSCFD (million standard cubic feet per day). Environmental permit No. 005 dated 13 January 2011 and its supplementary assessments allow for drilling 15 additional wells.

Termogas Machala Power Plant. It is located at Bajo Alto town in Cantón Tendales, El Oro province, north of the project area of influence. This is a combined cycle power plant operating with natural gas from offshore platforms in the Gulf of Guayaquil. It is currently being run by CELEC EP and has a power of 250 MW divided into two unit groups, 130 MW into two 6FA gas units, which commenced their operations by the end of 2002, and 120 MW into 6 units 6FA gas units, which commenced their operations in early 2012, supplying the resulting electricity to the National Interconnected System.

Bajo Alto Natural Gas Liquefaction Plant. It is run by Petroecuador EP, is located at the Bajo Alto town and its goal is to liquefy gas from Campo Amistad in the Gulf of Guayaquil. It processes around 100 metric tons of Natural Gas per day through a cryogenic process which reduces Liquefied Natural Gas (LNG) temperature until 160 degrees below zero, thereby producing a shift from its gas state to its liquid state.

Approximately 85% of this production is supplied to the ceramic industry of the Azuay province, and to more than 3,000 residents of the communities of Bajo Alto, Barbones, Tillales, Tendales and adjacent areas to Cantón El Guabo, which benefit from 63,000 cubic feet of gas per day for domestic consumption.

6.2.2. Leading economic activities in El Oro province

This section identifies the economic activities in the province, each of which consists of tens of private undertakings. Banana and shrimp farming activities not only create several local jobs, but are also a direct source of foreign exchange income to the country.

The official data in relation to these economic activities is compiled by the Central Bank of Ecuador. Although the relevant data pertains to a recent period, these activities have been carried out for several decades, as is the case with banana and shrimp farming. The latter's boom happened around the 1990s, when large natural areas were turned into shrimp farming ponds.

This section presents the historical development and impact of the main economic activities in the province, so as to show their relevance in the current environmental state.

Table 9. Undertakings and activities in El Oro province

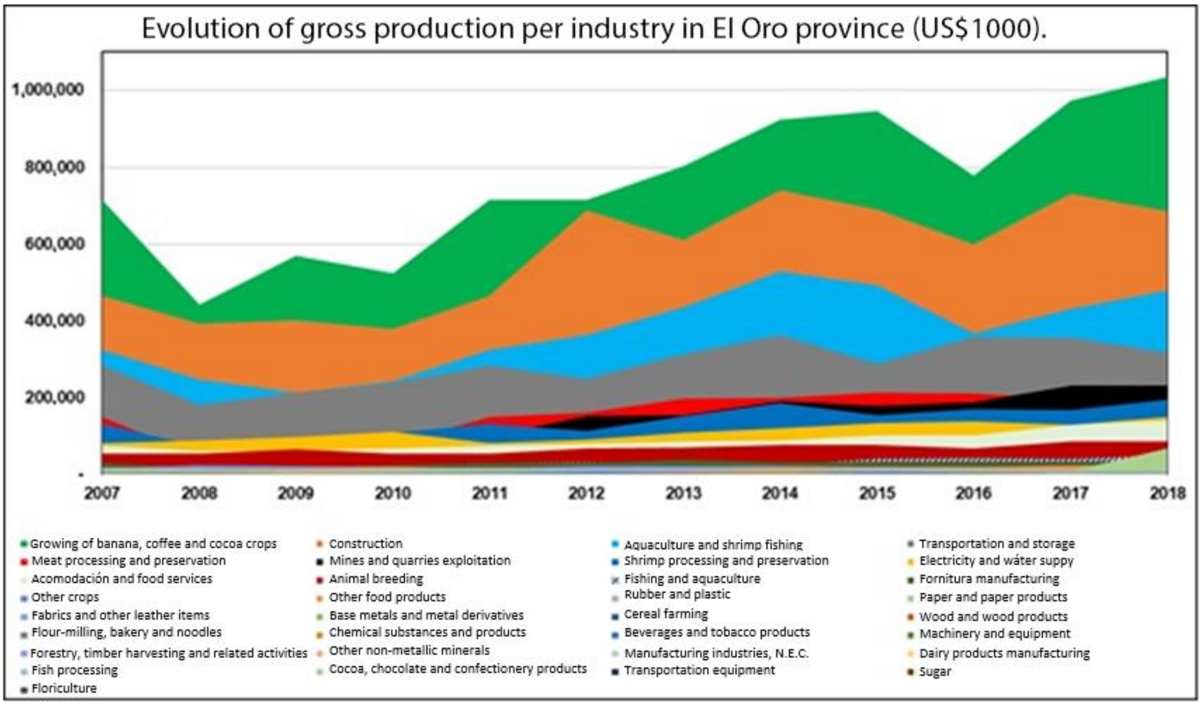
Gross Value Added (GVA) (Thousands of dollars)	
Activities	**Total**
Growing of banana, coffee and cocoa crops	768,150
Wholesale and retail trade, repair of motor vehicles and motorcycles	536,112
Construction	408,806
Education	232,172
Social and healthcare services	185,026
Transportation and storage	168,596
Shrimp aquaculture and fishery	157,873
Mines and quarries exploitation	148,203
Professional, technical and administrative activities	130,936
Public administration, defense, mandatory social security plans	129,329
Leisure, recreation and other service activities	109,856
Financial services activities	107,506
Real estate services	81,997
Accommodation and food services	81,214
Meat processing and preservation	70,968
Shrimp processing and preservation	69,815
Post and communications	62,784
Electricity and water supply	54,118
Paper and paper products manufacturing	27,139
Fishery and aquaculture (with the exception of shrimp)	26,084
Animal breeding	21,514
Other crops	17,665
Private homes with domestic service	16,263
Furniture manufacturing	13,346
Rubber and plastic products manufacturing	7,108
Other food products manufacturing	6,197
Cereal farming	4,824
Flour-milling products, bakery products and noodles manufacturing	3,596
Fabrics, clothing, leather and leather items manufacturing	2,823
Forestry, timber harvesting and related activities	2,481
Chemical substances and products manufacturing	2,469
Base metals and metal derivatives manufacturing	2,139
Wood and wood products manufacturing	1,712
Machinery and equipment manufacturing	1,529
Beverages and tobacco products manufacturing	1,322
Other non-metallic mineral products manufacturing	985

Gross Value Added (GVA) (Thousands of dollars)	
Activities	**Total**
Manufacturing industries, N.E.C.	766
Insurance plan financing, with the exception of social security	431
Dairy products manufacturing	392
Transportation equipment manufacturing	107
Cocoa, chocolate and confectionery products manufacturing	53
Floriculture	23
Sugar manufacturing	3
Oil and natural gas extraction and related service activities	0
Manufacturing of plant and animal derived oils and fats	0
Processing and preservation of fish and other aquatic products	0
Manufacturing of oil refinery products and other refinery products	0
Grand total	**3,664,429**

Source: www.bce.fin.ec
Prepared by: Ecosambito, 2020

The first step in order to identify relevant undertakings was to assess only the higher volume productive activities (excluding services) since those are the ones that produce damages to the environment. Subsequently, the development of these activities was analyzed in search of incremental tendencies, which is why their economic movement for the 2007-2018 period was illustrated.

Figure 9. Development of gross industrial production in El Oro province



Source: www.bce.fin.ec
Prepared by: Ecosambito, 2020

Figure 9 shows the relevance of 6 main undertakings in relation to money amounts and incremental tendencies in production during the assessed period. The following are the most relevant undertakings in El Oro province within the Project area of influence:

1. Continuous growing of banana, cocoa and coffee crops.
2. Construction
3. Shrimp aquaculture and fishery,
4. Transportation and storage,
5. Mines and quarries exploitation,
6. Meat and shrimp processing and transformation

Below are relevant data regarding the state of these activities after analyzing the characteristics and impacts related to them using the bibliographic review methodology.

Continuous growing of banana, cocoa and coffee crops

Continuous crops cover almost 50% of Cantón Machala surface (Figure 10), 35% of which are used for banana farming.

Figure 10 Surface by soil use in Cantón Machala.

Hectares by type of farming within canton Machala. Year 2014

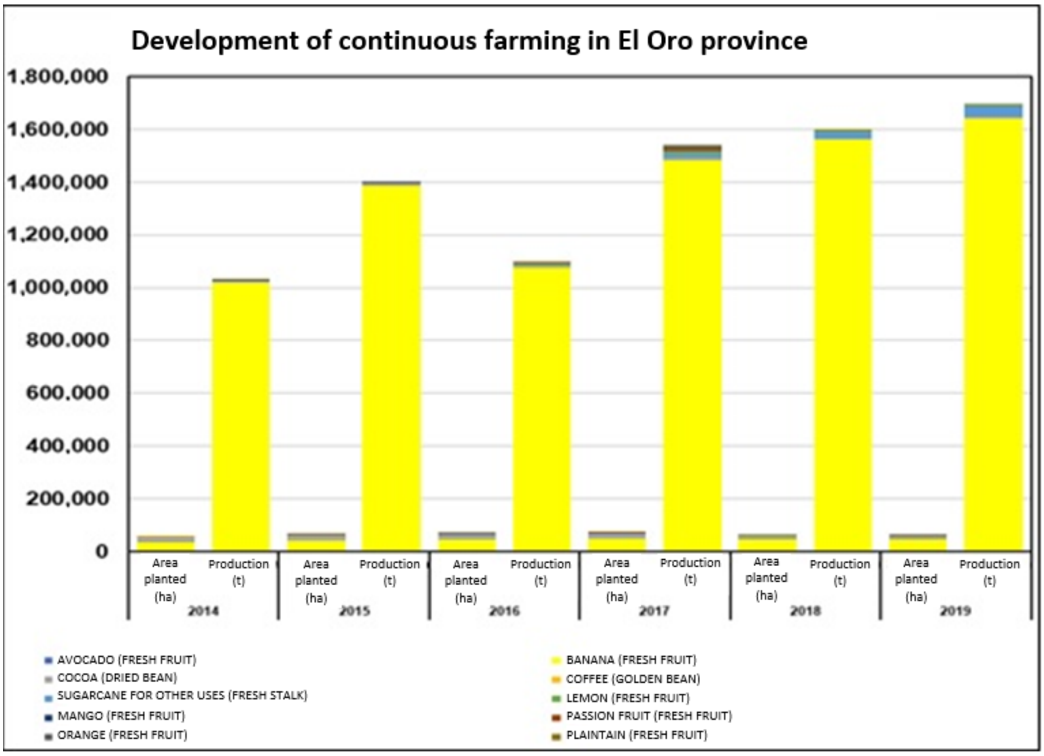
Soil usage	Area (Ha)	Territory %
MANGROVE	4,011.44	10.76
RICE	64.33	0.17
BANANA	13,224.18	35.48
COCOA	245.73	0.66
SHRIMP FARMS	8,236.66	22.10
ANNUAL FARMING	0.15	0.00
CONTINUOUS FARMING	96.63	0.26
SEMI-CONTINUOUS FARMING	905.24	2.43
FRUIT TREES	2,774.74	7.44
MOSAIC FARMING SYSTEM	417.10	1.12
PASTURELANDS	219.31	0.59
GRASSLANDS	1,505.41	4.04
BODIES OF WATER	1,778.74	4.77
URBAN AREAS	3,795.58	1.18
TOTAL	**37,275.23**	**100.00**

Source: POT GAD Machala, 2018
Prepared by: Ecosambito, 2020.

El Oro province has a surface of 579,185 ha, 37.94% of which is regarded as coast, whereas the remaining percentage pertains to mountainous regions. Banana, whose crops are found in flat and low regions, cover 45,549 ha, 21% of the province’s flat-level regions.

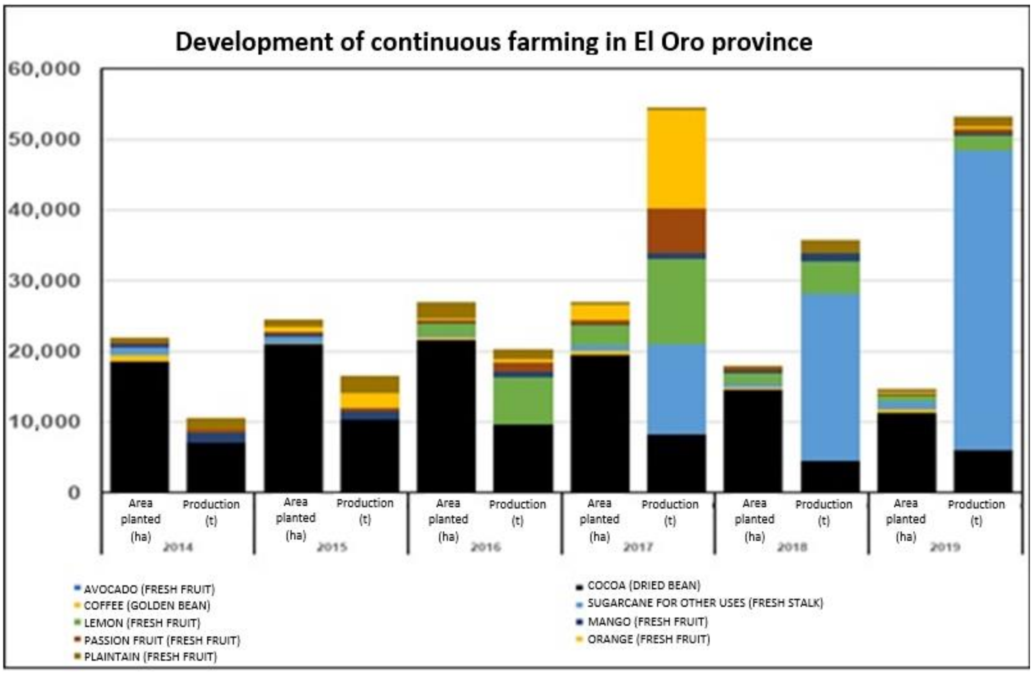
The development of cultivated surface, as described in the ESPAC database for these crops, shows that banana occupies the largest portion of the province’s cultivable soil, which also increased to 25.99% in 2019. Other crops, such as cocoa and coffee, are subject to considerable fluctuations each year, perhaps due to the instability of international prices. By 2019, cocoa was the second most-grown continuous crop in terms of cultivated surface. The continuous crop with the third most extensive surface use is sugarcane, which in 2019 registered 1,145 ha.

Figure 11. Development of planted surface and continuous crop production in El Oro



Source: www.bce.fin.ec, Prepared by: Ecosambito, 2020

Figure 12. Development of planted surface and continuous crop production in El Oro with the exception of banana



Source: www.bce.fin.ec
Prepared by: Ecosambito, 2020

The environmental footprint of the Ecuadorian banana, on the basis of carbon footprint (CF), water footprint (WF) and profit distribution throughout its value chain, was estimated by Roibas et al. in 2015, who determined that in conventional farms CF would be 302 g CO_2 / banana kg, whereas in organic farms it would be 249 g CO_2 / banana kg, thus concluding that the reason for such variation was the large quantity of nitrogen fertilizers used in the first ones. This rise in nitrogen levels is associated with an increase in its water footprint: 158 l / kg in traditional crops against 58 l / kg in organic ones.

The environmental impacts of banana crops, as per bibliographical sources (Russo y Hernández,1995), are as follows:

- Intensive use of agricultural chemicals, particularly of pesticides. Banana plants are affected by over 200 insect pests that cause direct harm to the plant or act as disease vectors (Purseglove, 1972). Black sigatoka, which is caused by the fungus of the *Mycosphaerella fijiensis* leave, constitutes the major limitation to banana world production. This disease illustrates one of the issues large monoculture plantations with scarce genetic diversity face: all plants are very much alike, hence prone to catching a disease or a common pest. Pesticides are persistent organic pollutants or contaminants, they bioaccumulate and move from one trophic level to another affecting multiple land and aquatic species. The indiscriminate use of pesticides in order to control these pests has also decreased the number of predatory insects and parasites, and has led to pest outbreaks of insects which were previously of minor importance to banana plantations (Stephens, 1984).
- Surface and subsurface water pollution by pesticides used in crops may occur: i. When using rivers to dispose of waste contaminated with pesticide residues. When washing equipment used in the application of these products directly at water sources or in close proximity to them. iii. Due to runoff. iv. By percolation. v. By the action of drift after aerial application procedures are performed (García, 1997).
- Due to poor management of plastic and degradable waste
- Due to deforestation and erosion. Large areas of tropical ecosystems were turned into crops, among which banana is one the main sources of changes during the last century.
- Intoxication by herbicides. A peculiar case is that of the Paraquat herbicide which damages the respiratory system regardless of the exposure pathway. In relation to the period lasting from January 2013 to December 2014, it was concluded that this herbicide was responsible for the highest number of deaths by pesticides in Ecuador: the monitoring of 216 intoxicated patients produced a case survival rate of 34.7%, as per the Toxicological information and counseling center of the Ecuadorian Public Health Ministry (Villalba and Zalazar, 2015).
- The pesticide load used in banana crops is proportionally higher than in other crops such as coffee and cocoa due to a greater number of international requisites in relation to origin quality, which requires crops free of pesticides during their production cycle.

There is keen interest from the industry to shift to organic production, which is also more profitable. However, organic crops would be more prone to catching black sigatoka. Organic crop yields compared with conventional ones, as per Jiménez et al (2007), had a 40% lower yield over “inorganic” crops, a result that shows banana crops’ heavy dependence on pesticides.

Construction

The second largest undertaking in El Oro province shows few published records in relation to its impacts with difficult traceability, except for the development of larger “formal” works carried out by construction companies; in spite of this, there is a predominance of informal constructions carried out without construction permits at the lower middle level of the Machala-Puerto Bolívar conurbation and its rural parishes within the area of influence.

On the basis of the Land Zoning and Development Plan (PDOT) of the Decentralized Local Government of Machala in its 2018 update, it was determined that the Machala Puerto Bolívar conurbation, bearing a population of 252,739, had occupied an estimated 37,275 ha by the year 2014 in Cantón Machala, and the projections for 2020 indicate 289,141 inhabitants.

Most impacts in this sector relate to the poorly-planned housing development and the lack of services; as a result, sewage (waste) water discharges of the developing Machala Puerto Bolívar conurbation are directed to natural waterways without being treated. Other related impacts include:

- Decline in the quality of water bodies. An assessment of the quality of Estero El Macho waters (López Apolo, 2015), which flow throughout the northern border of Machala and receive other waters from banana farms and waste urban waters and combine them with coastal ones, revealed concentrations exceeding the MALs for manganese, with maximum values of 1.72 mg/L; Iron, with value of 0,45mg/L; sulfurs, with a maximum value of 2,57 mg/L; and COD, with a maximum value of 850 mg/L; BOD, with a maximum value of 443 mg/L; furthermore, 9 out of 10 dissolved oxygen readings were below 2,8 mgO_2/L; and lastly, there was a rise in organic and total nitrogen downstream.
- Constructions in the coastal border would produce impacts associated with habitat transformation, being the latter one of the main agents involved in the reduction of mangrove-covered regions which have been turned into populated areas after their logging and filling.

Shrimp aquaculture

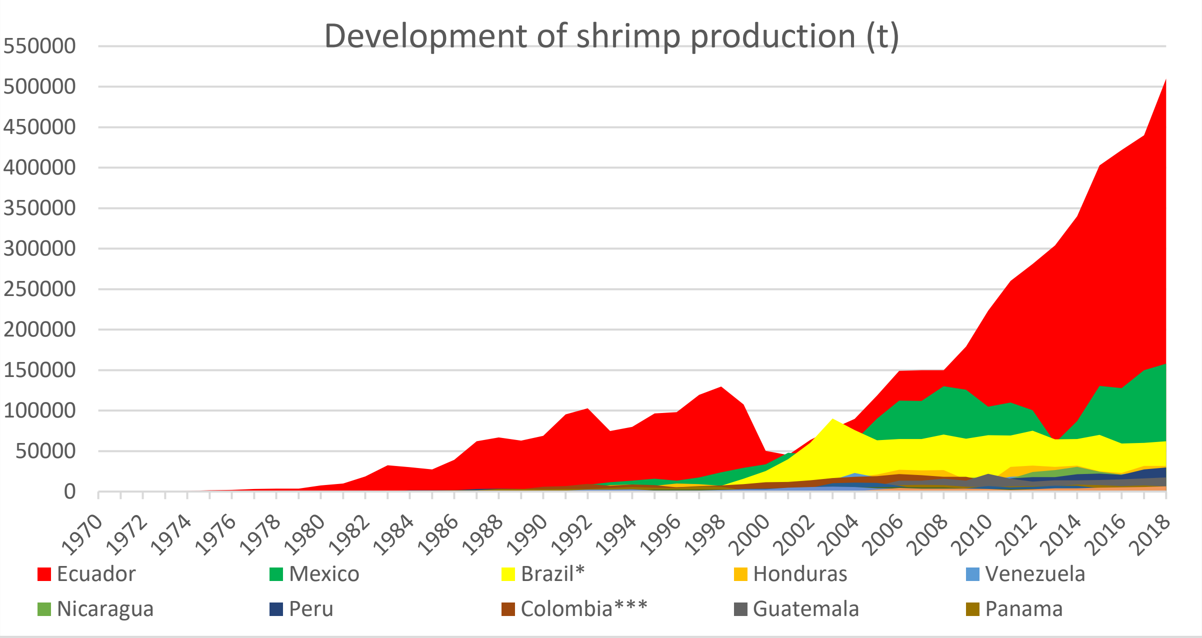
According to the Ministry of Aquaculture and Fisheries, Deputy Ministry of Aquaculture[3], by the year 2017, shrimp cultivation involved 996 production centers, which totaled 41,637.12 ha in El Oro province, i.e. 19.32% of the national surface for shrimp farms from that period, which totaled 215,421 ha.

[3] Official letter N° MAP-SUBACUA-2018-0392-O addressed to the Aquaculture National Chamber

Of these 41,637.12 ha of shrimp parcels, 652 of them were located in beach and bay areas, that is, close to the coastal border which was originally teeming with mangroves, totaling 20,855.89 ha, and 344 parcels were located in highlands, totaling 20,751.23 ha.

Figure 13 shows the development of the whiteleg shrimp *Penaeus vannamei* in Latin America, where Ecuador has increased its production five-fold in the last decade, greatly surpassing its main local competitors.

Figure 13 Production of the whiteleg shrimp Penaeus vannamei in America in the 1970-2018 period retrieved from FIGIS FAO



Prepared by: Ecosambito, 2020

Since 2017, shrimps have been the main non-oil international export product of Ecuador. By 2019, the Aquaculture National Chamber of Ecuador (CNA, 2020) informs a shrimp production of 635,222 tons valued US$ 3,652,684,081, and a 25.31% growth in relation to the 2018 period.

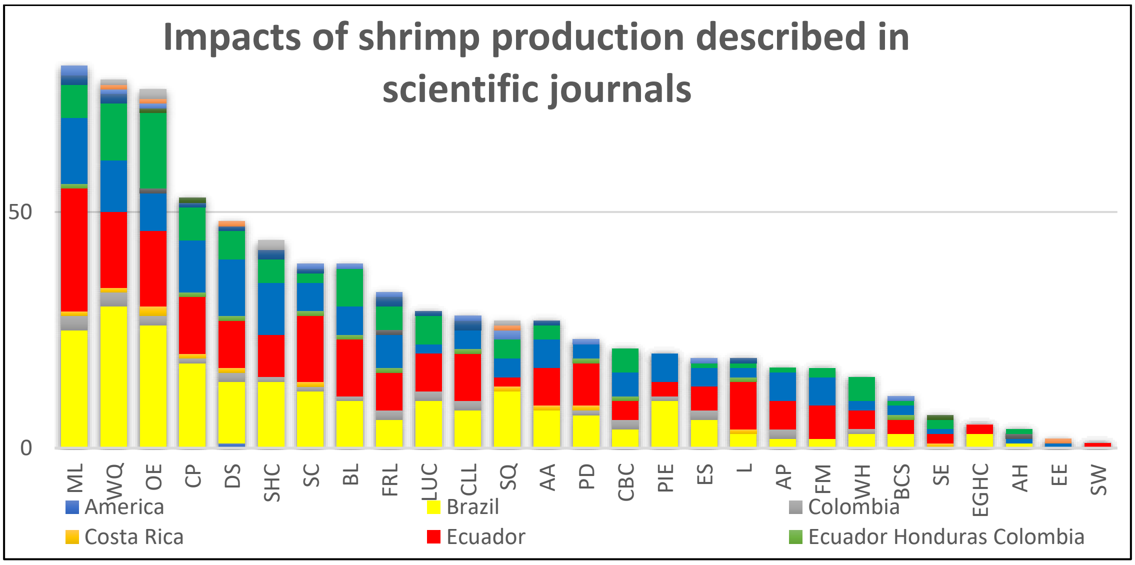
Cantón Machala PDOT document, on its 2018 update, mentions the existence of 7,126.45 ha, and states that "the number of legalized hectares is still being construed due to new regularization deadlines applied to them", and that around 44,000 ha in El Oro province belong to 921 producers who make 350 million dollar sales.

However, that growth is accompanied by environmental impacts that have been thoroughly discussed in researches and scientific papers, and which are shown in Figure 14. Below is a list of the main impacts:

- Mangrove loss
- Reduction in water quality and organic enrichment
- Chemical pollution

- Disease spread
- Salinization and hydraulic changes
- Social conflicts
- Biodiversity loss
- Fish recruitment lessening
- Land use changes
- Coastal livelihood loss
- Sediment quality
- Antibiotics
- People displacement
- Coastal border changes
- Potentially invasive species insertion
- Erosion and sedimentation,

Figure 14. Impacts of shrimp production described in scientific journals



ML= Mangrove loss, WQ=Water quality reduction, OE= Organic enrichment, CP=Chemical pollution, DS= Disease spread, SHC=Salinization and hydraulic changes, SC= Social conflicts, BL= Biodiversity loss, FRL= Fish recruitment lessening, LUC= Land use changes, CLL= Coastal livelihood loss, SQ= Sediment quality, AA=Antibiotics, PD=People displacement, CBC= Coastal border changes, PIE=Potentially invasive species insertion, ES= Erosion and sedimentation, L=Laws, AP=Abandoned ponds, FM= Fish meal content in feed, WH=Water hypoxia, BCS= Blue carbon storage, SE= Shrimp escapes, EGHC= Emission of greenhouse gases, AH= Anoxia/H2S production, EE= Effects on endangered species, W= Solid waste

Prepared by: Ecosambito, 2020

The above figure clearly shows the undeniable effects shrimp farms have caused in Ecuador, led by its most relevant impact: mangrove loss; alongside related impacts, such as effects on coastal biodiversity as well as in the livelihood of coastal populations.

