2017

ENVIRONMENTAL IMPACT STUDY

CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A.

YILPORT PUERTO BOLIVAR ECOSFERA CONSULTORA AMBIENTAL

MACHALA – EL ORO – ECUADOR

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EXECUTIVE SUMMARY

The Puerto Bolívar Port Terminal is located in the Machala canton, province of El Oro. It carries out operations of export and import of products by sea, having an installation capacity of 1,705,877 tons and 258,678 containers. Mooring, storage, equipment and port access works are being carried out.

The project DOES NOT INTERSECT with the National System of Protected Areas, Protective Forests as stated in the InterArticle Certificate MAE - SUIA - RA - DPAEO - 2017 - 208188 dated July 3 issued by the Ministry of Environment.

The source of information for this study was the Environmental Management Act with its regulations and technical standards, which made it possible to determine whether or not the main findings at the Puerto Bolívar Port Terminal comply with the environmental regulations in force regarding different aspects such as management of common and hazardous solid waste, liquid discharges, noise levels and others during the operating process.

The methodology used in this Environmental Impact Study was based on the analysis and interdisciplinary integration of the work team, which made it possible to establish the positive and negative impacts caused to the environment by the different activities and operations in the study area, for which the following was used:

- Rapid evaluations
- Methods and field collection
- Samples of discrete variables
- Review of specialized and existing information
- Review of secondary information.

In order to achieve better coordination of the works to be carried out, direct communication with the Port Terminal executive officers and employees facilitated the gathering of information to successfully carry out this Study.

The preparation of this Environmental Management Plan was based on the identified impacts. The main purpose of the Environmental Management Plan is to prevent and correct the occurrence of environmental impacts during the Construction, Operation and Maintenance works of the Port Terminal, as well as potential effects on the health and safety of the company's personnel.

1. TECHNICAL DATA SHEET

Table 1: Project Technical Data Sheetnical Data Sheet

CONTROL SUBJECT INFORMATION			
Company Name (control subject):	YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A.		
Legal representative:	Carlos Cruz Hernandez, Eng.		
Main economic activity	Operation Activities of Terminal Facilities, such as Ports		
Address:	**Province:** El Oro **Canton:** Machala **Parish:** Puerto Bolívar **Address:** Av. Bolívar M. Vargas s/n. Edificio de Autoridad Portuaria de Puerto Bolívar.		
Telephone (landline/mobile):	0987734139 0995083333	**E-mail**:	carlos.cruz@yilport.com
Type of company:	**Private**	**Public**	**Mixed**
	X		
ENVIRONMENTAL CONSULTANT			
ECOSFERA CÍA. LTDA. MAE - SUIA - 0010 - CC			
PROJECT INFORMATION			
Name of project:	Construction and Operation of Puerto Bolívar Port Terminal operated by YILPORT TERMINAL OPERATIONS YILPORTECU S.A.		
Geographic Location:	**Province:** El Oro **Canton:** Machala **Parish:** Puerto Bolívar		
Project phase:	**Construction**	**Operation**	**Closure/Abandonment**
	X	**X**	
CCAN Code:	CONSTRUCTION AND OPERATION OF TRADING PORTS		
Intersects with a Protected Area	Yes:	No: **X**	

COORDINATES WGS84		
East (X): 611290	**North (Y):** 9639124	**Altitude (masl):** 