Mangrove loss has been documented for El Oro province and Cantón Machala. According to the PDOT document and its 2018 update, by 2014 there were 4,011.44 ha of mangroves and 8,236.66 ha of shrimp parcels (22% of the canton’s surface).

The undeniable shift of mangroves to shrimp farms and other soil uses was originally documented by Terchunian et al. (1986), from whose document the first record of this ecosystem loss is extracted. The assessment was conducted in the current Machala Puerto Bolívar conurbation for the 1966-1982 period, as is shown in Figure 15, and establishes its relation to shrimp farming and construction activities.

Figure 15. Results of the mangrove loss estimation in the vicinity of Puerto Bolívar during the 1966-1982 period.

Table 1. Changes in land cover/use in the pilot area Machala–Pto. Bolivar, 1966–1982. [Cambios en el uso de la tierra en el area piloto Machala–Pto. Bolivar desde 1966 a 1982.]

	Urban [Urbana]		Mangrove [Manglares]		Shrimp ponds [Camaroneras]		Rivers [Rios]	
Year	ha	%	ha	%	ha	%	ha	%
1966	256.69	3	4692.88	54.84	0	0	1437.45	16.80
1977	434.66	5.08	4231.70	49.50	834.23	9.75	1514.46	17.70
1982	588.50	6.87	3294.08	38.50	2330.67	27.24	1465.65	17.13

Table 1. Continued.

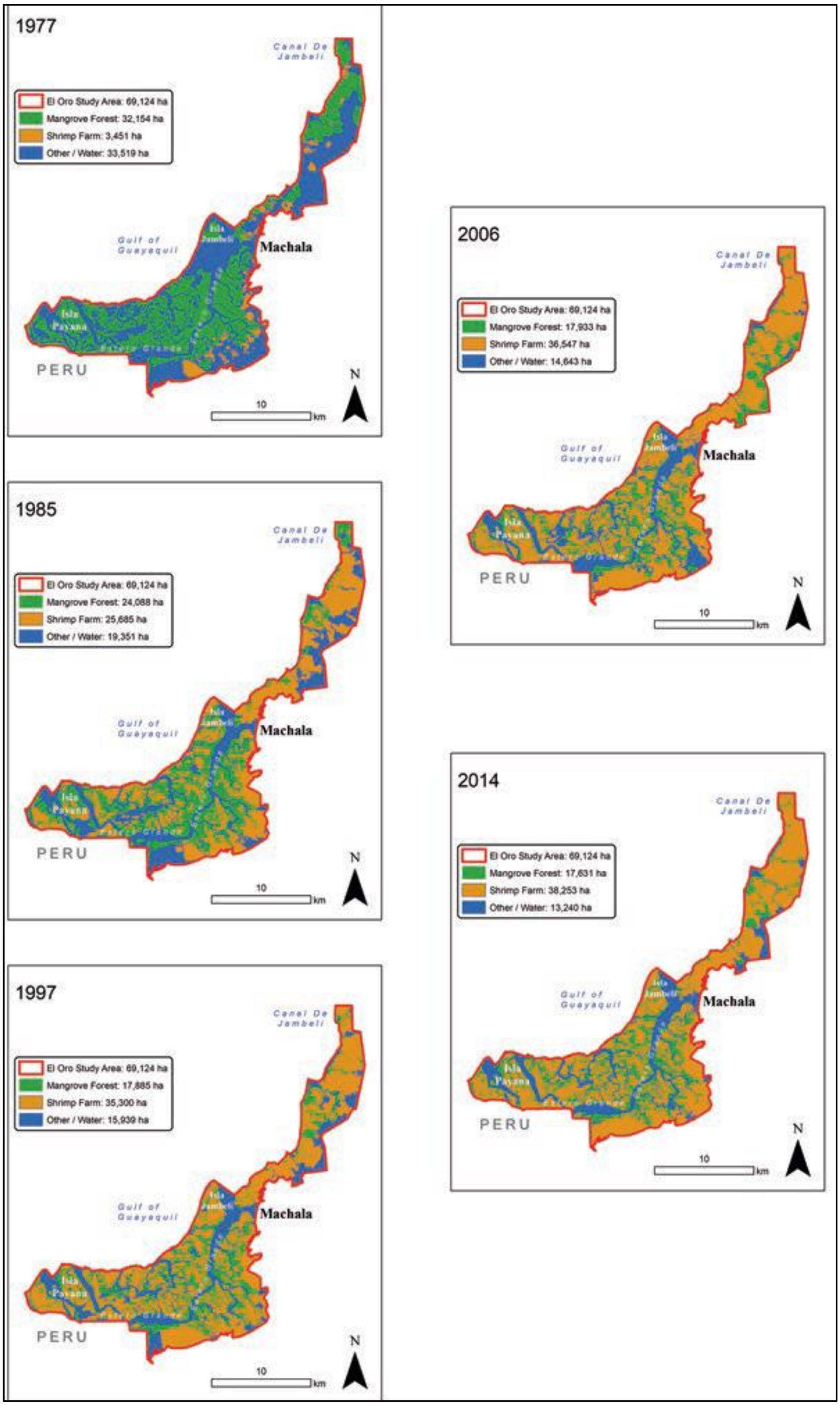
Areas of salt deposits [Salinas]		Upland vegetation [Vegetacion tierra alta]		Agriculture [Zona agricola]		Totals [Totales]		Margin of error
ha	%	ha	%	ha	%	ha	%	
1087.72	12.71	466.32	5.45	615.19	7.19	8556.25	100	±1.80
478.52	5.59	332.15	3.88	730.23	8.54	8555.95	99.98	±0.53
162.56	1.19	139.37	1.63	634.73	7.42	8555.05	99.95	±0.22

Source: Terchunian et al (1986).

These studies were extended by Stuart Hamilton, who publishes in 2019 his book *“Mangroves and aquaculture. A five-decade remote Sensing Analysis of Ecuador´s Estuarine Environments”,* from where Figure 16 and Figure 17 are extracted, and which illustrate the scale of mangrove loss and their correlation with shrimp farm activity. Figure 16 shows a change of color from green representing mangroves towards orange associated with shrimp farms during the 1977 to 2014 period.

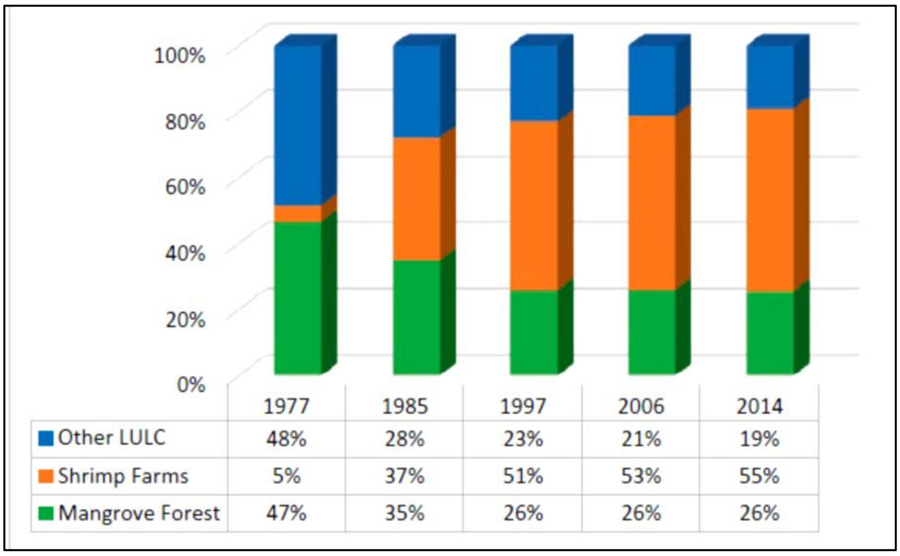
Figure 17 shows that the surface of shrimp parcels in El Oro province is 11 times higher than 37 years ago.

Figure 16 Temporary change in the use of soils associated with estuaries in Jambelí canal and archipelago during the 1977 to 2014 period.



Source: Hamilton, 2020

Figure 17. Development of mangrove area coverage, shrimp farms and other soils uses during the 1997 to 2014 period



Source: Hamilton, 2020.

Impacts on the area's biodiversity and biological productivity cannot be verified due to the lack of past assessments using standard qualitative methodologies which allow for drawing coherent temporal comparisons.

The international recognition of environmental performance of the Ecuadorian shrimp production does not differ much from the assessments published in this report, being mangrove loss its most critical aspect: The Seafood Watch program graded the environmental performance of the Ecuadorian shrimp farms with a score of 5.03 out of 10 (Thompson,2014). Table 10 shows the summarized criteria of such evaluation.

Table 10. "Seafood Watch" evaluation criteria for shrimps produced in Ecuador (Thompson, 2014). Criteria 9 and 10 are regarded as optional

Criterion	Score (0-10)
C1 Data quality and availability	4.75
C2 Effluents	5.00
C3 Habitats	3.77
C4 Evidence or risk of use of chemicals	5.00
C5 Feed	7.70
C6 Escapes	4.00
C7 Diseases, pathogens and interactions with pathogens	4.00
Source of stock, independence of wild fisheries	10.00
Wildlife and predator mortality	-4.00
Escape of intentionally introduced species	0.00
Total	40.22
Final score	**5.03**

As of the “Seafood Watch” presentation to the general public, the industry has improved in some aspects, such as disease management and progressive reduction of chemicals and escapes, but the quality of environmental data is still insufficient; effluent management is almost non-existent, and attention towards adjacent habitats—that is, remains of mangroves and used bodies of water—lack periodic assessments, thus evidencing the absence of official sector-specific regulations. This issue was informed in “Seafood Watch”, which pointed out that although the Ecuadorian environmental legal framework does require EIA for projects, these are general, do not contemplate cumulative impacts and lack a specific framework for aquaculture.

Recent years have seen a tendency towards implementing intensive cultivations, which are much more productive and profitable. This new technology also enables the establishment of shrimp farms in areas far from the coast and using fresh or brackish water. Even though this new cultivation technique allows for more production using less surface, this poses a new threat for other types of habitats such as dry forests and other natural habits remains, as well as for other natural resources, such as surface and subsurface fresh waters.

Transportation and storage

This industry is composed of air transport, land transport and maritime and fluvial transport.

Air transport is performed via the Santa Rosa Regional Airport south of the project area of influence. The airport is currently being underused and barely has two weekly frequencies.

Land transport is performed via passenger and cargo transport services, the latter being closely related to the rest of productive activities, particularly to those associated with exportable products.

The following are the environmental impacts derived from land transport:

- Effects on people’s health, by injuries caused by traffic accidents among vehicles, or with pedestrians.
- Effects on air quality and noise, particularly in urban areas.

Maritime transport is undoubtedly associated with the port activity, but it is not less relevant to shrimp farms supply activities as well as to the fishery industry.

The environmental impacts of maritime traffic are:

- Potential increase in underwater noise. Despite the lack of any national standard, since 2005 the IMO has passed resolutions where the critical issue is to minimize incidental noise addition via the maritime commercial traffic, such as Resolution A.982 (2005), It is important to remember that underwater noise addition is not exclusive to large vessels associated with port activities, but rather common to all motorized vessels.

Meat and shrimp processing and transformation

According to the provincial calculations of the Central Bank of Ecuador, meat and shrimp processing collectively represent $140,783 of added value. This assessment has combined both, since their environmental impacts are similar.

El Oro province has at least 5 shrimp packing plants, at least 3 of which are located in the project area of influence: Marecuador, Promaoro and Marest.

With regard to meat processing, only two of the three local slaughterhouses operate in the project area of direct influence: The Malacha slaughterhouse, recently semi-mechanized, where 520 bovines, 1,600 hogs and 120 goats are slaughtered on a monthly basis, and the Pasaje slaughterhouse, mostly manually operated, which slaughters between 720 and 960 bovines, between 360 and 600 hogs and from 72 to 120 goats each month. (Morán Sánchez, 2014). The third local slaughterhouse within the area of influence, “El Guabo”, was closed down by Agrocalidad together with the Pasaje slaughterhouse in 2013 due poor hygiene or visible health issues. (Diario Hoy, 2013). An interview intended for public officers in these premises revealed that 87% of them state that constructions do not meet the technical requirements for the efficient handling of meat, viscera, non-edible and seized products.

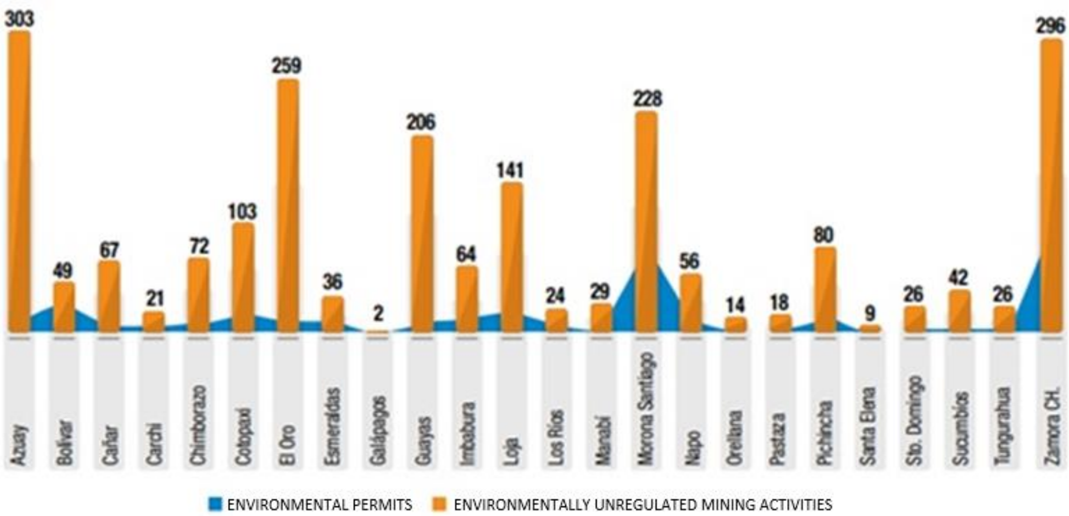
Slaughterhouses and packing plants produce solid and liquid waste which can pollute the environment if they are not treated appropriately:

- The main impact of this industry is the deterioration of water quality. The high organic load present in the effluents of this activities need to be treated prior to their unloading in order to meet the environmental legislation parameters, though in most cases, effluents are discharged without any such treatment.

Mines and quarries.

The sixth largest undertaking in the province what would probable produce major environmental impacts relative to the used surface is mining, with few records of this activity in the area of influence.

Figure 18. Statistics on concessions and environmental regulations



Source: presentation prepared by the Deputy Minister of the Former Ministry of Mining

Source: MEER, 2020

The serious problem regarding mining activities at a national level is its operation outside the Ecuadorian legal framework and regulation. Most of the traditional and small, or even medium mining activities are carried out “illegally” without any formal license granted by the mining authority, least of all with the environmental permits. However, of those mining activities for which there is a legal operating license granted by the Ecuadorian mining authority, very few possess an Environmental Permit (see Figure 18), which exposes a profound lack of knowledge about the real environmental impact of this activity, and grants the assumption that compliance with the environmental standards is little or non-existent.

Peña Carpio and Menéndez Aguayo, 2016, in the publication “Estudio de las colas de tratamiento de oro de la explotación minera en Ponce Henríquez /Ecuador desde una perspectiva ambiental” point out that “in all mining regions in Ecuador, large volumes of waste from mining operations have deposited through time containing considerable amounts of sulfur (pyrite, pyrrhotite). *Since that waste is rarely managed according to desirable standards from an environmental perspective in its disposal, the effect of surface or rain water and atmospheric oxygen gradually cause Acid Mine Drainage (AMD) which pollutes surface and/or subsurface bodies of water”*

Despite Ponce Henriquez political jurisdiction belonging to the Azual province, its relation to El Oro environmental components is explained by their physical proximity to one another, and by its runoff or hydrologic connectivity towards Canal de Jambelí, a body of water which, depending on the local tidal currents, may enter the area of direct influence, thereby becoming another impact to the area of direct influence of Puerto Bolívar. The chemical analysis of Ponce Henríquez mining tailings determined by Peña Carpio and Menénez Aguayo is shown on Figure 19.

Figure 19. Chemical analysis of Ponce Henríquez mining tailings

Chemical analysis of mining tailing samples (Ponce Enríquez-Ecuador). Source: the authors	
Parameters	Value (%)
Antimony (Sb)	<0.03
Arsenic (As)	0.12
Calcium (Ca)	1.22
Cadmium (Cd)	<0.01
Copper (Cu)	0.13
Iron (Fe)	11.51
Magnesium (Mg)	3.07
Lead (Pb)	<0.03
Zinc (Zn)	0.06
Sulfates (SO4=)	0.03
Sulfur (S)	5.84

Source: Peña Carpio and Menéndez -Aguayo 2016.

In 1998, Tarras Wahiberg et al. published *“Environmental impacts of small scale and artisanal gold mining in southern Ecuador” indicating the presence of modest gold mines in the Santa*

Rosa region, 30 km from Machala. The authors compared the quality of water and sediment samples at 4 mining sectors in the south of Ecuador, after identifying the mining processes at Zaruma, Portovelo, Nambija, Ponce Henríquez and Santa Rosa regions, which led to the observation that the polluting levels of arsenic, copper and cadmium were in second place with regard to arsenic and copper concentrations, surpassing Ponce Henríquez and Portovelo in arsenic, and Camilo Ponce in copper and cadmium.

Figure 20 Arsenic, cadmium, copper and mercury concentrations in bodies of water associated with 4 mining centers in the south of Ecuador

		As			Cd			Cu			Hg	
		water dis. µg L^{-1}	water rec. µg L^{-1}	sediment mg kg^{-1}	water dis. µg L^{-1}	water rec. µg L^{-1}	sediment mg kg^{-1}	water dis. µg L^{-1}	water rec. µg L^{-1}	sediment mg kg^{-1}	water dis. µg L^{-1}	water rec. µg L^{-1}
Río Amarillo	W	1.7	< 1.0	35	1.5	1.4	3.6	7.6	1.4	97.6	–	0.004
Portovelo-Zarruma	D	6.8	6.8	403	0.7	2.7	19.6	23.2	142	1680	–	< 0.002
Río Nambija	W	0.8	2.1	27	0.04	0.4	8.9	2.3	71.3	336	–	0.008
Nambija	D	2.9	3.0	1860	< 0.005	3.7	47.8	1.3	395	5360	–	0.015
Río Siete	W	35.3	349	2070	0.05	0.5	1.8	13.6	19.8	2420	–	0.002
Ponce Enríquez	D	264	3600	7700	0.05	2.3	6.05	11.1	33.3	2500	–	1.11
Río Pijili	W	1.9	0.5	7.2	0.02	0.04	0.052	0.7	5.3	24.6		< 0.002
Ponce Enríquez	D	2.1	2.5	454	0.01	< 0.005	0.58	0.3	0.7	578		< 0.002
Río Byron	W	6.0	14.9	359	0.5	0.04	0.6	2.2	3.5	217	–	< 0.002
Santa Rosa	D	10.8	48.9	620	0.2	0.07	1.06	1.4	5.7	303	–	0.0022
US-EPA (Acute) 25 mg L^{-1} $CaCO_3$		360	360	–	0.8	0.8	–	4.6	4.8	–	–	2.1
US-EPA (Chronic) 25 mg L^{-1} $CaCO_3$		190	190	–	0.4	0.4	–	3.6	3.5	–	–	0.01
EC - Threshold		–	–	5.9	–	–	0.6	–	–	36	–	–
EC - Probable effect		–	–	17	–	–	3.5	–	–	197	–	–

Source: Tarras-Walbergh et al, 1998.

Figure 20 highlights in red the mining fronts of Rio Byron in Santa Rosa, located towards the south of the project area of direct influence, which would be comparatively closer were they connected to Estero Santa Rosa springs

6.2.3. Current undertakings

New services at Puerto Bolívar Port Terminal.

With a view to broadening its services offer to the import and export industry, in addition to the containerized and palletized exportable banana cargo, which constitutes the major sector of managed loads, Yilportecu is currently developing new services, namely:

Ore concentrates export. Services for the mining industry. The export of sealed, containerized copper ore concentrates is to be expected during a first stage (2019-2021), this involves regular management of containers with the required preventive measures in place. The option of managing the “big bags” holding the material and placing it in containers is being contemplated

The goal at a second stage is to implement rotating container technology or “rotainers” which allow for bulk cargo loading onto bulk carriers using a spreader that can rotate the container and place it in the vessel’s hold, in addition to being equipped with a water mist system that releases water particles to prevent dust emissions into the environment.

During the first stage, 136,092 metric tons of concentrates are estimated to be moved, which constitute a monthly load of approximately 12,000 metric tons; whereas for the second stage (beginning in 2022), the annual load is expected to increase to 360,000 metric tons, or 30,000 metric tons per month.

So far, no new structures for appropriate cargo storage in big bags have been implemented; and once the rotainer system is in place, no additional structures will be required in the terminal; instead, the available storage yards will be used.

Solid bulk cargo management. In order to store and distribute grains, Yilportecu may contemplate the construction of several silos with a 45,000 MT capacity, which will be expanded to 75,000 MT if required by demand. The horizontal transportation from the vessel to the silo (import) will be initially carried out with hoppers and dump trucks, which will later be replaced by conveyor belts, depending on the demand.

Storage of carbon, cement, petroleum coke or similar bulk cargoes will be initially performed outdoors, with tarpaulins for cover if need be. This situation will be improved with enclosed silos, probably of the Dome type, when justified by demand.

Ro-Ro. Vehicle reception and storage for the southern region of Ecuador.

6.2.4. Future undertakings

In addition to Puerto Bolívar Project expansion itself, other undertakings intended for the project area of influence have been identified. It is worth mentioning that significant undertakings currently being performed in the area, such as banana and shrimp cultivation, will not be able to expand in a meaningful way since useful soils intended for these activities are already occupied. Nonetheless, these activities can be carried out in a more intensive manner, as is the case with shrimp cultivation, which is currently shifting towards the intensive cultivation technology, even in fresh water.

Puerto Bolívar Expansion Project. The most relevant future undertaking within the project area of influence, and which is certain to be realized, is the expansion project of Puerto Bolívar itself, devised in 3 stages so that load bearing capacity can be gradually incremented. Such stages are developed north of the current project.

Table 11. Stages of Puerto Bolívar Expansion Project, planned during the license term of Yilportecu S.A.

Stage 1	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Access canal	-16.5 m	-16.5 m	-16.5 m	-16.5 m	-16.5 m
Pier	750 m (at -16.5 m) 610 m (-12 m)	750 m (at -16.5 m) 610 m (-12 m)	750 m (at -16.5 m) 610 m (-12 m)	1,065 m (at -16.5 m) 610 m (-12 m)	1,065 m (at -16.5 m) 610 m (-12 m)
Yards	• Container yard expansion • New RTG blocks • Grain silos • Cold-storage warehouse • Yard remodeling	• Container yard expansion • New RTG blocks • On-demand storage facility expansion	• Container yard expansion • New RTG blocks • On-demand storage facility expansion	• Container yard expansion • New RTG blocks • On-demand storage facility expansion	• Container yard expansion • Solid bulk cargo silos expansion

Stage 1	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Additional equipment	• 2 mobile cranes • 4 STS cranes • 12 RTG • Ancillary equipment • 1 tugboat • Possible acquisition of hopper and damp trucks	• 1 mobile crane • 2 STS cranes • 6 RTG • Ancillary equipment	• 2 STS cranes • 6 RTG • Ancillary equipment	• 3 STS cranes • 10 RTG • Ancillary equipment	• 3 STS cranes • 16 RTG • Ancillary equipment
Capacity (TEUs)	600,000	1,000,000	1,500,000	2,100,000	2,600,000
Duration/activation factor	2 years	4 years 500,000 TEU	10 years 850,000 TEU	15 years 1,300,000 TEU	46 years 1,800,000 TEU

Source: Yilportecu S.A.

STAGE 1. This stage will be built between 2021 and 2022 and shall be operational in March 2023. It includes the construction of a pier 450 meters long, 62 meters wide and with a depth of -16.5 meters below the mean low water springs level (MLWS), for the mooring of container ships of up to 200,000 deadweight tons (DWT), and a container yard of 12 hectares for container storage (full dry, refrigerated and empty). It will also be equipped with 4 STS (ship to shore) pier cranes and 12 RTG (rubber tire gantry) yard cranes for piling up containers in the yards. It will provide all basic services, an electrical supply system for all load handling equipment and an emergency power system. Moreover, other loading segments will be developed through the construction of infrastructures for cereals and other solid bulk cargo, such as cement, clinker, copper, etc.

This stage will allow for an increased reception and load handling capacity of containers in Puerto Bolívar up to 600,000 TEU.

STAGE 2. When the operating capacity is about to reach 600,000 TEU during stage 1 realization, Yilport will commence stage 2 which consists in the construction of additional container yards and the acquisition of additional equipment for container handing: 2 additional STS cranes and 6 RTG cranes, as well as an increased number of additional equipment for container handling and transportation, which will enable a reception and handling capacity of 1,000,000 (one million) TEU.

Stage 2 construction, subject to the cargo containerization percentage in El Oro province and the arrival of cargo from nearby provinces, in addition to cargo from the north of Peru, may be carried out between 2031 and 2032.

STAGE 3. Mainly consists in the construction of additional container yards and the acquisition of additional equipment for container handling: 2 additional STS cranes and 6 RTG cranes, as well as an increased number of additional equipment for container handling and transportation, which will enable Puerto Bolívar to reach a reception and handling capacity of 1,500,000 (one million) TEU.

The development of stages 2 and 3 is to take place several years from now, and many development factors need to occur both in Ecuador's economy and in local maritime transport in order for such a large volume of containers to be moved from Puerto Bolívar; therefore, it is too early to identify very precise development patterns.

Consequently, Yilport may be more inclined to carry out a gradual development of container yards, a cheaper and eco-friendlier solution, as shown in Figure 21

Figure 21. Gradual development of container yards for stages 2 and 3.

Source: Yilportecu S.A.

The figure shows the partial development of Stage 2 (green rectangle) using only an area of land at a first stage, leaving the coastal line and the maritime area behind pier #6 untouched (transparent green rectangle), which will be assigned to future construction works at a later stage.

This development will enable the accommodation of 4 new container blocks for RTG cranes with a capacity of 1,540 FEU (Forty Equivalent Units) and a 200,000 TEU increase in container storage capacity.

The same model may be repeated in stage 3, in which the mainland yards will be developed (yellow rectangle), the coastal line will be left untouched (transparent yellow rectangle) and only an access to Pier #6 will be built to ease container circulation between the pier and the new yards, thereby optimizing the Terminal operation.

As a result, neither the coastline nor the small mangrove shrubs found at a corner of the beach will be affected in any way during stage 2, as seen in Figure 21 at the transparent green area.

STAGE 4. At the fourth stage, piers and yard will be extended and new equipment will be bought so as to reach an annual capacity of 2,100,000 TEU. The activation factor for this stage would be to reach a traffic of 1,300,000 TEU.
This stage consists in the construction of a pier measuring 315 m, reaching a total of 1,065 m with a 16 m draft, and 610 m with a 12 m draft. Besides, it contemplates the expansion of storage and container yards, equipment and acquisition of 3 STS cranes and 10 RTG cranes. Moreover, it contemplates the possibility of expanding the tugboat fleet according to the demand and the established quality criteria.
STAGE 5. The fifth stage consists in a new and final expansion of the container yard and the purchase of new equipment so as to reach an annual capacity of up to 2,600,000 TEU. The activation factor for this stage would be to reach a traffic of 1,800,000 TEU.
It contemplates the construction of yards intended for containers with RTG blocks, three STS cranes in piers, 16 RTG cranes in yards, and the ancillary equipment required for a smooth operation
Tugboats: Possibility of expanding the tugboat fleet according to the demand and the established quality criteria.

Mooring piles, walkway and supplementary works located at Canal de Jambelí. This project, which will be carried out within the area of direct influence, is in the process of acquiring an Environmental Permit. According to the EIA (Consulsua, 2020), it consists in the implementation of special structures that serve as mooring points for vessels. The operation will consist in the berthing of vessels, storage of liquid and gas hydrocarbons, distribution of hydrocarbon and maintenance of port facilities. The project will be linked with the gas pipeline that connects Amistad platform to Bajo Alto Natural Gas Liquefaction Plant. Transfer of gas is not being contemplated at this time since prior to that an environmental license needs to be granted by the operators of said gas pipeline belonging to Petro Amazonas. At its operational stage, permits will be valid for 10 years, whereas the license to the area will be in force for 50 years.

Estero Huaylá dredging project. This project belongs to the Autonomous Provincial Government of El Oro, and consists in the dredging of 3 of the 4.27 km of this marsh, and in the extraction of 454,000 cubic meters of sediment. The expected dimensions are -3.5 meters in draft at low tide, and 40 meters wide. The aim is to ensure fishing vessel navigation without tidal restrictions and to remedy the environmental impact caused by pollution (available at https://www.eloro.gob.ec/post/prefecto-entreg%C3%B3-a-yilport-proyecto-para-dragar-estero-huayl%C3%A1). Even though an Environmental Impact Assessment was conducted for this project, it is currently in search of financing by the Province's Decentralized Local Government of Machala (GAD).

Puerto Cobre. This 27-hectare project located north of Puerto Bolívar Port Terminal consists in the construction of port facilities and the storage and loading onto bulk carriers of copper concentrates from mining concessions in the Zamora province.

The proposed pier is a wharf type or marginal pier measuring 170 m long and 3.6 m wide, plus a service platform (main dolphin) 20 m long and 12 m wide, with 4 additional mooring dolphins (2 on each side), with an axle spacing of 50 meters. Dredging works will also be required at a depth of 10.75 meters, with an over-dredge of 11 meters, which represents 180,000 cubic meters (Ecosambito, 2007).

The project has an Environmental License and is up to date with its environmental obligations, although its construction date is unknown.

Estero Jelí dredging. According to the available information source[4], this undertaking consists in the excavation and evacuation of sediments from Rio Santa Rosa, Río Buenavista and Río Pital that accumulate at the mouth of Estero Jelí (located 17 km south of Puerto Bolívar, within the area of indirect influence), to prevent sediment accumulation from causing restrictions in the entry of local shrimp and traditional fishermen. Dredging procedures will be carried out in three specific locations: from Estero Santa Rosa until near Puerto Jelí gas station (3,600 m), at the inner harbor facing Puerto Jelí (500 m), and upstream of Río Pital, at the stretch between Puerto Pital and the Pan-American Highway bridge (5,700 m). From the marsh entrance until near the aforementioned bridge, its total length is 9,800 m. A dredged sediment disposal site has been stipulated at Hacienda La Emereciana located 1,400 m from Puerto Jelí promenade.

This project has had an Environmental License since 2012, even though activities were halted by the Ministry of Environment for failure of compliance with the environmental obligations. The performance of operations is still pending.

Cangrejos mining project. Cangrejos is an open-pit mining project for gold and copper located between parishes Bella María and San Juan de Cerro Azul, at cantons Santa Rosa and Atahualpa in El Oro province, 40 km east of Puerto Bolívar, licensed to Odin Mining del Ecuador S.A., subsidiary of Lumina Gold from Canada, an exploration and mining development company based in Quito (BCE, 2021).

A 20-year service life is estimated, with an annual production of 373,000 ounces of gold and 43 million pounds of copper. A processing plant is being planned consisting of a conventional copper and gold flotation concentrator and a CIL circuit (carbon in leach) which will manage 40,000 t/d during the first five years. As of year six, the capacity will increase twofold to 80,000 t/d for the remainder of the mine service life. The plant is designed to produce gold and silver doré, copper and gold flotation concentrates and molybdenum concentrate.

The Cangrejos project has 10 concessions: Los Cangrejos, Los Cangrejos 11, Cangrejos 10, Cangrejos 20, Cangrejos A, Cangrejos B, Cangrejos C, Cangrejos D, Casique and Canarias. The Ministry of Environment granted an advanced exploration license to Los Cangrejos concession, and an initial exploration license to Cangrejos 20 with its advance exploration license in process.

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[4] Available at https://maeeloro.files.wordpress.com/2013/11/esia-dragado-estero-jelc3ad.pdf

Up until the third quarter of 2020, the Cangrejos project has not defined the extraction method, nor has it set the commencement date for the construction of the mine.

6.3. Summary of undertakings.

Table 12 shows a list of preexisting, current and future undertakings near the project as well as its characteristics.

The Cumulative Impact Assessment is forward-looking, therefore, based on descriptions of the undertakings performed in previous sections and the incremental analysis of economic activities, some preexisting undertakings can be dismissed on the basis of not being potentially expandable in a meaningful way at a later time due to financial, legal and spatial constraints. Likewise, future projects whose realization is uncertain will be ruled out. The gray rows in table 12 highlight those undertakings which have been promoted to the next stage of the analysis, and subsequent paragraphs provide explanations about preexisting undertakings.

Table 12. Definitive undertakings

Undertakings		**Areas of influence**	**Environmental License**	**Service life (years)**	**Future activity expansion in the areas of influence**	**Future realization**
Preexisting	Puerto Bolívar Port Terminal	Direct	Yes	80		
	Campo Amistad	No	Yes	40	No	
	Termogas Machala	Indirect	Yes	40	No	
	Bajo Alto Natural Gas Plant	Indirect	Yes	40	No	
	Growing of banana, cocoa and coffee crops	Direct	Partial	20	No	
	Construction	Direct	Partial	40	No	
	Shrimp aquaculture and fishery	Direct	Partial	20	Implementation of intensive cultivation	
	Transportation and storage	Direct	Partial	10	No	
	Meat and shrimp processing and transformation	Direct	Yes	30	No	
	Mines and quarries	No	Partial	20	Rise in illegal mining	
Current	New services at Puerto Bolívar Port Terminal.	Direct	Yes	80	---	---
Future	Expansion of Puerto Bolívar Port Terminal	Direct	Yes	80		Certain
	Mooring piles, walkway and supplementary works	Direct	Pending	40		Certain
	Estero Huaylá dredging project	Direct	Yes	5		Certain

Undertakings		Areas of influence	Environmental License	Service life (years)	Future activity expansion in the areas of influence	Future realization
	Puerto Cobre	Direct	Yes	80		Certain
	Estero Jelí dredging	Indirect	Yes	5		Uncertain
	Cangrejos mining project	No	Exploration	20		Unknown date of exploitation

Prepared by: Ecosambito, 2020

Table 12 includes a column with the datum “Certainty of activity expansion in the area of influence” for preexisting undertakings, given that some activities may continue to operate under the same conditions in the short and medium term, whereas others may expand their operations and thus contribute to future cumulative impacts.

Therefore, the existing undertakings, namely Campo Amistad, Termogas Machala and Bajo Alto Natural Gas Plant, have no certainty as to the expansion of their activities in the short and medium term according to the consulted sources. As to the productive activities in the province, the following observations have been made:

- Growing of banana, cocoa and coffee crops: banana plantations alone cover 35% of the province surface. This activity, which is developed in flat lands and whose production has seen an incremental tendency in the last years, cannot increase it further in a meaningful way since it has already occupied all the soils it can use. Instead, it could reduce its impact in the area of influence by replacing its current production with a much better priced organic produce, also due to the urban growth pressure.
- *Construction.* This activity is mainly associated with future project of provincial and local relevance. Given its connection to regional economic dynamics, a reduction in its impact is expected due to the low rate of economic growth projected for the next years in Ecuador.
- *Shrimp aquaculture and fishery.* This preexisting activity in one of the most relevant ones at a provincial level, and it undoubtedly relates to some of the environmental components of the assessed project, though there are legal constraints on soil use in mangrove-covered areas, which have already occupied most surfaces suitable for the activity. As for shrimp farming, the current tendency is a shift in technology towards intensive cultivation, in which seed density, and thus productivity per hectare, is up to 25 times higher. This type of cultivation can be performed with fresh water, typically from a well, at the expense of higher energy and input demands, which leads to changes in environmental effects and future environmental conditions.
- *Transportation and storage.* Another activity closely related to the rest. It was decided that it be excluded from the analysis given its overlap with other undertakings.
- *Meat and shrimp processing and transformation.* As far as meat is concerned, this activity is facilitated by domestic demand, whereas the processing of shellfish such as shrimp is intended for export. No incremental tendency is observed as processing

plants and slaughterhouses have maintained their production levels and no expansion projects are known for this activity.

- Mines and quarries. This activity shows a significant growth at a national level with an emphasis on gold and copper metal mining. In both El Oro and the neighboring and nearby provinces of Azuay and Zamora there are proven and formal leased reserves in an advanced exploitation and exploration stage. However, as was previously mentioned, a large proportion of the mining activity is carried out illegally, which makes it impossible to establish its actual scope, temporal development and effects on ecosystems. It is therefore assumed that this activity has a great potential for ongoing growth in the coming years, which is why it was included in future cumulative impact assessments.

7. Definition of definitive geographical and temporal limits for EGIA

Puerto Bolivar Expansion Project Stage 1 will perform a physical expansion of piers towards the norther area which, even though it prolongs by 450 m, does not imply an increase in the geographical limit of direct influence. Expansion Stages 2 and 3 contemplate the construction of container and storage yards in the area near the new pier, whereas Stages 4 and 5 involve the construction of a new pier measuring 315 m with is corresponding yards and equipment.

Prior to the commencement of expansion stages subsequent to Stage 1, certain established goals associated with load demand need to be reached which serve as “triggers”; therefore, no implementation deadlines have been defined. However, these expansions are expected to be carried out during Yilportecu’s 50-year license period. Expansion stages subsequent to Stage 1 will require their individual assessments and analysis of alternatives in order to determine their final designs, environmental impacts, and preventive, mitigating, restoration or compensation measures. Nevertheless, an undisputed impact of this expansion will be the increased maritime traffic of higher capacity vessels, in addition to the transportation of new loads such as mineral concentrates and bulk cargoes.

Other assessed undertakings share the same field of activity as preexisting and current ones, as well as their estimated service lives, and the already established 50-year term. Therefore, the definitive geographical limits are kept within the current area of indirect influence previously defined, and the project temporal limit remains at 50 years, commencing in 2016.

8. Identification of definitive VECs and undertakings

Table 13 shows a summary of the interactions between definitive undertakings and the 12 environmental components identified for Puerto Bolívar project. Valued Environmental and Social components (VECs) are those which have interactions with more than two undertakings (influence equal or higher than 33%). In Table 13, selected VECs are shown in gray.

Puerto Bolívar Port Terminal undertaking takes into account both its preexisting operation and future expansion.

Table 13. Interactions among undertakings, cumulative impacts and environmental components in the area of influence of Puerto Bolívar project

Environmental components	UNDERTAKINGS						
	Puerto Bolívar Port Terminal	Shrimp aquaculture and fishery	Mines and quarries	Mooring piles in Canal Jambelí	Estero Huaylá dredging	Puerto Cobre	Influence of undertaking on VEC
Water and sediment quality	X	X	X	X	X	X	100%
Air quality and noise	X						17%
Soil quality	X	X	X		X		67%
Land traffic	X						17%
Maritime traffic	X	X		X	X	X	83%
Biodiversity	X	X	X			X	67%
Community health and safety	X		X				33%
Community relations	X						17%
Economy	X	X	X	X	X	X	100%
Tourism	X						17%
Cultural heritage	X						17%
Fisheries	X	X				X	50%

Prepared by: Ecosambito, 2020

9. Cumulative Impact Analysis Methodology

The modified Leopold Matrix will be employed for the assessment of cumulative impacts and to determine its significance and hierarchy. This matrix shows the potential environmental impacts identified for the physical, biotic and human components and determines the significance of the associated impacts. The classification process for environmental impacts considers all project stages with an emphasis in construction activities and their effects on both the natural and socio-economic environment within the area of influence.

The assessment will apply previously defined criteria, which will be assessed by means of semi-quantitative parameters established on a relative scale, such that every project activity correlates with the corresponding environmental impact produced. This assessment creates an index reflecting the quantitative and qualitative characteristics of the impact.

On the basis of assigning values within the corresponding ranges of each criterion, a matrix is generated which determines the significance and hierarchy of the different impacts, and which by means of a formula that includes all the assessed criteria, a numerical value is obtained that allows for drawing comparisons (CA).

Table 14. Evaluation criteria and value ranges.

Symbol	Criterion	Value range
D	Direction	-1 to +1
M	Magnitude	0 to 3
Du	Duration	1 to 3
R	Reversibility	0 to 3
E	Geographical expanse	1 to 3
F	Frequency	0 to 4
Po	Probability of occurrence	0.1 to 1

The environmental classification for each impact (CA) is the result of the interaction of each criterion to determine the characteristics of the environmental impacts. The classification is shown in the following equation: CA= D x Po x (M + E+ Du + F + R).

Environmental Assessment Criteria

The application of the criteria depends on the environmental assessment being conducted, as well as on the environmental sensitivities of the components that have been identified in field and reference studies.

Table 15. Semi-qualitative analysis of the Environmental Assessment criteria

Semi-qualitative analysis	Value range	Description
DIRECTION (D)		
Negative	-1	Net damage to the resource
Positive	1	Net benefit to the resource
Neutral	0	No benefit or harm to the resource
PROBABILITY OF OCCURRENCE (Po)		
High	1	When the appearance of the effect is known with certainty
Medium	0.9± 0.5	Likely, the probability of occurrence is high
Low	0.4± 0.1	Low probability of occurrence
MAGNITUDE (M)		
High	3	Predictable effects exceed the limits associated with potential adverse effects, or cause a detectable change in environmental aspect, beyond the natural variability or social tolerance

Medium	2	The effects are considerably above typical existing conditions, but do not exceed the criteria defined in the allowable limits or cause changes in the economic, social or biological parameters below the ranges of natural variability or social tolerance
Low	1	It is estimated that the disturbance will be slightly higher than the typical existing conditions
None	0	No change is expected
GEOGRAPHICAL EXPANSE (E)		
Regional	3	It extends beyond all sub-regional or administrative limits specified for each discipline or indicator, but confined to the region.
Sub-regional	2	Extends beyond the directly disturbed areas, but is within the limits of the assessed area (generally 1 km or less from the disturbed areas)
Local	1	Confined to the area directly disturbed by the project
DURATION (Du)		
Long	3	More than a year
Medium	2	Between 6 and 12 months
Short	1	Less than 6 months
FREQUENCY (F)		
Continuous	3	Will occur constantly
Isolated	2	Confined to a specific period
Occasional	1	Occurs intermittently but repeatedly
Accidental	0	Rarely occurs
REVERSIBILITY (R)		
Irreversible	3	Permanent effects
Reversible in the long term	2	Can be reversed in more than 1 year
Reversible in the medium term	1	Can be reversed in between 6 and 12 months
Reversible in the short term	0	Can be reversed in 6 months or less

Impacts hierarchy

Environmental impacts classified for all the environmental components are assessed according to the significance criteria using the following value ranges:

Table 16. Significance value ranges

Range	Environmental classification	Color code
0 to 15	Positive	Blue
-5 to 0	Mild negative	Yellow
-10 to -5.1	Moderate negative	Orange
-15 to -10.1	Severe negative	Red

10. Cumulative Impact Assessment

10.1. Assessment of the individual impacts of each undertaking on VECs

The following matrix shows the assessment of individual impacts of the undertakings on each VEC by applying the above methodology.

Two indicators have been defined at each row end.

Average impact on VECs: it is the arithmetic mean of the contribution of each undertaking to VEC, such that it is shown in the same value range of the classified impacts by undertaking; therefore, its color shows the impact significance degree on the VEC.

Total impact on VEC: shows a total accumulated value of all impacts caused by the undertaking on each VEC. This value may be useful for identifying the VEC that receives the highest cumulative impact.

The result shown in the columns constitutes the cumulative impact contributed by a specific [*sic*] on the assessed VEC. This impact has been classified as positive impact and negative impact, and is shown both in value and [*sic*].

Table 17 shows the cumulative impact assessment results arranged in order of significance. The matrix containing the semi-qualitative analysis of the Environmental Assessment criteria appears in Annex 3 of this document.

Table 17 Assessment matrix or cumulative impacts arranged in order of significance

	UNDERTAKINGS							
VEC	Puerto Bolívar	Aquaculture	Mines	Mooring piles	Huaylá dredging	Puerto Cobre	Average impact on VECs	Total impact on VECs
Water and sediment quality	-4.8	-6	-13.5	-4.8	-6	-4.8	-6.7	-39.9
Soil quality	-0.8	-5.5	-6.5		-5.4		-4.6	-18.2
Maritime traffic	-5.5	-5		-5.5	4	-5.5	-3.5	-17.5
Biodiversity	-5.5	-5	-6.5			-5.5	-5.6	-22.5
Economy	14	12	13	12	13	13	12.8	77.0
Fisheries	-1.5	-1.2				-1.5	-1.4	-4.2
Negative cumulative impact by undertaking	**-18.10**	**-22.70**	**-26.50**	**-10.30**	**-11.40**	**-17.30**		
% of negative cumulative impact	**17%**	**21%**	**25%**	**10%**	**11%**	**16%**		
Positive cumulative impact by undertaking	**14.00**	**12.00**	**13.00**	**12.00**	**17.00**	**13.00**		
% of positive cumulative impact	**17%**	**15%**	**16%**	**15%**	**21%**	**16%**		

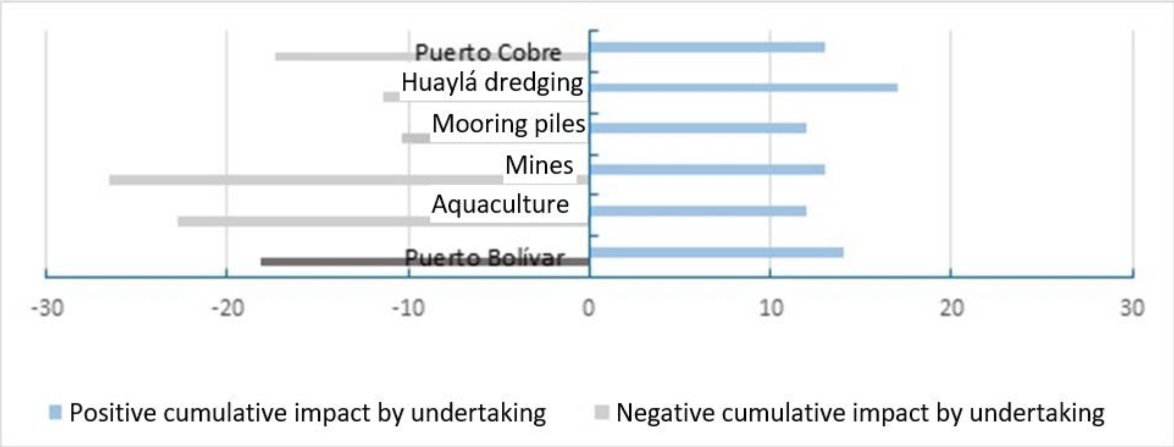
Prepared by: Ecosambito, 2020

10.2. Results

10.2.1. Cumulative impacts of the undertakings

This assessment shows the degree in which each undertaking produces an impact on all the assessed VECs. The right side of Figure 22 shows the positive impacts of the undertakings on VECs, calculated on the basis of their contribution to the local and regional economy, whereas the left side shows the negative cumulative impacts on VECs.

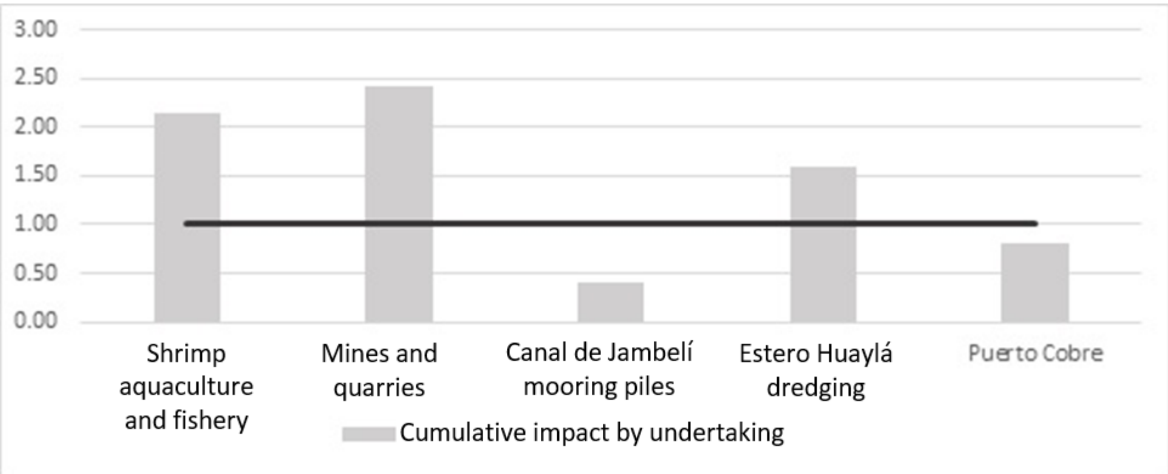
Figure 22. Cumulative impacts by undertaking



Prepared by: Ecosambito, 2020

The assessed contribution of the undertakings to Puerto Bolívar project are shown in Figure 23. To that end, the values pertaining to the impacts of undertakings on VECs have been normalized based on the values of impacts of Puerto Bolívar project, so as to assess and compare the cumulative impacts of the undertakings in proportion to those of the Project. This assessment only contemplates the negative impacts.

Figure 23. Cumulative impacts by undertaking in relation to the impacts of Puerto Bolívar project.



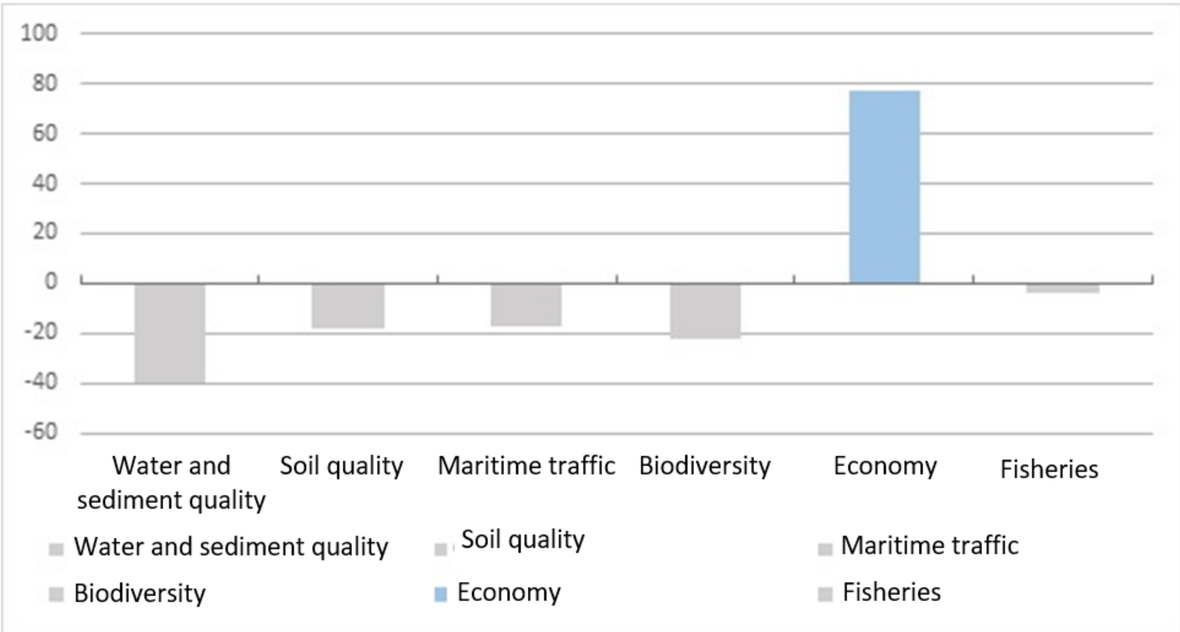
Prepared by: Ecosambito, 2020

This figure illustrates that the major contributors to cumulative impacts are aquaculture, with a future emphasis on intensive and super-intensive shrimp cultivation, and mining, which mainly operates illegally and whose growth and operation is largely performed outside government control.

10.2.2. Cumulative impacts on VECs

The figure below shows the net cumulative impacts of all assessed undertakings received by each VEC.

Figure 24. Cumulative impact on VECs



Prepared by: Ecosambito, 2020

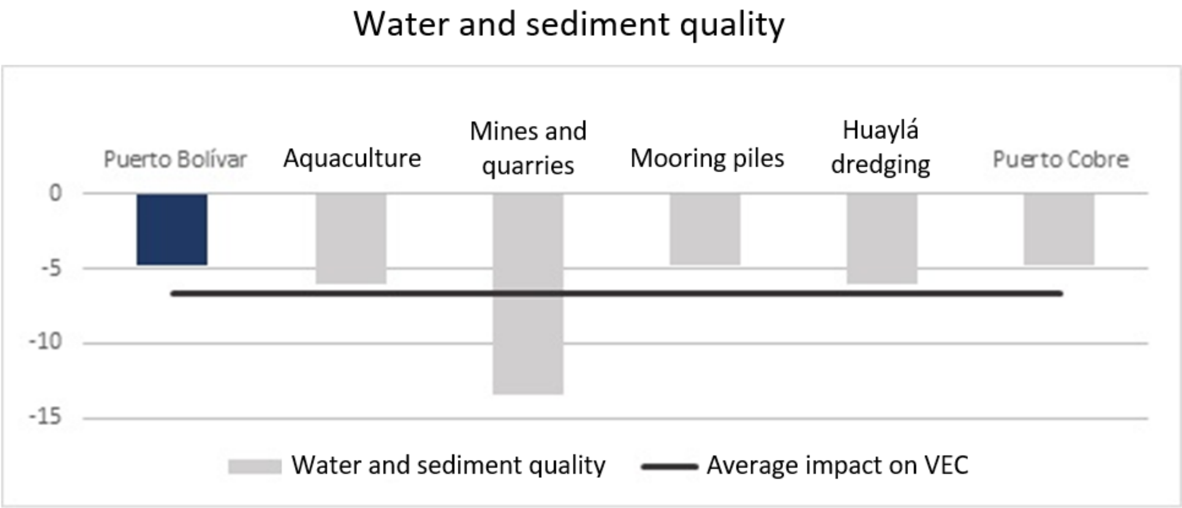
As seen in Figure 24, water and sediment quality as well as biodiversity are the VECs most affected by the assessed undertakings since they have more interactions with them, and among the effects they receive are moderate and severe impacts, whereas the economy receives a positive cumulative impact.

The obtained results for each assessed VEC regarding the cumulative impact of each undertaking is shown below:

- in relation to the total average of impacts for each assessed VEC (Average impact on VEC);
- in relation to the project impact (normalized absolute value).

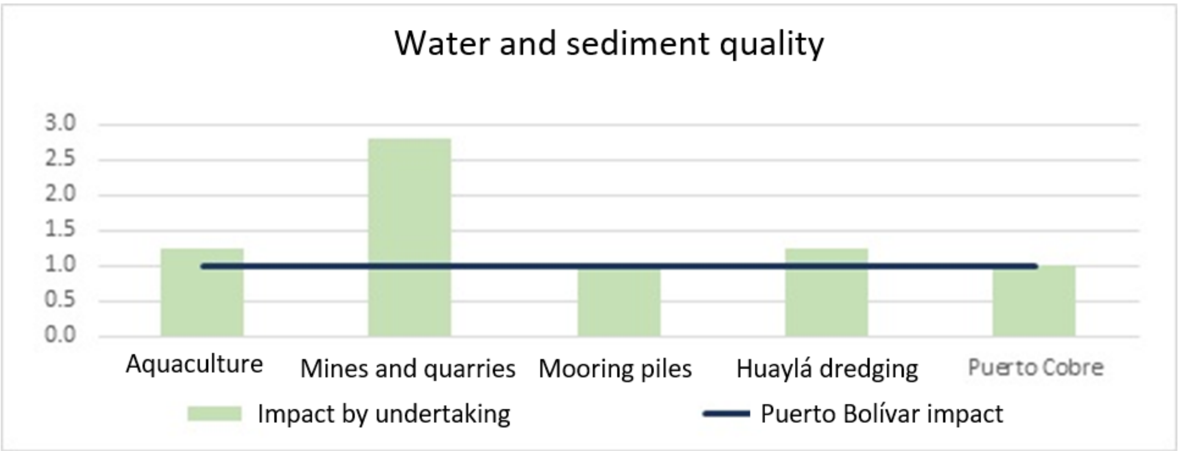
Water and sediment quality. This VEC has one of the most interacted with by other undertakings. Despite the descriptions of current conditions indicating that the marsh and adjacent marine areas are highly resilient, possibly due to the presence of the mangrove ecosystem in its vicinity, the close monitoring of its quality must continue, especially of heavy metal concentrations which could affect some regions irreversibly. Mining is unarguably the most significant contributor to the decline of this VEC, immediately followed by agriculture.

Figure 25 Cumulative impacts by undertaking against Average impact on water and sediment quality



Prepared by: Ecosambito, 2020

Figure 26 Cumulative impacts by undertaking against the Project in relation to water and sediment quality

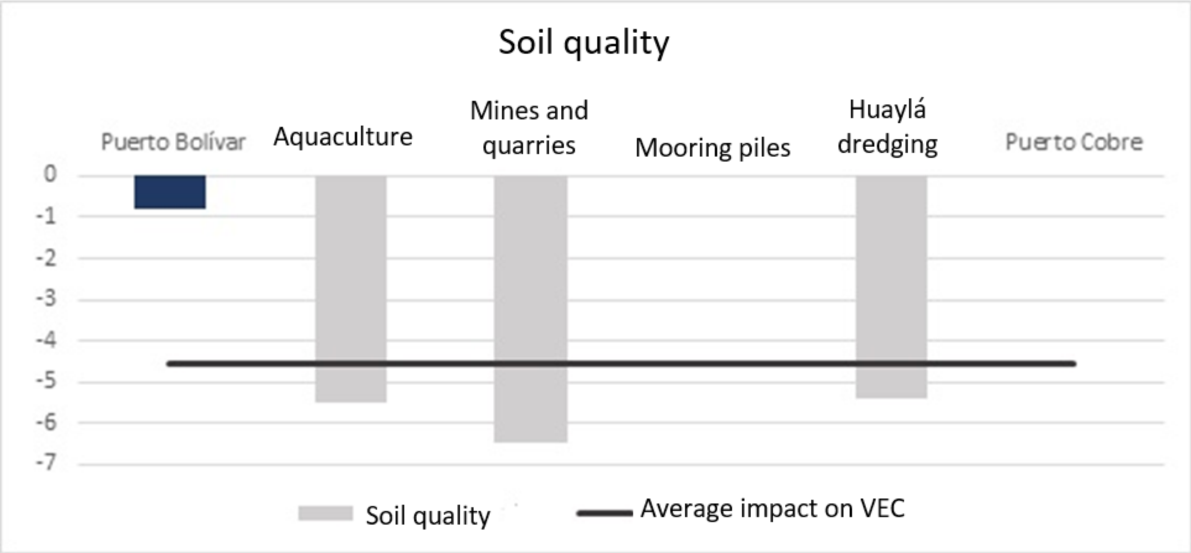


Prepared by: Ecosambito, 2020

Soil quality

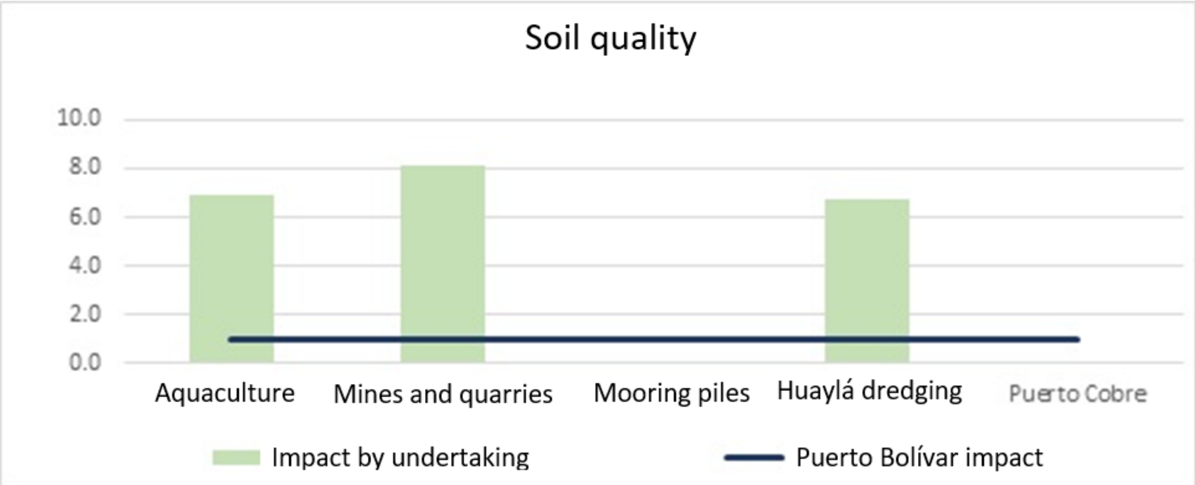
Soil quality is severely affected by cumulative impacts. Agriculture, which constantly changes the characteristics of the soil, and the dredging of Estero Huaylá, whose sediments are presumed to be heavily contaminated and should be disposed of in the mainland, significant contributors to this result.

Figure 35 Cumulative impacts by undertaking against Average impact on soil quality



Prepared by: Ecosambito, 2020

Figure 28 Cumulative impacts by undertaking against the Project in relation to soil quality

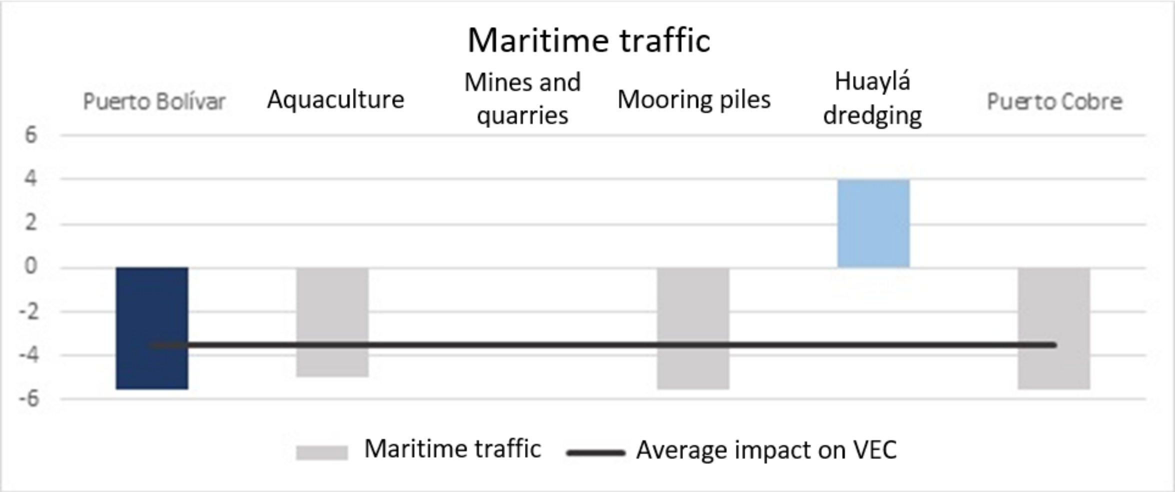


Prepared by: Ecosambito, 2020

Maritime traffic

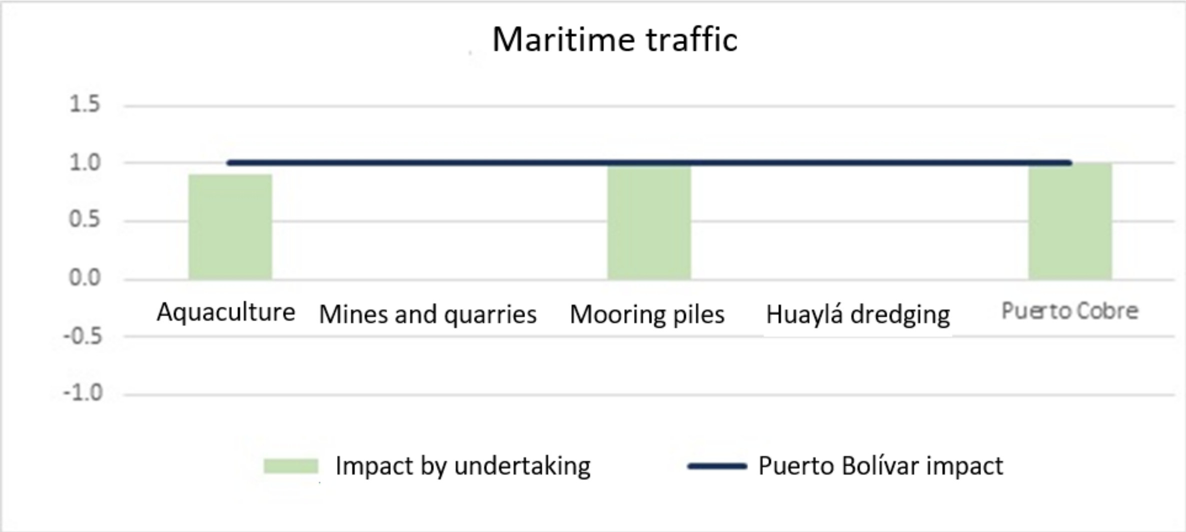
This VEC receives both positive and negative effects. Maritime traffic is heavy in the area of influence and even more so in the vicinity of Puerto Bolívar. The dredging of Estero Huaylá could prove beneficial to this VEC, although without any control by the authorities on the number of vessels with a license to operate in the area, this effect could become adverse in the medium term.

Figure 35 Cumulative impacts by undertaking against Average impact on maritime traffic



Prepared by: Ecosambito, 2020

Figure 30 Cumulative impacts by undertaking against the Project in relation to maritime traffic

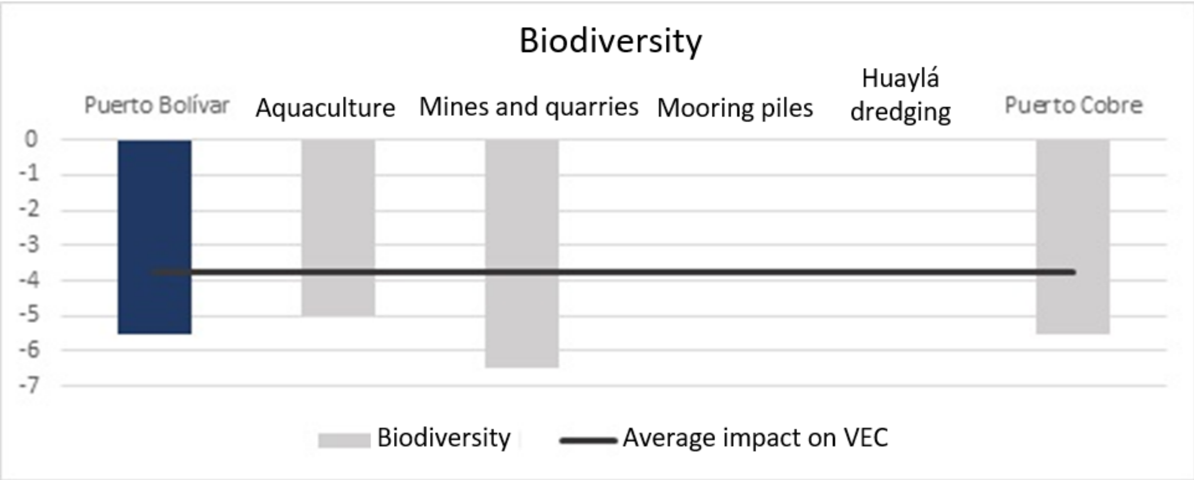


Prepared by: Ecosambito, 2020

Biodiversity

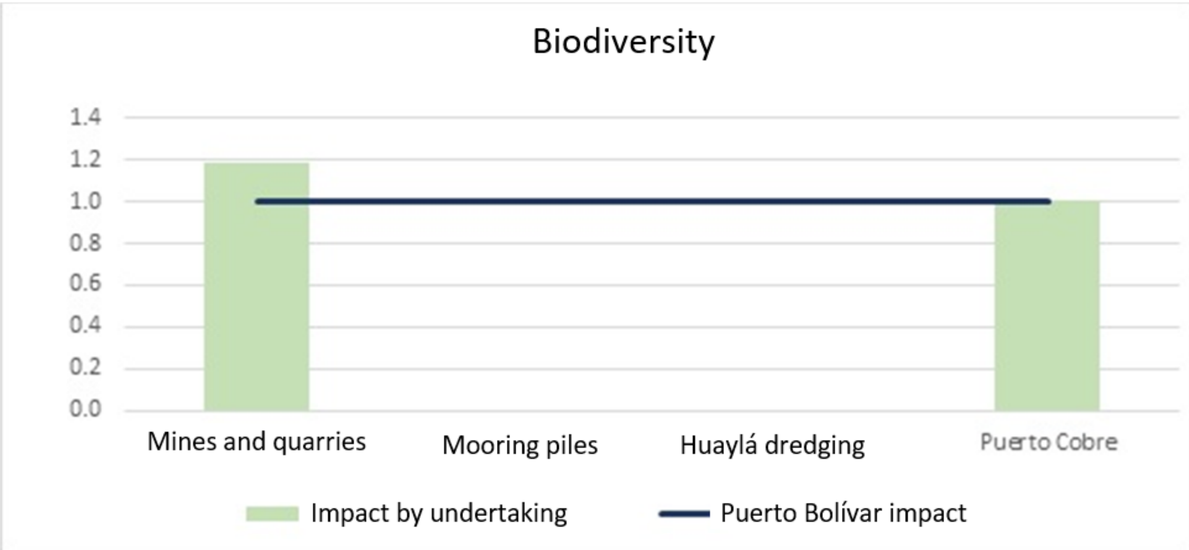
This VEC is negatively affected by all the undertakings described, although to a lesser extent by port activities; however, the magnitude of this effect is still moderate.

Figure 31 Cumulative impacts by undertaking against Average impact on biodiversity



Prepared by: Ecosambito, 2020

Figure 32 Cumulative impacts by undertaking against the Project in relation to Biodiversity

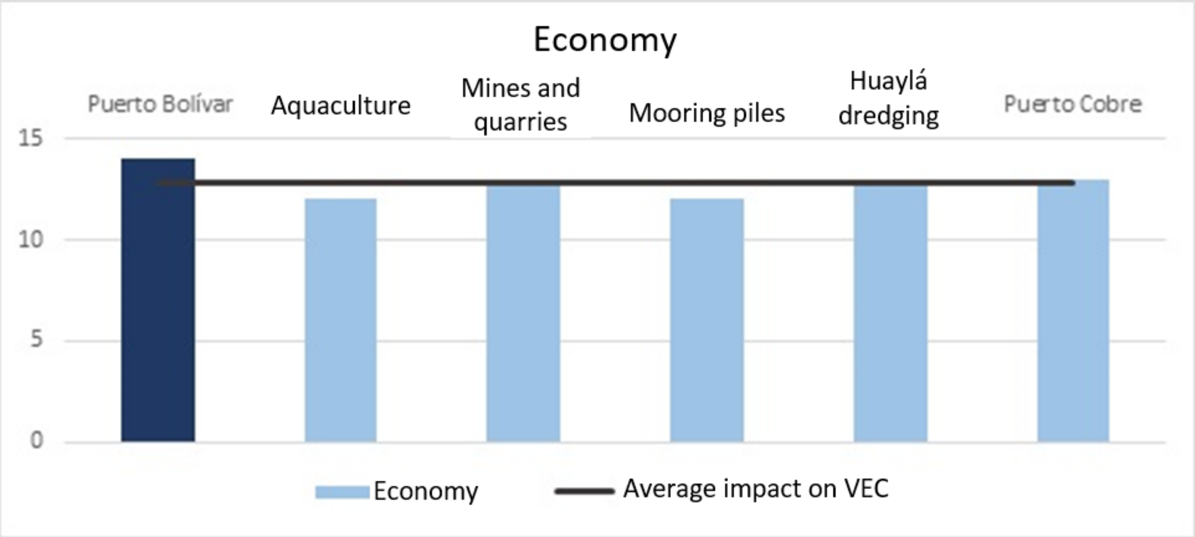


Prepared by: Ecosambito, 2020

Economy

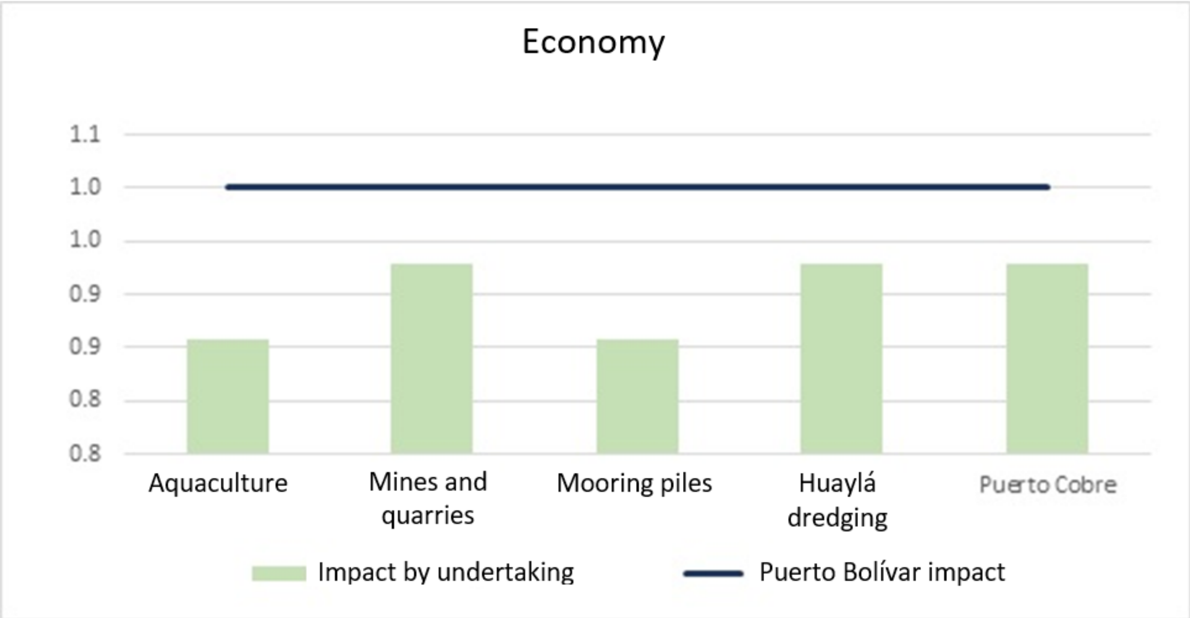
All undertakings make a similar contribution to the economy given their crucial importance in job creation and commerce as the main economic driving force in the region.

Figure 35 Cumulative impacts by undertaking against Average impact on the economy



Prepared by: Ecosambito, 2020

Figure 34 Cumulative impacts by undertaking against the Project in relation to the economy



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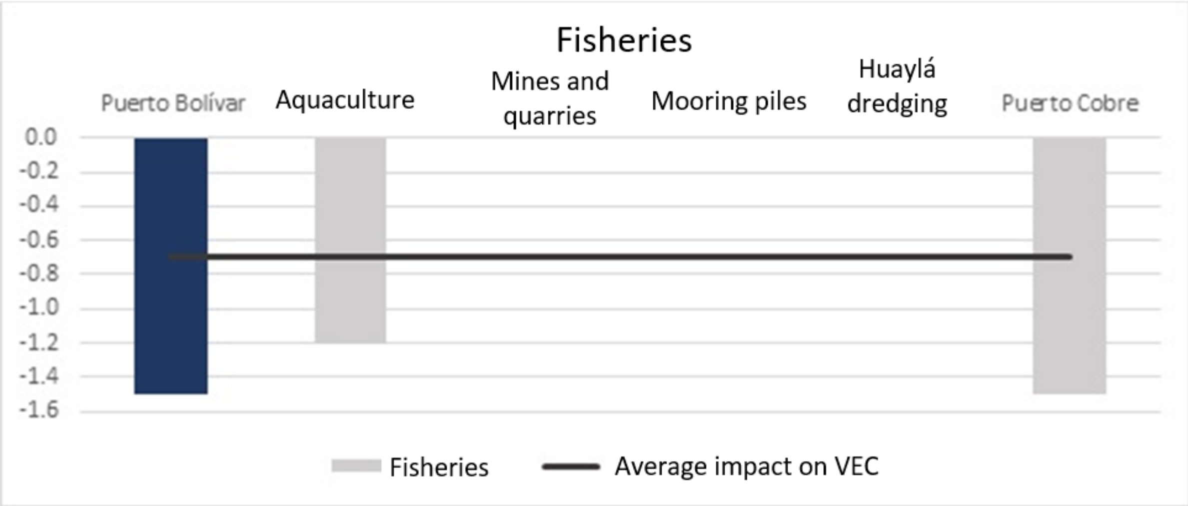
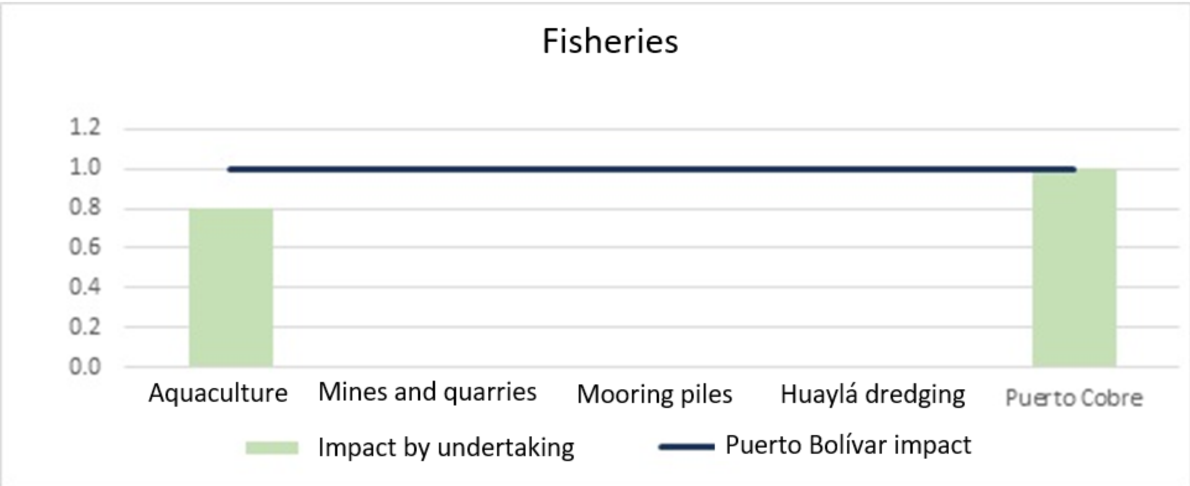
Fisheries

Direct impacts on fisheries receive the lowest negative results compared to other assessed VECs. However, they must be subject to careful inspection, e.g. regarding biodiversity and the quality of their water, given how valuable a resource they are, and of their marine coastal environment.

Figure 35 Cumulative impacts by undertaking against Average impact on fisheries



Prepared by: Ecosambito, 2020



Prepared by: Ecosambito, 2020

11. Management framework for cumulative impacts

An alternative that may improve to some extent the management of cumulative impacts from Puerto Bolívar Expansion Project Stage 1 is to adopt policies related to environmental management legislations which bind the leading company to their suppliers and clients, such as ISO standards, or implement them as requirements for contracting suppliers or services.

Practices to promote

With the aim of encouraging and reinforcing the environmental management culture of the Project and undertakings in the area of influence, especially with those which may relate to Yilportecu, the practices described in Table 18 have been laid down.

Table 18 Cumulative impacts management

VEC	Management action proposed	Goal	Responsible party	Tracking	Indicator	Interaction with other VECs	Observations
Water and sediment quality	Monitoring of water quality in the monitoring points established in Estero Santa Rosa (6 points included in the baseline) and the offshore sediment basin (1 point inside and one outside of the dispersion area) and assessment thereof according to Table 2, Annex 1, Book VI of TULSMA (A.M. 097 – A). -	Monitoring of marsh water quality in order to detect potential effects.	HSE Management	Ministry of Environment and Water of Ecuador (MAAE)	% of performance against forecast	Soil quality/ Biodiversity/ Fisheries/ Economy	Monitoring points are established in the PMA in force.
	Monitoring of soil quality in the monitoring points established in Estero Santa Rosa (6 points included in the baseline) and assessment thereof according to Table 1, Annex 1, Book VI of TULSMA (A.M. 097 – A) and Reference Values of Canadian Environmental Quality.	Monitoring of sediment quality in order to detect potential effects.	HSE Management		% of performance against forecast		Monitoring points are established in the PMA in force.
	Cooperation in the development of joint initiatives for reducing waste discharges to Estero Santa Rosa, alongside fishermen trade unions, residents and public institutions with subject matter jurisdiction (local government and the MAAE). -	Volume reduction of waste discharges near the marsh.	HSE Management/ Projects Department/ Human Resources Department	Management	% of implementation of the developed plan against forecast.		To be developed in the Community Relations Plan of the PMA in force and in Corporate sustainability initiatives.

VEC	Management action proposed	Goal	Responsible party	Tracking	Indicator	Interaction with other VECs	Observations
Soil quality	Inclusion of the following conditions in the terms of reference for service contracting and/or purchase: - The contractor and/or supplier must carry out the collection and management of common and recyclable waste pursuant to Technical Regulation NTE INEN 2841:2014-03. - The contractor and/or supplier must carry out the collection and management of hazardous and special waste pursuant to Ministerial Resolution 061, Art. 93 on sites for hazardous waste storage, and technical regulations INEN 2266 and INEN 2841 where applicable.	Decreasing the production and poor management of common and hazardous waste.	HSE Management/ Projects Department/ Legal Department/ Purchase Department	Management	% of implementation (number of included suppliers against the total)	Biodiversity/ Fisheries/ Economy	
	Inclusion in the Supplier Audit criteria of the verification of compliance with the conditions described in their facilities within the Port Terminal and in the Project area of influence. -		HSE Management		Supplier Evaluation Statistics.		

VEC	Management action proposed	Goal	Responsible party	Tracking	Indicator	Interaction with other VECs	Observations
Maritime traffic	Implementation and extension to contractors and/or service suppliers of the adoption of "Practice guidelines for the avoidance of collisions with whales or other marine mammals" should they occur. A report format must be included in every occasion this measure is implemented. - Implementation and extension to contractors and/or service suppliers of the adoption of Response guidelines in the event of marine mammal stranding, should they occur. A report format must be included in every occasion this measure is implemented. -	Appropriate response and monitoring in case marine fauna is affected.	HSE Management/ Projects Department/ Legal Department/ Operations Department	Management/ Projects Department	% of implementation (number of included suppliers against the total)	Biodiversity/ Fisheries/ Economy	Measure included within the PMA in force. Existing guidelines under review.
Biodiversity	Monitoring of main marine ecosystems: plankton, nekton and benthos, fishery productivity and description of activities of protected marine fauna, in the monitoring stations established in the PMA in force. -	Characterization of the conditions of main marine ecosystems, fishery productivity and protected marine fauna.	HSE Management	Ministry of Environment and Water of Ecuador (MAAE)	Biological diversity and richness. Biological descriptors	Fisheries/ Economy	Monitoring points are established in the PMA in force.

VEC	Management action proposed	Goal	Responsible party	Tracking	Indicator	Interaction with other VECs	Observations
	Monitoring of mangrove productivity of mollusks and crustaceans, in the productive areas identified by users (PAP) within the zones with AUSCM in Estero Santa Rosa laid down in the PMA. Inclusion of a compulsory monitoring procedure for identifying and recording fish species in the area, carried out by way of standardized casting nets or other means suitable for the area. -	Characterization and monitoring of mangrove productivity for mollusks and crustaceans.	HSE Management				
	Update on the bioaccumulation analysis of heavy metals in bivalvia (*Anadara Tuberculosa*) at the 4 sites included in this report. -	Characterization of the state of bioaccumulation in fishery resources (PAP).	HSE Management	Management	Conducted assessments		
Economy	--	--	--	--	--	--	--
Fisheries	Implementation and presentation of the Communication Guidelines to fishery organizations as a means for notifying them of potential effects on the fishery activity. -	Timely conveyance of information and avoidance of conflicts with social actors.	Management/ HSE Management/ Projects Department	HSE Management	Communication recording and tracking.	Economy	

VEC	Management action proposed	Goal	Responsible party	Tracking	Indicator	Interaction with other VECs	Observations
	Prior to the commencement of dredging or construction activities, compulsory announcement to public entities with jurisdictional capacity in the areas of influence of the activities to be performed, work schedules and restrictions (if any) with a minimum 1-week notice before the performance of said works. -			Projects Department			

Prepared by: Ecosambito, 2020

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13. Annexes

I, Miguel Angel Pantoja Shimanskii, certify that the present document consisting of 80 pages in english was translated from its original version in spanish, it's accurate to the best of my capacities as a Sworn Court Certified Translator of the Judicial Council of Ecuador.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, PUERTO BOLÍVAR PROJECT – PHASE 1

– ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN–

Prepared by:

[There is a logo of YILPORT- PUERTO BOLIVAR]

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Created by:

[There is a logo of SAMBITO - Total Environmental Solutions]

ECOSAMBITO C.LTDA.

December 2020

Table of Contents

EXECUTIVE SUMMARY

The Environmental and Social Management Plan of the Puerto Bolívar Project - Phase 1, contains a series of plans and measures required to ensure the additional management needs for compliance with the "Ecuador Principles" and the Performance Standards on Environmental and Social Sustainability of the International Finance Corporation (IFC).

The following sub-plans have been included in this plan: External Communication Mechanism and attention to complaints, Mitigation and remediation plan for affected areas, Biodiversity Management and Monitoring Plan, Management Plan for accidental findings, Monitoring and Supervision Plan for Contractor performance, Effluent Management Plan in Settlements, Community Health and Safety Plan, Severance Plan for seasonal workers, Participation Plan for Stakeholders.

Each plan contains its relevant objectives, scope, decision-makers, and protocol or proposed measures.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (PGAS) of the Puerto Bolívar – Phase 1 Project is a methodological tool intended to ensure the implementation of the social-environmental requirements resulting from the Environmental and Social Assessment complementary to the Project's Environmental Impact Assessment.

1. Objectives

The environmental and social Management Plan established in this document seeks:

- To prevent, minimize, control, and monitor the new impacts and risks identified, in their area of influence.
- To provide personnel involved in the project and users of the same with guidelines for managing installations and the implementation of activities according to efficient and socially responsible environmental conditions.
- To ensure that the implemented activities comply with current laws, regulations, ordinances, and standards of their jurisdiction and applicable to their activity.
- To ensure the implementation and management of the Environmental and Social Management System and its described plans.

2. Current Environmental Management Plans and Scope of these PGAS

The current environmental Management Plans for the project (Annex I), established according to national environmental standards, and the identification of environmental impacts and risks, based upon which the Environmental Licenses for the operation, dredging and construction of YILPORTECU's pier 6 have been obtained and maintained, contain a series of plans and sub-plans as detailed below:

A) TP Environmental Management Operation Plan.

Prevention, Mitigation and Impact Plan

Waste Management Plan, PMD

Communication and Training Plan,

PC Community Relations Plan, PRC

Contingency Plan, PDC

Occupational Health and Safety Plan,

PSS Monitoring and Follow-up Plan, PMS

Area Abandonment and Handover Plan, PAE

B) Dredging Environmental Management Plan

Prevention, Mitigation and Impact

Plan Waste Management Plan, PMD

Communication and Training Plan, PC

Community Relations Plan, PRC

Contingency Plan, PDC

Occupational Health and Safety Plan,

PSO Monitoring and Follow-up Plan, PMS

Area Abandonment and Handover Plan, PAE

C) Pier 6 Construction Environmental Management Plan

Prevention, Mitigation and Impact

Plan Waste Management Plan

Communication and Training Plan

Community Relations Plan

Contingency Plan

Occupational Health and Safety

Plan Monitoring and Follow-up Plan

Restoration Plan

Area Abandonment and Handover Plan

The PGAs have been created to ensure compliance with the “Ecuador Principles” and the Performance Standards on Environmental and Social Sustainability of the International Finance Corporation (IFC). Therefore, new plans with specific environmental measures have been included to complement the current and approved Management Plans.

3. Health, Safety, Environmental and Comprehensive Policy of YILPORTECU S.A.

3.1. HSE Policy

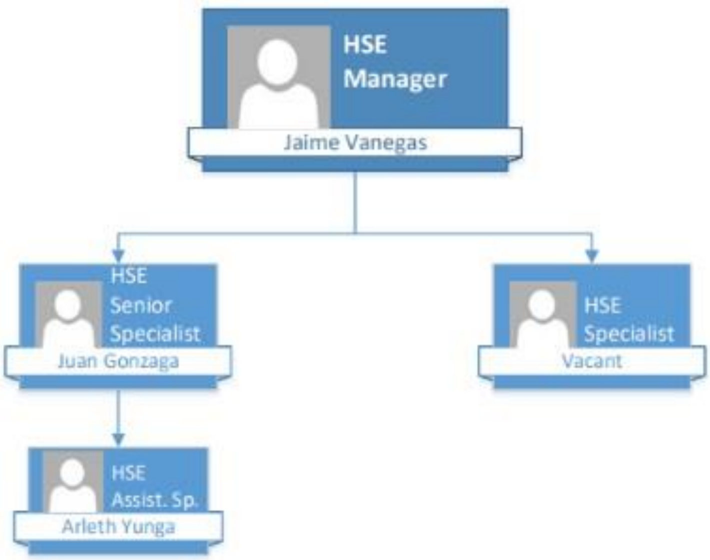
Because YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A., a concessionary company of the "Puerto Bolívar" maritime terminal, must ensure the Occupational Health, Safety and Environment of its collaborators, these regulations have been created for Occupational Health, Safety, and Hygiene. The following paragraph has been created as a comprehensive policy:

"YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A., focuses on providing sustainable value to its clients, employees, contractors, subcontractors, authorities, shareholders, and users of the port installations. Therefore, the company conducts its operations according to national and international standards for industrial and occupational health, safety, and the environment. It has identified and mitigated the risk level of its operations, taking the necessary precautions to prevent potential workplace accidents and illnesses while also minimizing environmental contamination. It is convinced that human resources are the most valuable company asset, and a healthy and sustainable environment is the best legacy for future generations".

3.2. Organization and Managers of the HSE Department

The General Management has delegated the activity of "Head of Environmental Management and Community Relations" to the HSE Department, which will carry out the activities of management and control of the Environmental and Social Management Plans with the advising and support of specialized external consultants.

Figure No. 1. Organization Chart of the HSE Department



Source: YILPORTECU S.A.

HSE Manager.

1. Objective of the position:

To design, control, verify and manage the occupational risk management, health and environmental system in the YILPORTECU installations, ensure the collaborators' quality of life, and comply with the current policies to maintain a safe workplace, mitigating risks through a model of ongoing and sustainable improvement.

2. Functions and responsibilities:

To permanently audit unsafe conditions in the YILPORT Puerto Bolívar offices and port terminal, including the maritime perimeter and the interior of the vessels moored in the piers.

To regularly create and update the Internal Regulations on Occupational Health and Safety, according to the new business modalities and the governmental provisions. In addition, to update the NTP 330 general risk matrix for work positions and its approval by the Ministry of Labor.

To implement the risk identification matrix for the ongoing improvement of the YILPORTECU installations in terms of occupational health, industrial safety, and the environment.

To create a matrix for industrial safety, occupational health, and the environment for the business operation activities performed by operations, construction, maintenance, and crew subcontractors.

To support the Management team in the organization of roles and responsibilities concerning occupational health and safety.

To define the specifications of the personal protection equipment (PPE) to be used, according to company activities.

To define the biosafety risk analysis in each work position and implement the biosafety PPE plan for pandemics.

To create, update and monitor the effective implementation of the health and safety procedures and regulations for YILPORTECU employees and subcontractors.

To ensure the familiarization and assimilation of the importance of the occupational health and safety system and the protective equipment.

To implement the Management Plan for the mitigation of occupational risks, health risks and environmental risks.

To lead and carry out implementing and maintaining the integrated management systems with support from different company departments.

To guarantee that all employees have been trained in Occupational Health, Safety, and the environment.

To design training and study plans for the distinct work positions and the different businesses of YILPORTECU, according to the need and demand of the business.

To offer service providers such as industrial cleaning, material recycling, solid and liquid waste management, occupational health doctor, and environmental consultants.

To obtain and manage the environmental licenses required for YILPORTECU to implement its operations and expansion plan.

According to the management model and external to the Port Loading Operating Companies, Related Service Companies, and other subcontractors, to implement and direct internal audits of laterally-structured departments in the distinct EHS areas.

To conduct investigations of occupational accidents and incidents, compile all relevant documentation, conduct investigative meetings, and compile the evaluation committee for ongoing improvements to ensure that these events are not repeated.

To continually advise the EHS Committee concerning the occupational health areas. To direct and manage the annual selection of the new EHS committee and its respective representatives. To oversee approval by the Ministry of Labor and to carry out actions in the case in which personnel substitutions are made.

To contribute with business initiatives and projects that review impact in areas related to occupational health and safety.

To design and prepare an analysis of the annual budget of the EHS department and to ensure compliance with the same.

To develop and establish KPI objectives and indicators and send reports to the relevant regulatory authorities (the Puerto Bolívar Port Authority, YILPORT HOLDING, the Ministry of Labor, the Ministry of the Environment, and Occupational Risks of the Environment IESS and the El Oro prefecture).

4. Environmental and Social Performance Standards applicable to the project

4.1. Ecuadorian law

- Constitution of the Republic of Ecuador.
- Codification of the Water Laws.
- Comprehensive Organic Criminal Code.
- Health Code and it's Organic Law.
- Organic Code of Land-Use Planning and Decentralization (COOTAD).
- Organic Code of the Environment and its Regulations.
- Regulations on Worker Health and Safety and Environmental Improvements of the Ministry of Labor and Employment.
- Ministerial Accord 061 “Reform of Book VI of the Unified Text of Secondary Legislation of the Ministry of the Environment (TULSMA)”

- Ministerial Accord 097A. Annexes of the Unified Text of the Secondary Legislation of the Ministry of the Environment.
- Ministerial Accord 100-A. Environmental Regulation on Hydrocarbon Operations in Ecuador (RAOHE).
- Ministerial Accord 026, issuing the procedures to register hazardous waste generators, the management of hazardous waste required for environmental licensing and for the transport of hazardous materials.
- Ministerial Accord 142. National Listing of Hazardous Chemical Substances, Hazardous, and Special Waste.
- Technical Regulations:
    - NTE INEN 2-288:2000, “Hazardous industrial chemical products. Warning labels”.
    - NTE INEN ISO 3864-1:2013 Safety Colors, Signs and Symbols, 1982-165
    - NTE INEN 2266:203 Transport, Storage and Handling of Hazardous Materials
    - Guide to Emergency Responses with Hazardous Materials. Ministry of the Environment. Technical Secretariat of the Management of Hazardous Waste

4.2. Performance Standards of the International Financial Corporation (IFC)

In the Environmental and Social Due Diligence (DDAS), the following Performance Standards (ND) of the IFC may be applied:

i) ND 1: Assessment and management of the environmental and social risks and impacts,
ii) ND 2: Work and employment conditions;
iii) ND 3: Effectiveness of resource use and the prevention of contamination;
iv) ND 4: Community health and safety and
v) ND 6: Preservation of biodiversity and sustainable management of living natural resources.
vi) ND 8. Cultural patrimony

4.2.1. Assessment and management of the environmental and social risks and impacts

Performance Standard 1 highlights the importance of the management of environmental and social performance during a project. An effective Environmental and Social Management System (SGAS) is a dynamic and ongoing process that implements and supports the management and that implies collaboration between clients, workers, local communities directly affected by the project (the Affected Communities) and, when applicable, other shareholders, based on previously established elements of business management-- in other words, the “planning, execution, verification and action”. The SGAS applies a methodological approach to managing risks and impacts in a structured and ongoing manner. A good SGA, based on the project’s scale and nature, promotes solid, sustainable environmental and social performance and may improve financial, environmental, and social results.

4.2.2. Work and employment conditions

Performance Standard 2 recognizes that the protection of basic worker rights should accompany the search for economic growth through employment and income generation. For any company, the workforce is a valuable asset, and good relations between workers and management is essential to the company's sustainability. Failing to establish and promote a good relationship between workers and management may lead to a decline in worker commitment and hinder employee retention. This may place the project at risk. On the other hand, constructive relationships between workers and management, fair treatment, and the provision of safe and healthy working conditions may promote tangible benefits for IFC clients, such as improved efficiency and productivity of their operations.

The requirements stipulated in this Performance Standard arise from a series of international conventions and instruments, including those of the International Labor Organization (ILO) and United Nations.

4.2.3. Effectiveness of resource use and the prevention of contamination

Performance Standard 3 recognizes that an increase in economic activities and urbanization tends to generate higher air, water, and land contamination levels and the consumption of finite resources, potentially placing the local, regional, and global population and environment at risk. There is also a growing consensus that suggests that the current and predicted emission of greenhouse gases (GGE) in the atmosphere is a threat to public health and the wellbeing of present and future generations. On the other hand, more efficient and effective use of resources is more accessible globally, as is the application of technologies and practices to prevent contamination and mitigate or prevent greenhouse gas emissions. Their implementation tends to involve the use of methodologies of ongoing improvement, similar to those used to improve quality or productivity, which, generally speaking, are well-known in most companies of the industrial, agricultural, and service sectors.

4.2.4. Community health and safety

Performance standard 4 recognizes that a project's activities, equipment, and infrastructure may increase the possibility of a community being exposed to risks and impacts. Likewise, communities that have already been subject to the impacts of climate change may experience an increase or intensification of said impacts due to the project activities.

Although the role of the public authorities in promoting public health and safety is well-known, this performance standard focuses on client responsibility to avoid or minimize risks and impacts on the community's health and safety derived from project activities, paying special attention to vulnerable groups.

The level of risks and impacts described in this performance standard may be greater in projects carried out in areas of conflict. The risks that a project may exacerbate an already sensitive local situation and generate tension on scarce local resources should be considered since new conflicts may result.

4.2.5. Preservation of biodiversity and sustainable management of living natural resources

Performance standard 6 recognizes that the protection and preservation of biodiversity, the maintenance of ecosystem services, and the sustainable management of living natural resources are all fundamental to sustainable development. The requirements proposed in this performance standard are based on the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”.

Ecosystem services are the benefits that are obtained by individuals, including companies, from the ecosystems. There are four types of eco-systemic services: (i) provisioning services, which are the products obtained by individuals from the ecosystems; (ii) regulating services, which are the benefits obtained by individuals from the regulation of ecosystem processes; (iii) cultural services, which are the non-material benefits obtained by individuals from the ecosystem and (iv) support services, which are the natural processes that maintain the other services.

Services provided by the ecosystems and valued by humans tend to be sustained in biodiversity. Therefore, impacts on these may jeopardize the ecosystems’ service provision. This performance standard considers how clients may sustainably manage biodiversity and the ecosystem services and mitigate the impact on the same, especially during the project’s life cycle.

4.2.6. Cultural patrimony

This standard recognizes the importance of cultural patrimony for present and future generations. Its objective is to protect cultural patrimony from a potentially adverse project impact and promote the balanced distribution of benefits derived from the same.

4.3. Ecuador Principles

The Ecuador Principles were established to ensure that projects to be financed are carried out in a socially responsible manner and to ensure the application of rigorous environmental management practices.

These principles are based on the declaration of the importance of climate change, biodiversity, and human rights to avoid, minimize, mitigate or compensate for the negative effects on ecosystems, communities, and the climate resulting from these projects.

4.3.1. Principle 1: Review and categorization

Categorization ensures that the environmental and social due diligence of the EPFI are in line with the nature, magnitude, and phase of the project and with the environmental and social risk and impact levels.

The categories are as follows:

Category A – Projects having potentially significant adverse environmental and social risks and/or impacts that are diverse, irreversible, or unprecedented.

Category B – Projects having potentially limited adverse environmental and social risks and/or impacts that are scarce in number, generally located in specific locations, mainly reversible and easily corrected through mitigation measures; and

Category C – Projects having minimal or non-adverse environmental and/or social risks and/or impacts.

4.3.2. Principle 2: Environmental and Social Assessment

For all of the projects in categories A and B, the EPFI demands that clients carry out an assessment process to consider the environmental and social risks and impacts related to the proposed project. The Assessment Documentation offers an appropriate, precise, and objective assessment and presentation of the environmental and social risks and impacts. Measures should be proposed to minimize, mitigate and compensate for the adverse impacts, permanently and appropriately, according to the specific nature and magnitude of the proposed project.

For the projects in Category A and, when applicable, in Category B, the Assessment Documentation includes an Environmental and Social Impact Assessment (EIAS).

It may also be necessary to complete an assessment on human rights and analyze alternatives to assess potential options having a lower intensity of GGE.

4.3.3. Principle 3: Applicable environmental and social standards

First and foremost, the assessment process should ensure compliance with all relevant laws, regulations, and permits of the host country regarding environmental and social aspects. The EPFI operates in diverse markets. Some of these have solid environmental and social governance, legal systems, and institutional capacity to protect the population and the environment. Others are currently developing the necessary technical and institutional capacity to manage environmental and social aspects. The EPFI requires that the assessment process evaluate compliance with the applicable standards, as detailed below:

1. In the case of projects carried out in non-designated countries, the assessment process will evaluate compliance with performance standards on the environmental and social sustainability of the IFC (Performance Standards) and environmental, health and safety guidelines of the World Bank (MASS guidelines) (Document III).

2. In projects carried out in designated countries, the assessment process will evaluate compliance with the host country's laws, regulations, and permits concerning environmental and social aspects. The laws of the host country should comply with the requirements of environmental and/or social assessment (Principle 2), management systems and action plans (Principle 4), the participation of interest groups (Principle 5) and complaint mechanisms (Principle 6).

The assessment process should demonstrate, to the satisfaction of the EPFI, overall compliance of the project with the applicable standards or any justified deviation with the same.

Applicable standards (mentioned above) represent the minimum standards adopted by the EPFI. The EPFI may apply other additional requirements, as it sees fit.

4.3.4. Principle 4: Environmental and Social Management System and Action Plan of the Ecuador Principles

For all Categories A and B projects, the EPFI will demand that clients demonstrate or maintain an Environmental and Social Management System (SGAS).

Furthermore, the client will be required to create an Environmental and Social Management Plan (PGAS) to consider the aspects proposed in the assessment process and include the necessary compliance with the applicable standards. When the applicable standards are not in compliance, according to the EPFI, the client and the EPFI will agree to an Action Plan for the Ecuador Principles (PA). The PA of the Ecuador Principles is intended to indicate the differences and commitments for compliance with the requirements of the EPFI, according to applicable standards.

4.3.5. Principle 5: Interest Group participation

For all projects in Categories A and B, the EPFI will require that the client demonstrate the ongoing, structured, and culturally appropriate participation of the Interest Groups and, when applicable, that of other Interest Groups. In projects with potentially significant impacts on the affected communities, an informed consultation and participation process will be carried out. The client will adapt its consultation process to the following: project risks and impacts; the project development phase, the linguistic preferences of the affected communities, their decision-making processes, and the needs of disadvantaged and vulnerable groups. This process should be exempt from external manipulation, interference, coercion and intimidation.

To facilitate the participation of the interest groups, the affected communities and, when applicable, other interest groups, will be provided with the assessment documentation in the local language and in a culturally appropriate format. The interest group participation process results will be documented, including established measures derived from said process. In the case of projects having adverse environmental and social risks and impacts, the information will be provided during the first phases of the assessment process and, in any case, before the onset of the project’s construction and in a periodic manner.

4.3.6. Principle 6: Complaint mechanisms

For all projects in Category A and, when applicable, Category B, the EPFI will require that, as a part of the SGAS, the client define a complaint mechanism to receive and facilitate the resolution of any concerns and complaints related to the project’s environmental and social performance. The complaint mechanism should be in line with the project's risks, and impacts and the affected communities should be their main users. Concerns should be resolved quickly, using an easy-to-understand and transparent consultation process that is culturally appropriate and of easy access. It should be free of cost and no fear of reprisal for those making the complaint or raising the issue.

The mechanism should not impede access to administrative or judicial resources. The client will inform the affected communities regarding the mechanism during the interest group participation process.

4.3.7. Principle 7: Independent review

Project financing. For all projects in Category A and, when applicable, those of Category B, an Independent Environmental and Social Consultant having no direct relationship with the client, will carry out an independent review of the assessment documentation, including the documentation of the PGAS, the SGAS and from the interest group participation process, to contribute to the due diligence tasks of the EPFI, and to assess compliance with the Ecuador Principles.

The Independent Environmental and Social Consultant will also propose or assess an Action Plan for the Ecuador Principles that is appropriate, capable of guaranteeing that the project complies with the Ecuador Principles, or indicating when this compliance is not possible.

Corporate Loans Related to Projects. An independent review, to be carried out by the Independent Environmental and Social Consultant, will be required for those projects having potentially high-risk impacts, including, but not limited to the following:

• adverse impact on indigenous populations

• impact on critical habitats

• significant impact on cultural patrimony

• large scale resettlements

For other corporate loans related to projects in Category A and, when applicable, Category B, the EPFI may determine if it would be useful to carry out an independent review or if an internal review made by a financial entity is sufficient. This review may include due diligence carried out by a multi-lateral or bilateral financial entity or an export credit agency of the OECD.

4.3.8. Principle 8: Contractual commitments

For all of the projects, the client agrees to the following: to commit to the clauses included in the financing documentation, to comply with all environmental laws, regulations and permits of the host country for all relevant aspects.

Similarly, for all of the projects in categories A and B, the client commits to the following, through clauses included in the financial documentation:

a) To comply with the PGAs and the Action Plan of the Ecuador Principles (if relevant) during the project construction and operation, for all relevant aspects; and

b) To provide periodic reports in the format established with the EPFI (the frequency of these reports will be proportional to the severity of the impacts or based on legal provisions, but will be (at least) annual), created by internal or external experts, which:

i) document compliance with the PGAS and, when appropriate, the Action Plan of the Ecuador Principles, and

ii) demonstrate compliance with environmental and social laws, regulations and permits on a local, state, and national level (of the host country); and

c) Dismantle the installations, assuming that this is applicable and opportune, according to the established dismantling plan.

When the client breaches its contractual commitments in the social and environmental area, the EPFI will work with the client on corrective measures so that, to the greatest extent possible, the project will once again comply with the required measures in these areas. If the client does not re-establish compliance in the established grace period, the EPFI reserves the right to apply measures as it deems opportune.

4.3.9. Principle 9: Independent follow-up and report

Project financing. To assess whether or not the project complies with the Ecuador Principles and to ensure the ongoing follow-up and the report, following the financial closure and during the loan term, the EPFI will require that an Independent Environmental and Social Consultant be appointed for all projects of Category A and, when applicable, Category B or that the client has qualified external experts verify the follow-up information to be shared with the EPFI.

Corporate Loans related to projects. In the case of projects requiring an Independent Review based on Principle 7, the EPFI will require an Independent Environmental and Social Consultant appointment following the financial closure, or that the client has qualified, experienced external experts verify the follow-up information to be shared with the EPFI.

4.3.10. Principle 10: Report presentation and transparency

Client requirements for the presentation of reports. In addition to the information requirements of Principle 5, the following requirements have been established for the presentation of reports by the client.

For all of the projects in category A and, when applicable, category B:

- The client guarantees that (at least) a summary of the Environmental and Social Impact Assessment will be accessible and available online.
- The client will publically report the levels of GGE (combined emissions of Scope 1 and Scope 2) during the operating phase for projects in which more than 100,000 annual tons of CO_2 are emitted.

4.4. Guidelines on the environment, health and safety (MAAS) of the GBM

The guidelines on the environment, health, and safety are technical reference documents containing general and specific examples of the International Good Practices for the Industry

(GIIP).

These guidelines contain the performance levels and indicators that can typically be reached in new installations, with the current technology, and at reasonable costs. In already existing installations, it may be necessary to establish specific goals for the location as well as an appropriate calendar to achieve them.

The application of these guidelines will be based on the results of the risk identification and environmental assessments in which variables specific to the site are considered.

In cases in which the recipient country has distinct regulations for the levels and indicators in the guides, the projects should consider the strictest of the same.

5. Structure

This Environmental and Social Management Plan

a) Plan for external communication and attention to complaints (stakeholders)

b) Plan for internal communication and attention to complaints (workers)

c) Mitigation plan and remediation of the affected areas (EAS)

d) Plan for the Management and Monitoring of Biodiversity

e) Management Plan for Archaeological Findings.

f) Plan for the Supervision and Monitoring of Contractor Performance

g) Settlement Waste Management Plan

h) Community Health and Safety Plan

i) Severance plan for seasonal workers

j) Public consultation and participation of stakeholders

6. External communication and attention to complaints

6.1. Justification and objectives

To maintain good neighborhood relations, it is necessary to establish and maintain a communication channel that is open to the public and easy access by stakeholders (i.e., telephone number, website, email address).

The external stakeholders may offer valuable information and suggestions to improve products, early warnings in critical situations, opinions regarding relations with employees or comments before the regulatory bodies, non-profit organizations, and others concerning the project's social and environmental performance.

The purpose of a complaints mechanism is to establish a means by which people, groups or communities affected by Yilportecu's activities can contact the same, in the case of any doubts, issues or formal complaints.

6.2. External communication

The external communication procedure should include actions to be carried out by the promotor's Community Relations Department or the individual delegated for the same purpose, and that is primarily implemented in the urban parish of Puerto Bolívar:

- To receive, record, and validate external communications and requests for information from the public;
- To analyze and assess the importance of the proposed issues and to determine the manner of responding to the same;
- To provide, offer follow-up on, document, and publish the responses, and
- To adjust the management program as necessary.

The external communication should promote an active and fluid relationship and, at the same time, facilitate complaint mechanisms having a response capacity.

The most effective participation mechanisms in the area, identified via the surveys carried out in the project's area of social influence, are:

- Informative meetings (48%)
- Informative round tables (23%)
- Brochures and leaflets (21%)
- Radio (8%)

Yilportecu promotes communication through spaces that permit the receipt of stakeholder comments or opinions, establishing the following communication system and dissemination mechanisms for the informative meetings: personalized invitations, massive convocations through the radial and written press, speakers and delivery of flyers,

as considered appropriate, allowing for the assessment of compliance with the measures established in the PGAS along with the receipt of feedback.

6.3. Attention to suggestions, complaints, and claims

In practice, a complaint mechanism should:

- To establish a procedure by which individuals can contact YILPORTECU (anonymously or nominally) to propose questions, express doubts, or make complaints. Possible examples include: a suggestion box, a toll-free telephone assistance line, an email address, or periodic meetings held to discuss especially problematic issues.

- To designate a YILPORTECU individual or group as the party responsible for receiving, recording, and processing complaints.
- To establish procedures to record, analyze, categorize, investigate and determine alternatives for resolution or repair.
- To create a system to communicate the decisions adopted and the progress made in the pending issues. People should know when they can expect to receive a response.

Not all complaints can be resolved in the same manner. The simpler issues, e.g. that a company service vehicle has run over an animal in the road can be handled by the team responsible for recording the complaint. More complex problems, such as a complaint about widespread pollution, may require immediate intervention by upper management and more specific resources for the research, documentation, and presentation of reports. In complex and recurrent problems, the possibility of convening external consultants to act as independent mediators should be considered.

The more serious the complaint, the more independent the mechanism to determine the resolution and the options for its attention.

The complaint mechanism must be accessible and reliable. It should be adapted to the reality of the local community, in this case, Puerto Bolívar, so that it will be easy to raise concerns. This requirement requires that the appropriate individuals from the company perform this task.

The value of a duly implemented complaint mechanism should not be underestimated. The information received may serve as an early warning, before the problem becomes overwhelming over time.

6.3.1. Definitions

Complaint: Resentment, complaint, reluctance, or dissatisfaction with a personal situation of the complainant, concerning the company, which directly or indirectly affects them and which requires correction. It should be made in writing.

Claim: Opposing something, either verbally or in writing, expressing disapproval, or a complaint related to a demand caused by some type of event in the work environment.

Unrest: Concern, lack of knowledge regarding an area or situation related to the work environment in which the individual participates.

Suggestion. Declaration of an idea or proposal to improve the organization’s service or management.

6.3.2. Receipt mechanism

The mechanisms to be implemented for the receipt of suggestions and complaints from the stakeholders will be (at least) the following:

- Physical mailbox, installed upon entering the Yikportecu Port Terminal.

- The establishment of a contact email, which will be published on the website.
- Physical receipt of communications, within the Yilportecu installations.

The suggestions received via these communication channels should follow the established protocol. For improved communication, the following are recommended:

- Publication of the existence of the complaint mechanism so that people know where to go and whom to contact.
- Commitment to offer a response within a given period and compliance with the same, since this will increase the transparency and perception of a "just process".
- Registration of each step to create a "documented traceability".

6.3.3. Responsibilities

***Receptionist*.**

Receiving the complaint, from the distinct receipt mechanisms, recording it and continuing the procedure.

Maintaining a logbook on the follow-up to the communication.

Reporting the resolution.

***Manager of Safety, Health, and the Environment*.**

To create and update the protocol on external communication management.

To direct the relevant departments, which should manage and coordinate with the contracted companies as relevant, in the case of an event involving an external employee.

To share the results obtained on implementation and execution of the procedure to attend to complaints, claims, and personnel suggestions.

Human Resources Manager

To review, supervise and coordinate the approval, dissemination, and compliance with the procedure.

General Manager

To approve the procedure.

To approve the responses in the case of serious circumstances requiring the same.

6.3.4. Communications management protocol

i. All communications that are received will be recorded in a Follow-up File, which consists of the issuer's name, the procedure number and the date of receipt, and the contact telephone number and email of the issuer.

ii. The party entrusted with reception will classify the communications for its referral (along with a digital copy) to the relevant department (industrial safety, management, legal, others), sending a copy to the General Manager and the legal department.

Comments, suggestions, complaints, and other communications made in specific areas will be sent as follows:

- Environmental and/or Safety Topics: HSE Manager

- Requests for donations or collaboration: HR Manager, Administrative Director
- Concerns regarding work areas, dredging, implemented projects: HSE Managers, Project Department
- Request for information: Legal Department, Administrative Manager.

iii. A physical and digital file will be made for all communications – be they complaints, claims, requests for information and/or meetings or other types, as received from stakeholders, union representatives and/or communities in the project's area of influence.

iv. Thirty (30) business days are permitted for the issue of an official response on behalf of YILPORTECU, upon approval of the document by the General Manager and/or the Legal department or others designated by the administration.

v. In the case of communications regarding environmental and/or safety issues, after the response by the HSE Manager, a working meeting will be requested with the Legal department, General Manager, and environmental advisor to discuss the scope and implications of the communication. Depending on the type and scope of the claim or complaint, the Attention Protocol or the Rehabilitation of affected areas protocol may be activated. In this meeting, a course of action will be defined to propose a solution or the drafting of the response. In the case of activating one of the cited protocols, the issuer will be notified of the decision and steps to be taken in the respective protocol.

vi. This response will be sent via email and will be notified via telephone for its withdrawal in printed version from the YILPORTECU offices.

vii. The response document issued by YILPORTECU will be registered in the Follow-up File, where the date of issue and initial communication generating the response (its code or number) will be recorded. The delivery of the printed copy will be recorded in the follow-up file.

TIME AND MOMENTS OF THE EXTERNAL COMMUNICATION MECHANISM

1 day	Receipt and recording of the communication (follow-up file)
2 day	Analysis of the issue
1 day	Referral of the communication to the competent department
1 day	Completion of the procedure and response generation
2 days	Assessment of the relevance of the response, for serious and very serious cases
2 days	Readjustment of the responses for serious and very serious cases and re- sending to the manager or delegate for community relations issues
1 day	Sending of the response to the complainant
1 day	Verification of compliance of the response
1 day	Closing of the complaint file

7. Internal Communication Mechanism and attention to complaints

7.1. Justification and Objectives

These permit all personnel working in the YILPORTECU S.A. port installations to express their opinions and ideas related to their environment, needs, and the work environment, such that their suggestions are considered to improve fluidity in the established procedures and to attend to topics that may be beyond the perception of the Human Resources administration, respecting the basic principles of transparency and accessibility, Yilport's corporate policies and values and the laws of Ecuador.

7.2. Internal communication process.

The internal communication process is guided by the Procedure of Complaints and Suggestions of Human Resources with code: RH-PR-13 (ANEXO II)

8. Mitigation plan and restoration of the affected areas

8.1. Objectives:

To prevent and mitigate environmental contamination resulting from spills or escapes and restore the areas affected by contamination and environmental liabilities.

8.2. Proposed measures

- The areas intended for the storage of hydrocarbons, hazardous substances, chemical products in general, be they consumables or merchandise (in transit or stored), should be covered, have cross ventilation, waterproof floors and containers or containment wells for spills, as established in INEN standard 2266, as well as other applicable ones.
- Bi-annual testing should be carried out on water tightness and calibration of hydrocarbon storage tanks, in accordance with the technical standard of reference (API 350, API 353).
- There should be spill containment elements in all operational areas: work areas, settlements, piers, tank area, warehouses, and others on solid ground and in the floating installations or in the sea, where hydrocarbons and chemical and hazardous substances are handled or stored, or where machinery is operated which, in the case of an accident, may lead to a major spill.
- Annual simulations should be conducted to contain spills, evacuation in the case of toxic material spills and fires, including sites that represent the diversity of areas and conditions where these are considered risks (warehouses, vehicles, patios, outdoors or in open decks, etc.).
- Quality control monitoring should be carried out on the underground water in deep wells

that are used for consumption to control the evolution of its quality over the medium and long term.

- If there is any suspicion of pollution plumes in the ground or underground, exploratory perforations should be made to determine the spill's magnitude.
- In the case of confirming the presence of a pollution plume in the ground or underground, a correction program should be designed and implemented according to the substance's magnitude, characteristics, spill location, and time in the location.
- To implement a plan of fast and systematic repair of fissures and cracks in soils and pavements to reduce potential sources of underground contamination.

9. Management Plan and Biodiversity Monitoring

9.1. Objectives:

- To have the necessary means to ensure that biodiversity is not affected by the Port Terminal activities.

9.2. Invasive species management plan

It is necessary to act based on the YECU-EHS-126-Instructive Review of Certificates IMO_MARPOL_V1 procedure (Annex 10 of this book) of Yilportecu, which verifies that the ballast water of the vessels complies with the following parameters:

- To verify that all vessels of the signatory countries constructed after September 8, 2017 comply with the D2 standard (treatment).
- For vessels build before September 8, 2017, those from the signatory countries should comply with the D1 (exchange) or D2 (treatment) standard.
- For vessels built before September 8, 2017, that have renewed the International Oil Pollution Prevention Certificate (IOPPC) after September 8, 2017, they should comply with the D2 standard.
- To request the logbook on ballast water that verifies the last water loading and unloading point, checking if it took place in Puerto Bolívar and verifying the compliance with the coordinates record.
- For the IAPPC and IOPPC certificates, the supervisor should ensure that the date of validity is for at least 3 months for the next renovation.
- After verifying the compliance and validity of the certificates, it is necessary to continue with the vessel's safety inspection process.
- In the case of detecting a "non-conformity" with the requested documents, it is necessary to contact the EHS department to receive specific instructions on how to proceed.
- If the EHS department identifies that the vessel does not have the documentary support or guarantees of compliance with the standards, it will send a communication to the Maritime Authority, informing them of the event, to perform governing actions by the port through the Port State Control.

- The documents should be delivered to the EHS to register the validity of the dates.

9.3. Monitoring plan

9.3.1. Water quality

In addition to the 6 already existing locations for bi-monthly monitoring, 2 additional sampling points were included, in the southern area of the Santa Rosa marsh, for a total of established monitoring points as indicated below:

No.	Location	UTM 17S Coordinate X	Y
1	*Mouth of the Huaylá marsh	609894	9638207
2	*Two kilometers to the north of the entry to the Bravo marsh, where it meets with the Guajabal marsh	609009	9636266
3	In front of the Port	610680	9639902
4	In front of the Naval School	610682	9640521
5	Isla del Amor	610505	9641879
6	Entry to the Balneario El Coco	611365	9645418
7	Punta el Faro	608302	9646721
8	Entry to Jambelí	609094	9642541

**New monitoring points*

The samples taken should be compound (integration of surface water and water from near the sea bed) to avoid the effect of dilution by recent rainwater or the failure to detect compounds that tend to sink to the lower layer of the water column. All samples should be collected from low tides or low water phases, to prevent the possible entry of coastal water that does not belong to the interior water bodies. The same parameters will be analyzed as in the six already monitored points.

9.3.2. Hydrology

To examine the Lagrangian derivatives launched before the Puerto Bolívar installations to observe the movement of surface waters (1m),

the following should be ensured: 2 during tides and 2 in “breaks” both in the winter or the rainy season of the Ecuadorian coast and during the summer or dry season. It is suggested that follow-up of the buoys be carried out using satellite positioning (GPS) to register trajectories which will be followed by small vessels to prevent their loss and avoid their becoming entangled in fishing nets.

This same study should be carried out in the dredging disposal tank since this ensures that there is no physical connection, especially with shrimp nets.

9.3.3. Sediment quality

Two monitoring points located towards the south are increased. These are those that were described in the Water Quality section. The sample of sediments should be obtained with tubes or by demanding that the dredge have an upper opening to permit the obtaining of superficial sections of a maximum depth of 5 cm. It is recommended that the work be performed with 3 cm sections, to avoid alteration of the sampling due to its mixture with the contents of the dredge. The surface film of the sediments is the part that is of the greatest interest for systematic analysis.

Due to population abundance and lack of wastewater treatment systems, it is suggested that the organic parameters of the sediments be included, such as

- Total nitrogen
- Ammonium
- Phosphates
- Nitrites and
- Nitrates

In addition to already established parameters of the current PMA, the presence of exclusively human compounds should be monitored, including:

- BTEX
- TBT
- Non-chlorinated aliphatics
- Chlorinated aliphatics

This, considering that some of these compounds will have a greater relationship with exogenous activities to the project, allows differentiating the potential origin of the same. In the case of the TBT, the presence and concentration of a product for specific use in antifouling paints for boats and other marine vessels will be established.

9.3.4. Biological sampling

9.3.4.1. Phytoplankton

The methodology used for phytoplankton should focus on the UTERMOHL protocol, demanding the observation of equipment. Samples should be collected with sampling bottles, recording the surface phytoplankton information, water medium, and sea bed, and communicating basic ecological descriptors.

Currently, the following locations have been monitored

- Santa Clara island
- 3 random points within the dredging disposal tank and
- In front of pier 1 of Puerto Bolívar
- In addition, two additional locations have been added in the Santa Rosa marsh:
    - In the buoy at the entrance of Santa Rosa marsh, on the beam of la Playita, and at the mouth of Huaylá marsh

Like that of the water samples, samples associated with the Santa Rosa marsh should coincide with the low tides.

9.3.4.2. Zooplankton

At the vicinity of the new points added in the previous section, 3-minute dredging operations will be performed in each location to obtain sestonic biomass of 3 fractions: 60, 300, and 500 microns. The fractions of 300 and 500 microns of zooplankton should be measures analyzed separately, and ecological descriptors and data on sestonic biomass abundance should be recorded for each fraction.

9.3.4.3. Benthos

Standardized dredging will be carried out with a Van Been dredger in the same sites described for the planktonic analysis (section 8.2.4.1), with sieving at 500 microns (carried out aboard the vessel). The observation of the equipment is necessary before each sampling and the creation of photographic catalogs. In addition, the use of the AMBI marine biotic index is recommended and other traditional ecological descriptors.

9.3.4.4. Ichthyofauna

At the previously described fishing locations, two additional fishing locations should be added:

- At the mouth of the Santa Rosa marsh
- 1 Km to the south of Puerto Bolívar towards the mangroves of Isla Jambelí.

9.3.4.5. Marine mammals

Reports of marine mammal sightings shall continue to be made in the paths traveled by the marine biological monitors. This will include two paths towards the two additional monitoring points described in the previous point.

9.3.4.6. Sampling in the mangrove resources

Continue with the current monitoring plan:

- Standardized collection of bivalves: 1 hour of effort by a collector, suggesting the use of the same collector to avoid differences caused by collector ability. Following the collection of the sample, all of the individuals collected will be gathered at:
  - Jambelí, Vikingos del mar
  - Isla del Amor, (both at the beach as well as the internal mangrove)
  - La Playita

  Individuals should be counted by species, and the following variables should be obtained:

  - Valve diameter in mm
  - Total weight, the weight of soft parts in grams with 0.1 g of sensitivity
  - Percentage proportion of the soft parts
- In the Vikingos del mar association area, the same monitoring was performed for red crabs (*Ucides occidentalis*), reporting the weight and cephalothoracic width of the same (in mm).

9.3.4.7. Share specific biodiversity data of the project with the Global Biodiversity Information Facility (GBIF) and the relevant repositories of national and global data

To register and formalize data on biodiversity so that it is compatible with the SISBIO platform (National Database on Biodiversity of Ecuador), which is the national institution authorized to manage biological databases and whose work is replicated in the GBIF platform, to permit access to said data and reuse of the same in future decisions and research applications.

9.4. Management plan for beaching and collisions with marine mammals

9.4.1. Management plan for beaching

Ecuador has approximately 30 marine mammal species (dolphins, whales, and sea lions), 5 sea turtle species, approximately 60 shark species, and over 30 stingray species. Many of these species are affected by diverse impacts, including natural and man-made impacts. The majority of the non-natural impacts are caused by factors such as maritime traffic (collisions with vessels), pollution (hydrocarbon, solid waste spills dumping of untreated wastewater, plastic waste, noise), direct aggressions, and contact with fishing nets.

Although the causes of the beaching are often difficult to identify, especially when the individuals are found in a state of decomposition, beaching serves as a source of biological and ecological information on these species, since many of them are difficult to observe in the sea.

<u>Types of beaching.</u>

A beached animal is an animal that is found at the shore of a body of water, be it alive or deceased, or in a defenseless position, unable to return to its natural environment on its own.

For the case of pinnipeds, the term beaching is only applied when discussing deceased, injured or entangled animals, since in other cases, these animals may move on the ground and climb rocks naturally. Live pinnipeds on the beach do not require assistance unless they have been seriously injured.

Beaching may be classified by: the number of individuals (individual or multiple), the number of species involved or the physical state of the individuals.

Individual beaching. These are the most frequent. This considers solitary animals found on the beaches. They may be alive or deceased.

Massive beaching. This consists of various animals and generally occurs in various nearby points. This implies a massive death of marine animals and is a danger to public health due to the quantity of decomposing animals.

Strange beaching. These are cases in which only part of the animal is found, such as turtle shells or partial remains of dolphins, or in which females have beached with their offspring or in those cases in which the beached animals are not common in the region.

Beaching Network. In Ecuador, via Ministerial Accord 090 from August 21, 2018, the **Ecuadorian Network in Response to Beaching and Rescue of Marine Species - RERV**, has the objective of carrying out the follow-up and study of marine fauna, which, for distinct reasons, appears on the coasts of Ecuador, offering valuable biological information related to areas such as feeding, reproduction, development level and pathological affectations, which would be difficult or impossible to obtain through other methods; and in addition, it may serve as a useful tool to determine the conservation state of the populations; these studies are carried out in collaboration with qualified specialists.

Scope.

This protocol establishes specific actions for each beaching and/or sighting of cetaceans, pinnipeds, sea turtles, whale sharks or stingrays, beached alive or dead, within the area of direct influence of the Port Terminal operations and its projects in the waters of the Santa Rosa marsh (dredging).

Responsible parties.

The following parties are responsible for the dissemination and application of this protocol:

- Yilport Terminal Operations (YILPORTECU) S.A. and its departments:
    - Department of Industrial Safety, Occupational Health and the Environment (HSE);
    - Operations Department
    - Department of Protection
- Port loading and service operators (OPC and OPSC)
- Contractors and their Subcontractors, including Security personnel
- Pilots.

Protocol.

In the case of the sighting of a beaching of any type (individual or multiple, strange, living or deceased animals), the observer, be it a collaborator from YILPORTECU, a contracting company, port operators, or service operators, should do the following:

1. Immediately report it to Security personnel and/or Pier Supervisors who are on shift, who will subsequently report it to the Department of SAFETY, HEALTH AND ENVIRONMENT (HSE) of YILPORTECU.

2. The HSE Manager receiving the notification will be entrusted with verifying the case at the location and notifying the authority via the **ECU 911** emergency line. The following information should be reported:
    a. Citizen's name
    b. Location of beaching
    c. Accessibility to the area
    d. Type of animal that is beached
    e. Number of beached animals
    f. Approximate size
    g. Sea conditions (high or low tide/waves)
    h. Condition of the animal (live, injured, deceased)

i. Cell phone number of a contact person.

3. The HSE Manager will convene the Emergency Brigade in the beaching area to provide assistance and support as necessary, to the best of its abilities.
4. The necessary provisions should be provided to establish a sanitary cordoning off of the area where the beaching occurs and prevent the approach of by-passers and individuals from outside of the institution until the designated environmental authority has arrived.
5. The alerting party or its delegates should remain at the beaching site to observe the location's conditions and report them to the authority when so required.
6. The HSE Manager will initiate the following actions:
    - Provide activities for the members of the participating Emergency Brigade.
    - Coordinate the establishment and maintenance of the sanitary cordoning off of the area with the corresponding authorities.
    - Implement normal communication channels with distinct participants.
    - Conduct a detailed external inspection in search of parasites, marks, scars, fishing nets, or any other sign that may assist in determining the death.
    - Photograph the animal, first overall at different angles (frontal, lateral, dorsal, ventral) and then, by body parts, head (mouth and teeth), genital area, dorsal fin, tail, emphasizing with close-ups of areas with injuries, pigmentations, parasites or any other anomaly.
    - In the case in which the beached animal is alive, and there is evidence of human artifacts that may have harmed it (fishing nets, hooks, cords, plastic and others), these materials should be removed, assuming that the animal cannot move and does not represent a threat to the personnel. The removed elements should be placed in plastic bags and delivered to the Authority.

- Taking morphometric measurements with a tape measure according to the field records of each species (see Annex III. Stranding registration formats).

1. Yilport personnel and the Emergency Brigade in the stranding area will join the Ecuadorian Marine Stranding Response Network team to provide the necessary assistance and support within their capabilities and availability. The Authority shall designate a **STAFF MEMBER** responsible for the decision-making and course of action to be followed and requesting and allocating available resources to the various tasks to be carried out.

9.4.2. Plan for preventing collision with whales and other marine mammals

The humpback whale (*Megaptera novaeangliae*) is widely present throughout the world's oceans, although they prefer coastal areas less than 200 m deep to reproduce. There are different populations of humpback whales in both hemispheres, divided in turn into various stocks. In the southern hemisphere, the International Whaling Commission (IWC) recognizes 7 different stocks, referred to by letters A through G, each related to one side of each continent and the other in the center of the Pacific Ocean. The population of the Southeast Pacific is known as the Reproductive Stock G.

In mid-August, when most births occur, mothers seek shallow areas to carry their offspring, usually 20 m or less. No high-concentration sites of mothers with young offspring have been found on the coast of Ecuador; rather, whales appear to be distributed along the country's entire coast. However, based on satellite information, it was found that the Gulf of Guayaquil would possibly be the most important breeding area for humpback whales in Ecuador. Other areas of the country with appropriate topographic conditions for breeding would be located west of Puerto Cayo and Cojimies in Manabí, off the coast of Esmeraldas, and north of Salinas in Santa Elena. The reason for this more coastal distribution of mothers with offspring would be to protect them from killer whales and sharks that are known natural predators of whales. There are two records of killer whales attacking humpback whales around La Plata Island. For this reason, when mothers with young offspring begin their trip to Antarctica at the end of the season (late September and October), they do so by bordering the coast and it is possible to observe them in many places from the shore.

Scope

This Protocol sets specific actions in the case of sightings of cetaceans, pinnipeds, sea turtles, whale sharks, and manta rays; In the areas: where dredging work is carried out (access channel, maneuvering zone, and piers in Puerto Bolivar), the sediment deposit area in the open sea, the sediment transfer route between the two zones, and the transit areas of service vessels, platforms, and barges, linked to the construction of Pier 6.

Responsible

The following are responsible for the dissemination and application of this protocol:

- Yilport Terminal Operations (YILPORTECU) S.A. and its units:

    - Projects Department
    - Department of Industrial Safety, Occupational Health, and the Environment (HSE).
    - Operations Department.
- Pier 6 dredging construction contractors, and their corresponding subcontractors.
- Captains of the dredger ship, platforms, barges, service vessels; and their corresponding crews.

<u>Preventive Measures.</u>

During the whale watching season, from June 1 to October 31 of each year, the following actions must be taken:

- As soon as it is safe and practical to do so, vessels must set a speed of no more than 10 knots.
- During the construction works of Pier 6, and in case of extraordinary execution of dredging activities, an expert marine biologist and assistant equipment must be provided onboard the vessel, which will act like a whale-watching watch, and in the case of the detection of an individual or group of marine mammal individuals within the direct influence area of the project, shall lead the actions of:
    - Evasion
    - Temporary suspension of activities
    - A daily report of sighting and application of this protocol

<u>Protocol in Case of Sightings.</u>

Once, using navigation and remote sensing instruments (e.g., high-range radar or binoculars), or by direct observation, the presence of one or more individuals of the species covered by this protocol is established, the captain of the vessel shall execute the following under the direction of the leader:

i. Deceleration of the vessel to the minimum speed, to reach 400 m of the individual or group of whales and keep it constant.
ii. Watch carefully and evaluate the direction and speed of the whales and their diving pattern to establish the route to continue avoiding colliding with the animal(s). A distance of at least 100 m. must be maintained; this will help reducing ship path corrections by minimizing discomfort to whales.
iii. Continue at a maximum speed of 4 knots until whales pass or change course.
iv. If the whales are in surface activity with jumps and particularly with repeated blows of fins and tail, proceed with even more caution and maintain a distance of 100 m, as the vessel’s presence may interrupt periods of socialization.
v. If the sighting involves groups where there are young offspring, the evasive maneuver must be done with more care since they are very curious and sometimes try to approach boats. The mother can interpret this as a hazardous situation and will try to keep the younger ones away from where it occurs, which can lead to risky situations

That is preferable to avoid. Never attempt to intervene with the boat between the mother and the baby.

vi. The discharge of sediment using the bottom gates shall be suspended until the individual(s) have moved away from the area at least 400 meters.

vii. Once the individual or group moves away from the ship, restart activities progressively, avoiding abrupt acceleration and movement.

Protocol in the Event of a Collision:

In the event of a collision with one of the species considered in this document, the Sighting Leader shall:

i. Report the following information immediately to the YILPORTECU Operations area on Radio Channel 16:
   a. Type of animal or animals affected.
   b. Number of animals affected.
   c. Approximate size
   d. Sea conditions (high and low tide/waves)
   e. Condition of the animal (alive, wounded, dead)

ii. The CCTV Head or *Planner* who receives the ship's communication must urgently retransmit this information to the Head of the HSE Department of YILPORTECU.

iii. Based on the information provided, the HSE Manager at YILPORT will issue a notification to **ECU 911**.

Depending on the instructions received by the Authority (Ministry of Environment and Water), the **PROTOCOL FOR THE RESPONSE TO MARINE MAMMAL STRANDING** will be activated**.**

All actions must be included in a report that collects the information necessary to identify the animal(s) involved, place, and conditions of the collision, and others detailed in Annex IV of this document and must be kept in files of the HSE department.

9.5. Critical Habitat Management Plan

The project and its area of influence are framed within areas identified as critical habitats as defined in IFC Performance Standard 6. While it is emphasized that the project will not generate direct impacts on these habitats, their implementation in an area where they are located must involve tangible benefits linked to conservation goals. To this end, a portfolio of support initiatives is proposed to manage AUSCM, RMISC, and in general, the development of management capacities for conservation both to the public institutions with competence in the area (MAAE and RMISC park rangers). as to social organizations of ancestral villagers and traditional mangrove users.

To achieve one of these initiatives, participation and even the signing of commitments with other social institutions and organizations will be required in advance, and agreement to work together on the issues considered a priority by the parties; therefore, the selection of the initiative(s) that will eventually be implemented shall be made based on a feasibility assessment that will be achieved in initial stages. Similarly, the proposed budget is referential, and the actual amount committed will depend on the definition of issues and objectives.

These initiatives are:

No.	Initiative	Beneficiaries	Duration (years)	Total Cost (USD)	Means for verification	Person in Charge
1	Raising awareness among YILPORT staff on critical habitats in project AID (biannual)	YILPORTECU Staff San Antonio Tourist Assoc.	6	15,000.0	Photo record and visit script	HR-HSE
2	Support and equipment for patrolling in RMISC (biannual)	MAAE	6	22,500.0	YILPORT-MAAE Cooperation Agreement, Annual Evaluation Reports	Directorate
3	Recovery of the mangrove natural zoning (reforestation) in the area of Isla del Amor	Community organization of traditional mangrove users	6	47,747.0	Technical report and process publications	HSE
4	Financing of the Mangrove Partner Program for AUSCM in AID	Community organization of traditional mangrove users	3	49,211.0	YILPORT-MAAE-Social Organizations Cooperation Agreement	Directorate
5	Research project financing: - Carbon capture in mangroves within the AID -	Scholarship - Research University or Institute	4	48,400.0	YILPORT-MAAE COOPERATION AGREEMENT, TRANSFER CERTIFICATES, RESULTS REPORTS	Directorate
6	Support institutions with expertise in marine-coastal areas for the establishment and monitoring (five-year) of the status and trend of Mangrove Forests (ICTBM) within the area of direct influence	Scholarship - Research University or Institute	10	75,000.0	YILPORT Cooperation Agreement-Institutions, academic publications, reports, and/or technical reports	Directorate

7	Support the integration of "Community Scientific Station" for monitoring and mangrove studies (biannual): Mangrove structure and coverage, carbon stocks, species identification	University - Organizations of ancestral villagers and traditional users	10	72,000.0	YILPORT Cooperation Agreement- Institutions, academic publications, reports, and/or technical reports	Directorate

9.6. Cumulative Impact Management Plan

One of the alternatives that could improve in some way the management of cumulative impacts since the expansion project of Puerto Bolívar phase 1, could be to assume guidelines associated with Environmental Management Regulations that bundle the leading company to its suppliers and customers, as are ISO regulations, or include them as requirements in the hiring of suppliers and services.

9.6.1. Actions to promote

To encourage and strengthen the culture of environmental management of the project and the undertakings in the area of influence, with emphasis on those that may have a relationship with Yilportecu, the actions described in Table 18 are set forth.

Proposed management measure	Objective	Responsible	Indicator	Observation
Water quality monitoring at control points established in the Santa Rosa plant (6 points included in the baseline) and the sediment cube in the open sea (1 point inside and a control point outside the dispersion area and evaluate them according to Table 2 in Annex 1 of Book VI of TULSMA (A.M. 097 – A).	Monitor the water quality of the estuary to detect possible affectations.	HSE Management	% of execution versus planned	Monitoring points are established in the current WFP.
Soil quality monitoring at points established in the Santa Rosa Estuary (6 points included in the baseline) and evaluating them according to Table 1 of Annex 2 of Book VI of TULSMA (A.M. 097 – A) and the Canadian Environmental Quality Guidelines.	Monitor the quality of the sediment in the mat to detect possible affectations.	HSE Management	% of execution versus planned	Monitoring points are established in the current WFP.

Collaborate in the development of joint initiatives to reduce waste discharges to the Santa Rosa estuary, together with fishermen's trade organizations, residents, and public institutions with competence in the field (municipal government and MAAE).	Reduction of load of discharges into the estuary.	HSE Management/ Project Department/ HR Department	% of Plan implementation developed relative to plan.	To be developed within the current WFP Community Relations Plan and corporate sustainability initiatives.
Include in terms of reference for contracting and/or purchasing services the following conditions: - The contractor and/or supplier shall carry out collecting and managing common and recyclable wastes according to Technical Standard NTE INEN 2841:2014-03. - The contractor and/or supplier shall carry out the collection and management of hazardous and special wastes in accordance with the provisions of A.M. 061, Art. 93 hazardous waste storage locations, and technical standards INEN 2266 and INEN 2841 where applicable.	Reduce generation and mismanagement of common and hazardous wastes.	HSE Management / Projects Department/ Legal Department/ Purchasing Department	implementation % (number of suppliers included vs. total)	
Include in the Supplier's Audit Criteria verification of compliance with the conditions described in their facilities within the Port Terminal and the project's area of influence.		HSE Management	Supplier Evaluation Statistics.	

Implement and extend to contractors and/or service providers the adoption of the "Protocol of Action to Prevent Collisions with Whales and Other Marine Mammals" if it occurs. A report format should be included for each occasion the measure is executed.	Provide adequate response and follow-up for possible impacts on marine fauna.	HSE Managemen t / Projects Department / Legal Department / Purchasing Department / Operations Department	implementati on n % (number of suppliers included vs. total)	Current WFP-included measure.
Implement and extend to contractors and/or service providers the adoption of the Marine Mammal Stranding Response Protocol if it occurs. A report format should be included for each occasion the measure is executed.				Existing protocols under review.
Monitoring of major marine communities: Plankton, nekton, and benthos, fisheries productivity, and description of protected marine fauna activities, at monitoring stations established in the current WFP.	Characterize the state of major marine communities, fisheries productivity, and protected marine fauna.	HSE Manageme n t	Biological diversity and richness. Biological descriptive	Monitoring points are established in the current WFP.
Monitoring of mangrove productivity for mollusks and crustaceans in user-identified productivity areas (PAP) within the areas with AUSCM of the Santa Rosa estuary set forth in WFP. This should include monitoring of the identification and registration of fish species in the area, carried out using standardized sweep net sets or another method suitable for the area.	Characterize and monitor mangrove productivity for mollusks and crustaceans.	HSE Management		
A five-year update of the study of Bioaccumulation of heavy metals in bivalves (Anadara tuberculosa) at the 4 sites included in this report.	Characterize the state of bioaccumulatio n in fishery resources (PAP).	HSE Manageme n t	Studies carried out	

Implement and socialize with fishing organizations the Communication Protocol as a means of channeling possible impacts on fishing activity.	Provide relevant information promptly and avoid conflicts with social actors.	Management / HSE Management / Projects Departmen t	Records and communications tracking.	

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Before the start of dredging or construction activities, public entities with competence in the Area of Influence should be provided information on the activities to be carried out, working hours, and restrictions (if any) at least 1 week before starting works.

10. Fortuitous Findings Management Plan

10.1. Objectives

- Anticipate and lessen the likely impacts on cultural heritage.
- Mitigate potential impacts through research.

10.2. Scope

This procedure is set forth for construction activities of Pier 6, and others that require excavations and ground movement, in addition to access channel dredging activities and maneuver areas.

10.3. Responsible

The Project Department of Yilport Terminal Operations (YILPORTECU) S.A. is in charge of implementing this Archaeological Findings Management Plan. This responsibility shall be extended to contractors and subcontractors who carry out activities within this plan's scope.

10.4. Mitigation and Archaeological Contingency Protocol

During the execution of excavations and soil movement, the following actions must be performed:

- Supervision of monitoring equipment specialized in archeology detects the possible presence of superficial or subsurface pre-Hispanic archaeological vestiges.
- If traces are found, the work in this sector must be stopped, for the relevant recording of the findings (three-dimensional location, plot, photograph).
- If for any reason, someone outside the archaeological monitoring team finds archaeological remains during the construction stage, they should not be retained by the site personnel but should be communicated to the archaeological monitoring team, or in the absence of this, the Zonal Directorate 7 of the National Institute of Cultural Heritage should be notified to proceed in accordance with their recommendations.

11. Contractor Performance Monitoring Plan

11.1. Objectives.

- Ensure project contractors and subcontractors comply with the Environmental and Social Management Plan, regulations applicable to their activities, and the environmental and social policies of Yilport Terminal Operations (YILPORTECU) S.A.

11.2. Scope

This procedure is established for the expansion activities of the Puerto Bolívar Phase 1 expansion project, for the construction works of Pier 6, and dredging activities in the access channel and maneuver zones.

11.3. Responsible

The Projects Department at Yilport Terminal Operations (YILPORTECU) S.A. is responsible for implementing this Contractor Performance Monitoring Plan.

11.4. Proposed measures

The Contractor shall be obliged to comply with the environmental and labor regulations of the project, the socio-environmental policies of Yilport Terminal Operations (YILPORTECU) S.A., and the specific measures of its approved Environmental Management Plan. Shall also extend this responsibility to subcontractors and suppliers.

Contractors will be required, through their work or service contract, to:

- Have an environmental department, which ensures the prevention, mitigation, and control of environmental and social impacts within its activity.
- Prepare a monitoring or control report on environmental and social measures and/or environmental obligations arising from the environmental permit of their activity. This report may be an integral part of the technical audit determined for the project.

For its part, Yilport Terminal Operations (YILPORTECU) S.A., must:

- Set a program of weekly inspections of the work or service in execution, to verify onsite the compliance of environmental and social measures, and the environmental regulations applicable to its activity.
- Keep a record of the visits, and in the case of findings, prepare a report which shall be delivered to the contractor, who must respond in writing and documenting the justifications, and emerging actions to be carried out, if the case may be.

- Perform an annual Technical and Legal Compliance Audit to subcontractors, including:

    - Updated environmental regularization (compliance with obligations such as Annual Report, Environmental Audit, Hazardous Waste Generator Registry, and other acquired environmental obligations).
    - Training records and evaluation in environmental issues.
    - Other requirements are outlined in the Environmental Management Plan and Environmental and Social Management Plan.

12. Management Plan for Emissions, Wastes, Effluents, and Discharges in the Construction Phase

12.1. Rationale and objectives

Work fronts are generally areas of concentration of workers for long days and are far from other facilities such as restrooms, dining rooms, or offices, which makes it convenient for supplies and services to be brought there. As a result, we have the obvious generation of waste and effluents on the work front, waste that must be managed correctly, to prevent it from generating negative environmental impacts, temporary or permanent, on the soil, or the water of the construction areas or surrounding sites.

12.2. Scope

This procedure is established for the constructive activities of Pier 6, and in general, work fronts for the expansion activities of the Port Terminal.

12.3. Responsible

The execution of this plan is the responsibility of the Project Department of Yilport Terminal Operations (YILPORTECU) S.A., through contractors and subcontractors who carry out the activities within the scope of this Plan.

12.4. Management plan for liquid effluents during construction

- During the construction period, the installation of hygienic services must be ensured, in sufficient quantity and adequate quality. Hygienic services must be equipped with water, soap, and toilet paper.
- The number of hygienic services required, duly separated by sex, as set out in the Ecuadorian regulations, is as follows:

WC	1 per 25 males or fraction 1 per 15 women or fraction
Urinals	1 per 25 males or fraction
Showers	1 per 30 males or fraction 1 per 30 women or fraction
Washbasins	1 per 10 workers or fraction

- For the work fronts, chemical baths or temporary fixed sanitary batteries may be installed. The following selection criteria are proposed:

Fixed sanitary battery:	- More than 250 workers - Location less than 500 m from the project's sanitary sewer facilities - Duration greater than six months
Chemical Baths:	- Fewer than 250 workers - Location to more than 500 m of the project's sanitary sewer facilities - Less than 6 months in duration

- Fixed sanitary batteries must be installed in such a way that they are supplied from the Yilport Terminal Operations (YILPORTECU) S.A. drinking water service, and that the black and gray waters are sent to the collection and treatment system of the Port Terminal. Once the construction activities have been completed, these temporary constructions must be uninstalled, leaving the area in the same conditions before installation.
- In this case and considering the existing wastewater treatment capacity at the Terminal, the alternative of implementing a modular, containerized wastewater treatment plant installed in a defined area within the camp and/or site fronts may also be considered, and that it be emptied (its sludge and sediments) according to the capacity and technical specifications of the same, by an authorized service of transfer of effluents to the municipal oxidation lagoons. The treated waters may be discharged into the port terminal's sewerage system.

- Chemical baths, also known as portable toilets, are portable sanitation units, which consist of a hygienic service that is located on an airtight tank with a chemical solution that facilitates the digestion of excreta and reduces bad odors. Cleaning and disinfection of chemical baths should be carried out at least twice a week or when necessary, according to the intensity of use. This cleaning may be provided by the service provider, or otherwise, an authorized supplier will be hired to do so.

12.5. Solid waste management plan during construction

- For the collection and classification of non-hazardous wastes, NTE INEN 28:41:2014-03 should be used.
- Implement solid waste collection and recycling centers on work fronts. Signage should be implemented, and staff trained, for wastes to be properly classified, and never disposed of outside the waste collection stations.
- Where possible, avoid food suppliers delivering food in single-use plastic containers. If it is identified that plastic wastes whose origin is the supply of food to workers are being accumulated in construction areas or on the beach line, the area will be cleaned up immediately, and talks will be given to workers, for them to take corrective action.
- Common waste must be evacuated daily through the municipal collection service. If the contractor is unable to provide the service, the contractor must hire a supplier to transport the waste and deliver it to the municipal landfill. This supplier must be authorized to perform this activity and must provide the Contractor with evidence of the delivery of the waste to the landfill.
- The surplus materials of the basic work (rubble) or those generated by other structures (if any) shall be placed in zones intended for such purpose approved by the municipality, or shall be reused in landfills within the project, being first fractionated or reduced, to improve performance.

12.6. Management plan for hazardous waste during construction

Project contractors operating inside the Port Terminal, and generating hazardous and/or special wastes, shall keep up to date with administrative obligations concerning this environmental aspect, or in its absence, to carry out the management of these according to the requirements of the environmental obligations assumed by Yilport Terminal Operations (YILPORTECU) S.A., which are:

- Obtain Hazardous Waste Generator Registry
- Develop Hazardous Waste Minimization Plan
- Annual Hazardous Waste Declaration and Results Report of the Minimization Program.
- Update of RGDP when required by the Environmental Authority.

To do so, the company must implement and maintain the following activities and infrastructures:

- Adequate facilities for the storage of the generated hazardous wastes: A collection center meeting the requirements of environmental regulations, i.e.: waterproof flooring, waste compatibility considerations in storage, signage, cover and ventilation, containment cubits, and spill cleaning elements, as well as fire extinguishers.

- Manage hazardous wastes through accredited environmental managers.
- Deliver the waste generated at least once a year.
- Maintain the proper archive of waste input and output logs, delivery statements (single statement), and certificates of destruction (final disposition), of managed wastes.

12.7. Plan for noise prevention and mitigation during construction

- Prohibit the use of horns in the revenue to the construction area.
- Minimize the use of audible alarms to the essentials.
- Plan activities that generate the greatest hearing impact to be carried out during the day.

12.7.1. Underwater noise control during construction

Although there are no local environmental regulations in this regard, it has been found that underwater noise can cause effects on marine fauna, in particular marine mammals, which are overly sensitive to noise. However, as described in Book IV.B. Biodiversity Baseline, the presence of marine mammals is limited to a colony of sea wolves (about 800 specimens) that inhabit the island of Santa Clara (50 km), while the humpback whales do not approach less than 60 km from the coast, and the bottlenose dolphins seen in the areas closest to the access canal come from Posorja, 63 km from the project area.

It is therefore recommended that a measurement of underwater noise be made during the pile swelling, to allow the intensity of the underwater noise to be known, taking as reference the values reported for affectations to marine fauna (Ian Stewart, Genesis Oil and Gas Consultants, 2010).

12.8. Plan for prevention and mitigation of accidental spills during construction.

- Comply with technical regulations for storage of hazardous chemicals: spill containment cubes, waterproof floor, storage tank sealing, signage, etc.
- Do not clean, wash, or maintain machinery on the ground or next to bodies of water. Carry out these activities in workshops or areas arranged for this purpose.
- Maintain spill cleaning kits in each chemical and hydrocarbon storage area: shovels, absorbent material, tacks, or collection bags.
- Always keep water spill kits available.

13. Community Health and Safety Plan

13.1. Objectives.

- Have measures to anticipate and avoid the health and safety risks of the potentially affected communities, both inside and outside the Port Terminal.
- Establish mechanisms to assess the status of health and safety indicators of potentially affected communities.

13.2. Scope.

This Plan contains the measures and actions necessary to prevent and counteract the risks and impacts on the health and safety of communities that may be affected throughout the project's life cycle.

The guidelines of the World Bank Group on Environment, Health, and Safety (MASS) or other internationally recognized sources have been used to identify appropriate measures to act on these risks and impacts.

13.3. Responsibilities

The HSE Department will be responsible for implementing this plan, and it will also be extended to the Expansion Project Contractors through its General Management and HSE Department.

13.4. Disclosure.

This plan should be disclosed to the communities potentially affected by the project. Where complex health and safety aspects are presented at the different phases of the project, it may be desirable to hire outside experts to conduct an independent evaluation, helping to identify risks and impacts required by Performance Standard 1 that can be fed and strengthened during the project cycle.

13.5. Proposed measures

13.5.1. Disease control

Vector cleaning and control

Both Yilportecu staff and project contractors, through their departments of Maintenance and Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Routine maintenance of all project areas and work fronts, order control, and cleaning. Accumulation of standing water and garbage deposits in the open air should be avoided. Check for clean and clear drains.
ii. Periodic maintenance (at least monthly) of the rainwater drains. During the rainy season, it should be weekly.

iii. Continue periodic inspections of bathrooms, dining room, and restrooms. Cafeterias should receive special attention on disinfection and general hygiene.
iv. Maintain periodic fumigation plan for vector control, at work fronts, warehouses, yards, and offices. The frequency will depend on the season of the year and the type of vector to be controlled.
v. Perform a monthly cleaning and disinfection of the areas outside the Port Terminal to promote cleaning through campaigns to sensitize workers not to use exterior spaces as bathrooms or landfills.
vi. Timely management of tanks, drums, and other containers of hazardous and non-hazardous substances through MAAE-authorized managers. Maintaining optimal conditions at the Hazardous Waste Collection Center according to NTE INEN 2266, until delivery to the manager. Tanks, drums, and other containers should be drilled in their base, to prevent them from being collected by villagers in the sector for domestic or commercial use.

Prevention and control of diseases in staff

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Training of staff in preventive measures and good health practices. The following topics should be addressed, with the schedule established by each medical department:
   - Ergonomic care training
   - Cardiovascular health and EKG
   - First Aid Workshop
   - HIV - AIDS prevention
   - Sexual and reproductive health
   - Prevention of alcohol and drug use
   - Awareness-raising to prevent gender-based violence.
ii. Continue with the following preventive campaigns:
   - Deworming campaign
   - Vaccination campaign
   - Active break campaign
   - Diabetes prevention campaign
iii. Medical care on-site
iv. Medical follow-up through Pre- and Post-Occupational Health Forms, preventive, and special examinations.

Protocols concerning COVID 19

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Adopt the Good Health, Safety, and Hygiene Practices for the Prevention of the Spread of Covid-19 and Other Infectious Diseases (ANNEX 1) in developing projects funded by the IDB. The purpose of this Technical Note is to provide safety, health, and hygiene recommendations for the prevention of infectious disease infections, as well as to indicate recommendations for preventing infection and responsibly managing the situations of personnel infected, including possible cases of COVID-19.
ii. Continue with the requirement for the submission of COVID-19 tests to contractor and subcontractor personnel and the implementation of the current Biosecurity Plan (YECU-EHS-01-07-V9_BIOSECURITY Plan), and recommendations for best practices from local health authorities and competent multilateral agencies (PAHO/WHO).

13.5.2. Mobility and traffic impact control

Ground traffic impact control

Both Yilportecu staff and project contractors, through their Departments of Physical Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

i. Assess existing risks where members of the public will have access to new construction sites or structures, including the possible exposure to operational accidents or natural hazards, and will be consistent with the principles of universal access.
ii. The implementation of structural elements that allow universal accessibility (ramps, railings, emergency accesses, others) shall be designed and constructed by qualified professionals and shall be certified or approved by competent authorities or professionals. In the case of mobile equipment on public roads and other forms of infrastructure, precautions should be taken to prevent the public from being affected by incidents and injuries related to the operation of such equipment.
iii. Implement with transit authority:
    - Safe pedestrian steps in the areas surrounding the Port Terminal’s entrance.
    - Signs on the port access road, indicating the permitted speed limit for cargo vehicles.
    - Traffic lights and organization, in the arrival and departure of vehicles in the Port Terminal.
iv. If more than 10 vehicles are expected to be in or out of the Terminal, designate a traffic controller, which monitors the progress of vehicles in groups of 5 units. All other units must remain on standby with the engine off.
v. Implement clean points (waste sorting sites) in the Waiting Area inside the Terminal, so that carriers can dispose of the waste generated on their route properly.

vi. Implement a formal commitment with carriers and their guilds to:

- Comply with and follow the traffic controller's guidelines in case waiting queues are expected to enter and exit the Terminal.
- Prioritize the use of visible signals such as flashing lights, rather than audible signals. If required, audible signals must not exceed permissible noise limits.
- Correct final disposal of solid waste generated in transport.

vii. Maintain and update feature indicators as:

- Times of permanence and anchorage of vessels in port.
- Wait time for transport units to enter and exit.

And analyze their developments at least quarterly, to take additional measures if necessary.

viii. When subcontractors carry out transportation-related activities, Yilportecu must use commercially reasonable efforts to influence the safety of these service providers, contractually requiring the analysis of traffic safety risk and the adoption and implementation of driver safety programs. For this, it is important to comply with emergency preparedness and response to road emergencies that address emergency driver and third-party assistance contingencies equally, especially in remote locations or situations with little capacity to cope with emergencies involving traumatic and other serious injuries.

ix. Where new buildings have public access, the design must be consistent with the principles of universal access. The issue of accessibility is one of the key principles of the Convention that should be included in the design and operation of buildings intended for public use. The concept of “universal design” is defined in Article 2 of the United Nations Convention as follows: “the design of products, environments, programs, and services that can be used by all people, to the greatest extent possible, without the need for adaptation or specialized design. The “universal design” will not exclude technical support for particular groups of people with disabilities, when needed.” The concept of “Reasonable adjustments” can be used in situations where Universal Design alone is insufficient to remove obstacles to accessibility. As defined in the United Nations Convention, “Reasonable adjustments” means “necessary and appropriate modifications and adaptations that do not impose a disproportionate or undue burden, when required in a particular case, to ensure enjoyment or exercise by persons with disabilities, on an equal footing with others, all human rights and fundamental freedoms”.

Maritime traffic impact control

Both Yilportecu staff and project contractors performing water body operations, through their Departments of Physical Safety, Health, and Environment (SSA, HSE, or other denomination), in the event of impasses with fishing, commercial or tourist vessels, in the maneuvering areas or access channel, it is needed:

i. In the event of an inrush or blocking of the access channel or maneuver zone, the vessel will be assisted in communicating to the vesselship transit zone and requesrequesting If necessary, the fact will be reported to ECU 911, from where the Captaincy of Puerto Bolívar is informed for intervention. If there are any complaints from the occupants of the vessel, proceed following Measure 7.3. Attention to suggestions, complaints, and reclamations.

ii. Disseminate this plan to fishermen and their guilds, being the main actors in the project's area of influence.

iii. Set discussion tables with the mediation of representatives of public institutions and/or social facilitators, in case of disputes or claims.

13.5.3. Project infrastructure security

Infrastructure

During the design stage, to ensure the reduction of possible safety risks, the following measures must be considered:

i. Inclusion of a seat belt or other methods of physical separation around the project site to protect the public from the main risks associated with hazardous material incidents or process failures, as well as noise, odor, and other emission-related inconveniences.
ii. Incorporating technical safety criteria and site selection to prevent accidents caused by natural hazards such as earthquakes, tidal waves, wind, floods, landslides, and fires. All buildings must be designed according to technical and design criteria based on site-specific hazards but not exclusively, seismic activity, soil stability, wind intensity, and other dynamic loads.
iii. Application of local or internationally recognized building codes and regulations to ensure that buildings are designed and built following good architectural and engineering practices, including fire prevention aspects and fire emergency plans.
iv. Technicians responsible for designing and constructing facilities, buildings, plants, and other structures must demonstrate proven experience in designing and constructing projects of similar complexity. Qualifications can be demonstrated through the combination of formal technical training and practical experience, or membership in a more formal professional association, national and international certifications.

v. For complex structures, the need for prior certification and approval of structural elements and engineering safety skills, including geotechnical, structural, electrical, mechanical, and fire specialties, must be established by professionals from national or international professional organizations authorized to perform these tasks, and/or local regulatory agencies that control these matters. Buildings accessible to the public must be designed, built, and operated in full compliance with the local building code(s), fire department standards, local legal/insurance requirements, and following an internationally accepted life and fire safety standard (L&FS[1]).

vi. While major design modifications are not feasible for ongoing projects, risk analysis can be performed to identify opportunities to reduce the consequences of a failure or accident. For example, reduce the likelihood and consequences of accidental leaks, spills, or leaks of hazardous materials by:
   - improvements in inventory and process management.
   - improvements in operations and control systems.
   - maintenance and inspection activities; and
   - improvements to existing equipment and infrastructure.

Port maritime operation

Both Yilportecu staff and port operators (OPC, OPSC) operating inside the terminal, through their Departments of Physical Safety, Health, and Environment (SSA, HSE, or other designation) will continue to implement and continuously improve their respective security management systems (SMS) that are capable of effectively identifying and correcting unsafe conditions, including:

i. Procedures for regulating the safe movement of vessels within the port (pilotage, port control, and ship traffic services, navigation aids, and studies of hydrography, among others), actions to protect the public and surrounding communities from hazards arising from the open sea and port activities, and to prevent events that could result in injury to workers and the public, including fishermen and recreational users.
ii. Comprehensive emergency preparedness and response plans, which provide a coordinated response based on government, port authority, port users, and community resources needed to manage the nature and severity of the emergency event, Included or complementary to Document YEC-EHS-01-010-V3_Oil Spill Contingency Plan and the National Plan.

[1] Available at https://www.ifc.org/wps/wcm/connect/3590ce6b-b3ab-42b8-b061-416719168937/Life%26FireSafety.pdf?MOD=AJPERES&CVID=jqeIe4L

Port security

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) will continue to do the following:

Periodic training of port operators on their responsibilities, including international legal and technical obligations, to provide security to passengers, crews, and personnel at the port, following the provisions of the current PBIP Compliance Statement of the Port Terminal.

13.5.4. Emergency and contingency

Both Yilportecu staff and project contractors, through their Departments of Safety, Health, and Environment (SSA, HSE, or other designation) must:

i. Plan and execute, together with the competent authorities, an annual drill involving the community: Public institutions, educational institutions, guilds, and other actors within the area of potential involvement, for fire and explosion events, floods and tsunamis, evacuation.
ii. Develop posters, diptychs, or other information mechanisms to disseminate the emergency and contingency plans of the project to natural and anthropic events that may generate community affectations. This information should contain the main actions to be taken in the event of an emergency.
iii. Provide relevant local authorities, emergency services, and affected communities and other social actors with information on the nature and scope of environmental and human effects that may result from routine operations and unplanned emergencies at the project site.

Information campaigns should describe appropriate behavior and security measures in the event of an incident and actively seek the affected community's views or other social actors about risk management and preparedness. Consideration should also be given to the inclusion of the affected Community and other social actors in regular training exercises (e.g., simulations, exercise evaluations, and actual events) to familiarize them with appropriate procedures in case of emergency. Emergency plans should address the following aspects of preparedness and response:

- Specific emergency response procedures.
- Trained emergency response teams.
- Contacts and communication systems/protocols in case of emergency, including notification to authorities, emergency services, and neighboring communities affected or susceptible to compromise.
- Procedures for interaction with local and regional emergency and health authorities

- Permanent emergency equipment and facilities (first aid stations, fire extinguishers and hoses, sprinkler systems)
- Protocols for emergency vehicle services such as auto pumps, ambulances, and others
- Evacuation routes and meeting points
- Drills (yearly or more frequently as needed)

13.5.5. Community Impact Prevention Plan for Physical Security Services

Both Yilportecu staff and project contractors, through their Departments of Physical Security and Human Resources, must implement physical security service contracting protocols that include:

i. Conduct reasonable investigations to ensure that security officers have not been involved in past abuses.

ii. Continue with the demand for ongoing training in the proper and proportional use of force (and, where appropriate, firearms), appropriate behavior toward the workers and communities concerned, and respect for applicable law, and good international practices (e.g. United Nations Code of Conduct for Law Enforcement Officials and UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials).

iii. In no case shall the use of force be approved, except for preventive and defensive purposes proportional to the nature and extent of the threat.

iv. The complaint handling mechanism of affected employees and communities should also consider the concerns of these groups regarding security arrangements and the actions of security personnel.

v. Consider and, where appropriate, investigate any reports of illegal or abusive acts of security personnel, take measures (or urge the relevant parties to take them) to prevent such acts from recurring, and report such acts to the public authorities.

14. Plan for Emergency Preparedness and Response

14.1. Objective

Preserve the human life of each person who in one way or other works within the YILPORT - TERMINAL OPERATIONS (YILPORTECU) S.A. facilities, then to protect the infrastructures and to restart normal activities in the event of a disaster, communicate to communities through effective and efficient communication channels in coordination with the RISK CENTER and the ECU 911 to minimize the impact of an emergency and its potential consequences.

14.2. Scope

The EHS Emergency Preparedness and Response Plan of YILPORT - TERMINAL OPERATIONS (YILPORTECU) S.A., applies to all activities carried out by YILPORT - TERMINAL on different types of catastrophic events.

The different causes of possible total general evacuations of staff to the meeting points or concentration point are for the different reasons subscribed at the top. For this reason, it is necessary to consider the resources necessary to mobilize and make all activities effective.

The plan is framed in the event of direct affectation by a possible unwanted event in case of emergencies, for which it has been defined as direct recipient actors to neighboring communities, groups of cooperatives, universities and neighboring education centers, state entities, subcontractors, clients, shareholders, suppliers, employees, workers, communities and neighboring companies, shipping lines, ships, and crew personnel, all wrapped in the range of action of the possible affectation. The communication channel will then be when the emergency has reached a level of control by the state's professional emergency institutions so that effective communication is carried on such action area.

14.3. Responsible

The procedure is designed so that the responsibilities of managing the resources are entirely the responsibility of the “INCIDENT COMMAND” so that for each case they will be responsible for each of the institutions of the Ecuadorian state, Firefighters of the GAD of Machala and its department of specialization, The capital of ports of the National Navy of Ecuador, the GAD of Machala, the Provincial council of El Oro and the national secretary of risk management provincial among others as the most principal, depending on the degree of risk and the identification of the hazard.

Any person involved in the activities of the concession project and/or operation, for the activities of the project: Design, Financing, Equipment, Execution of Additional Works, Operation, and Maintenance of the Port Terminal of PUERTO BOLIVAR is responsible for following this document in full for its faithful fulfillment.

The effective incident command SHOULD contact the 911 PBX to coordinate emergency control activities, while the YILPORTECU emergency control delegate, (CAE) has the role of communicating to the social actors of each community or neighborhood near the incident and its possible affectations according to the data of the expansionary wave.

14.4. Procedure

See ANNEX 7.

15. Training plan for human rights and proportional use of force by security personnel

15.1. Objectives

Achieving the units of competence in general theory and practice will be closely related to the development of specific activities; under this, methodological strategies used by instructors are aimed at responding directly to competencies; that students learn to recognize and solve problems, valuing the context in which they develop, orienting at every moment to a continuous improvement, the focus on competencies requires the development of skills, skills, attitudes, and practices, education under this approach responds to the needs of students' comprehensive development.

15.2. Scope

All personnel assigned to the Security of the Port Terminal of Puerto Bolívar.

15.3. Responsible

Yilportecu must ensure that the company contracted for the Security of the Port Terminal of Puerto Bolívar complies with the training and rights of the personnel.

15.4. Training program

See ANNEX 8. Planning prepared by the current company providing the Security

Service. ANNEX 9. Comprehensive Security Training Final Report.

16. Plan for termination of construction workers

16.1. Objectives

- Ensure that the employment generated in the construction and maintenance phase of the project brings positive benefits to the population in their area of influence.
- Avoid creating dependency of the community surrounding the project, for the constructive activities that are carried out in limited periods, within the plans of expansion of the Port Terminal.
- This Plan must be implemented following the environmental and social policies of Yilport Terminal Operations (YILPORTECU) S.A.

16.2. Scope

This procedure is established for the construction activities of Pier 6, and other port terminal expansion activities of the Puerto Bolívar Expansion Project Phase 1. This document is supplemented by the internal procedure RH-PR-009 V1 Termination and Disengagement (Annex V).

16.3. Responsible

It is the responsibility of the Projects Department of Yilport Terminal Operations (YILPORTECU) S.A., and through the Prime Contractor for the construction of Pier 6, and other expansion activities or projects, for the implementation of this Plan. Its compliance will be supervised by the Department of HSE (Environment, Health, and Safety) and with the support of the personnel assigned by this department at Yilport Terminal Operations (YILPORTECU) S.A.

16.4. Procedure

The Contractor for the hiring, maintenance, and termination of personnel for the expansion of the Port Terminal shall comply with the following:

- Establish an office/department, which receives resumes from applicants to work on the project. Priority will be given to hiring labor from the social influence area of the project if they meet the required competencies.
- Recruitment programs should be aligned with the institutional staff policies of Yilport Terminal Operations (YILPORTECU) S.A., respecting national labor legislation.
- Submit a report detailed the personnel hired for the site, classification by main activity, and time in which such personnel will be required.
- Before the recruitment of construction personnel, the date of possible termination and the mechanisms of the disengagement should be reported, together with the working conditions offered.
- Set a Training and/or Certification of Competencies Program for workers in the process of termination. This program will consist of implementing courses or training in practical trades and/or entrepreneurship skills, which will allow former workers to have the tools to achieve economic independence after the project is completed.

17. Public consultation and stakeholder participation

17.1. Rationale and objectives

Both project activities and their management plans must be strengthened by the criteria and contributions made by the community through a process of socialization and social participation.

Two-way interaction and communication with project stakeholders enable decisions to be made and mutual understanding, actively involving individuals, groups, and organizations that have an interest in the project. Such participation will improve the project's long-term viability and increase its benefits to affected individuals at the local level and other stakeholders.

17.2. The current reality in the face of a pandemic.

On March 12, 2020, given the imminent possibility of a mass contagion due to the presence of the SARS-COV2 virus, the Ecuadorian Government declared the State of Sanitary Emergency in all establishments of the National Health System and resolved that, as preventive measures, the use of mechanisms such as teleworking, distance learning, among others, will be promoted to prevent the spread of the virus. Further measures are set out below, such as suspension of flights, prohibition of landing in Ecuadorian ports of passengers arriving onboard cruise tourist vessels, development of mass events, restriction of pedestrian and vehicular traffic on public roads, operation of restaurants, hotels, and shops, among others. On 17 March, the President declared a state of emergency for public calamity, which, in addition to limiting the transit, association, and assembly of the population in general, established a curfew and the suspension of face-to-face working days with exceptions.

In this sense, any process of public consultation in Ecuador will have to follow a rigorous implementation of the existing security protocols, as well as the guidelines of the national environmental authority for the purpose, World Bank guidelines, always seeking to follow the established by IFC for instances participation, consultation, and dissemination of information.

17.3. Stakeholder participation

This plan seeks to establish a permanent and two-way communication mechanism with stakeholders so that inputs can be made to and from stakeholders and the project.

17.3.1. Identification of interested parties.

Stakeholders have been identified and mapped in Book IV.C. Social Baseline.

17.3.2. Prior consultation activities

YILPORTECU has carried out two Social Participation Processes (PPS) as part of its Environmental Licensing, on two previous occasions:

1. PPS of the “Environmental Impact Study for the construction and operation of the Puerto Bolívar port terminal operated by Yilport Terminal Operations Yilportecu S.A.”, carried out in October 2017.
2. PPS of the “Environmental Impact Study and Environmental Management Plan for Dredging Docks 1, 2, 3, 4, 5 and 6, Zone of Maneuver and Access Channel of Puerto Bolivar”, carried out in June 2017.

These processes were carried out following environmental regulations and with the participation of control and surveillance institutions that validated and approved these processes.

17.3.3. Stakeholder Participation Plan

The following communication strategy is established based on the identification and prior mapping of stakeholders:

OBJECTIVE	SOCIAL ACTOR	COMMUNICATION/PARTICIPATION STRATEGY
CLOSE MANAGEMEN T	Customers Financial institutions Governance APPB CAPBOL -SUBSIR	Voluntary and direct communications Attention to complaints and reclamations. Image and satisfaction survey Quality Control Survey Involvement in socialization processes
KEEP SATISFIED	GADPEO MAAE communications Truck drivers legislation Employees	Voluntary and direct Prompt compliance with Involvement in community leverage campaigns/initiatives Training, recreation, and leisure activities Ensure attendance at citizen participation processes. Attention to complaints and reclamations.
KEEP INFORMED	Suppliers Contractors Women Neighborhoods UOPAO	Publications in the press and other indirect media Image and perception survey Labor Climate Survey Attention to complaints and reclamations. Ensure attendance at citizen participation processes
BASIC COMMUNICATION	Municipality State Prosecutor UPC Fire brigade Tourist transportation Health subcenters	Direct contact Publications in press Image and perception survey Include them in citizen participation processes

17.3.4. Implementation timeline

ACTIVITIES	**MONTHS**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Communication	X	X	X	X	X	X	X	X	X	X	X	X
Attention to complaints and reclamations	X	X	X	X	X	X	X	X	X	X	X	X
Image and satisfaction survey												X
Quality Control Survey						X						X
Socialization processes						X						
Prompt compliance with legislation	X	X	X	X	X	X	X	X	X	X	X	X
Involvement in community leverage campaigns/initiatives				X				X				X
Training, recreation, and leisure activities				X				X				X
Publications in the press and other indirect media						X						
Image and perception survey												X
Labor Climate Survey						X						

17.3.5. Roles and responsibilities

The company management should determine mechanisms to manage the interested parties, to balance their expectations and those of the company. To do this, the following roles and responsibilities are generally established.

Senior Management:

• Ensure that the project communicates to stakeholders what they need and when they need it.

• Determine when to involve stakeholders in the project and to what extent.

• Manage stakeholders' expectations

HSE Department:

• Identify stakeholders by name and re-evaluate them when needed.

• Determine their requirements, interest in the project, and level of influence.

• Establish stakeholder expectations and turn them into requirements.

• Assess the knowledge and skills of stakeholders.

• Communicate to stakeholders what requirements are to be met and what are not and let them know why.

• Manage and influence stakeholder involvement in the project, use stakeholders as experts.

17.3.6. Reporting and monitoring

An annual report of the activities carried out in compliance with this Plan will be made. The report should be made available to interested parties, so it is recommended that an extract of this report be published in media such as the institutional website.

17.4. Public consultation

The consultation process for the implementation of the activities of the Puerto Bolívar Expansion Project Phase 1 consists of 1) planning, 2) implementation, 3) development of a systematization report/updating of the consultation plan, 4) revision and/or inclusion of population criteria, 5) feedback.

17.4.1. Planning

Time of participation

In general, and with the aim that the process of citizen participation is carried out in a fair and meaningful way, the right time for carrying out a participation process is given when the project is still in the design stage (before the final design, It can also be carried out in the conceptual design stage), in such a way that it allows – both the Promoter and the Contractors – to adopt the changes and/or criteria that are required as a result of citizen participation, being constituted in a contribution to the project that enriches and improves it, in terms of acceptance and appropriation.

Date, place, and responsible

Mechanisms for participation (Personal Invitations, Solicitations, Press Publications, and others) should be properly defined considering applicable national legislation, biosafety protocols, national and international guidelines regarding the COVID 19 context. Once the participation mechanism(s) have been defined, the date, time, and place of the consultation process shall be established, with due motivation and justification, considering local practices and uses, such as fairs, festivities, and others, to guarantee the greatest and best condition of convocation and concurrence to the event and to comply with the principle of maximum access to the information of the IFC.

The consultation process will be carried out by YILPORTECU, who shall be responsible for the respective coordination through its Community Relations Department or the delegate for this purpose. It is essential to have the collaboration and participation of technicians who know the details of the project in terms of design, timetable, and other specificities; as well as any other representative that the proponent considers necessary.

Participants

The stakeholder list incorporates at least the following criteria:

• Main stakeholder categories and subcategories.

• The level of interest on the project: Likely impacts or benefits, or interest; positive or negative.

• Key characteristics (social situation, cultural factors, location, size, organizational capacity and level of influence, vulnerability, or social exclusion).

• How the project will relate to each of the different groups (how it will provide meaningful background information, whether it will use public meetings, focus groups, key informants, or structured interviews such as instances or formats to link, etc.).

This information will create the query plan.

Mechanisms of call and dissemination

- Prepare and deliver formal written invitations, preferably in person or by means that are most convenient for the guest. Carry delivery/receipt record as a means of verifying the call. If possible, they should be signed by the maximum authority of the project proponent.

- To ensure adequate publicity and the greatest possible assistance, the feasibility of managing additional call mechanisms such as messages on broadcasters and/or local print daily, the placement of information posters in strategic mass venues (e.g., temples, squares, markets), and other high media will be evaluated in the field.
- The call should include a brief introduction to the project and a preliminary agenda, it must be run at least 10 business days before the event to ensure the greatest number of attendees and a reminder will be made one or two days before the event through 01 (one) publication in the most widely circulated local paper.

To ensure equitable access to the process, the working hours of fishermen, shell collectors, and crustacean collectors, in general, should be taken into account. when setting the date and time the event was executed so that they could participate in the process and obtain their opinions and concerns.

Query method

The query method to be implemented is that of a public presentation assembly, to which the stakeholders of the project implementation area, the local authorities and organizations, and other stakeholders previously identified should be invited.

The information will be presented in a didactic manner and adapted to local socio-cultural conditions, ensuring that the following are included at least:

- Objectives of the consultation and agenda
- The nature of the project, benefits, and/or possible impacts to different groups of parties.
- Environmental and social analysis of the project.
- Progress and/or Project Status.
- Rights and responsibilities of individuals within the framework of project implementation.
- A mechanism for filing complaints and reclamations.

The assembly will create a space for dialog where concerns will be answered, and comments and views received. To make the consultation process meaningful, channels will be proposed for dialog and listening to the concerns and opinions of the participants.

17.4.2. Execution

On the day of the event, ¡ all the logistic facilities necessary for the development of the event shall be ready and the formats for the recording of comments, the registration of attendance, and the management of them.

The advantage of public meetings as a consultation format is that the project can contact many stakeholders and that there is a degree of transparency in the process because everyone receives the same information and listens to the discussion. Special care shall be taken to verify that the process is not governed by dominant interest groups.

Consultations will be carried out in places of easy access, always safeguarding the health of the participants and the technical team, taking the measures established in the Protocol for the resumption of social/citizen participation processes of projects, works, or activities in the process of environmental regularization at the national level, MAAE-001, dated 2020, for the implementation of processes of citizen participation in times of pandemic.

17.4.3. Preparation of a systematization report/updating of the consultation plan.

Once the query process has been completed, the consultation plan should be updated based on information provided by interested parties. The consultation plan can be extended or updated permanently with the following additional information:

• Key concerns and recommendations expressed by different stakeholder categories and subcategories.

• How the project will address the views of each stakeholder group.

• How the project will provide feedback to stakeholders on how their views are reflected in project decisions.

• How the project seeks to relate to different stakeholder groups during the remainder of project preparation and implementation.

17.4.4. Review and/or inclusion of stakeholder criteria

The analysis of stakeholder inputs will be based on four points:

I. How stakeholder input can be reflected in project implementation.

II. How stakeholder inputs can provide the basis for adding additional and specific benefits to local communities to the project.

III. How potential adverse impacts should be avoided and minimized.

IV. What are the most appropriate institutional and organizational mechanisms for the project to respond to the needs and concerns of stakeholders.

The consultant shall include in the environmental and social analysis the opinions and observations generated in the participation processes, provided that their relevance and technical and economic viability are justified.

17.4.5. Feedback

Within 15 days of the consultation, participants will be notified of the summary of the consultation. The information will be presented using an infographic or easy-to-understand scheme and distributed through one (01) of the previously established mechanisms of call and dissemination. The information to be disseminated shall include the following:

• Registration of the place, the time, and the people who participated.

• Key issues discussed.

• Agreements reached.

• How recommendations from stakeholders have been or will be considered in the implementation of the project.

• How decisions made based on stakeholder input are expected to improve benefits and reduce adverse impacts.

• Areas of disagreement or divergent opinions, whether between stakeholders or between participants and project authorities, and the reasons why some recommendations cannot be included.

• Dissemination of the complaints and complaints mechanism.

18. Annexes

ANNEX 1. YILPORTECU Environmental Management Plans

ANNEX 2. RH-PR-13 V1. Human Resources Claims and Suggestions Procedure

ANNEX 3. Protocol for response to marine mammal stranding.

ANNEX 4. Protocol of action to prevent collisions with whales and other marine mammals during dredging activities.

ANNEX 5. RH-PR-009 V1 Termination and Disengagement

ANNEX 6. YECU-EHS-01-068-EHS POLICY_2020-2022

ANNEX 7. Emergency preparedness and response plan

ANNEX 8. Academic Planning Human Rights and Proportional Use of Force

ANNEX 9. Comprehensive Security Training Final Report

ANNEX 10. YECU-EHS-126-Instructional Certificate Review IMO_MARPOL_V1

I, Miguel Angel Pantoja Shimanskii, certify that the present document consisting of 66 pages in english was translated from its original version in spanish, it's accurate to the best of my capacities as a Sworn Court Certified Translator of the Judicial Council of Ecuador.

Yo, Miguel Angel Pantoja Shimanskii certifico que el presente documento que consta de 66 páginas en ingles fueron traducidas de su versión original en español , son precisas en mis capacidades como traductor calificado y jurado del Consejo de la Judicatura.

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ENVIRONMENTAL AND SOCIAL IMPACT STUDY, PUERTO BOLÍVAR PROJECT - PHASE 1

– INFORMATION QUERY AND DISCLOSURE

Prepared for:

YILPORT TERMINAL OPERATIONS, YILPORTECU S.A.

Prepared by:

ECOSAMBITO C.LTDA.

December, 2020

INFORMATION QUERY AND DISCLOSURE

As part of the Environmental Permits for Projects considered to be of medium and high impact, national environmental regulations require that the content of the Environmental Impact Study and the Environmental Management Plan be submitted for consideration by the general public, and that different outlets be used for the social stakeholders and the general public to learn about results thereof first hand. For this purpose, the study is published digitally and physically at an information desk, and the most important point of this process is the Public Assembly or Informational Meeting where the Bidder gives a presentation to the social stakeholders regarding the characteristics of the project, the identified impacts, and the Environmental Management Plan, and also receives suggestions or comments from them.

YILPORTECU has carried out two Social Participation Processes (PPS) as part of its Environmental Permits:

1. THE PPS OF THE "ENVIRONMENTAL IMPACT STUDY FOR THE CONSTRUCTION AND OPERATION OF THE PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A.," held in October 2017.
2. THE PPS OF THE "ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE DREDGING OF PIERS 1, 2, 3, 4, 5, AND 6, THE MANEUVERING AREA, AND THE ACCESS CANAL OF PUERTO BOLIVAR," held in June 2017.

The reports of these processes can be found in the Annexes attached to this report.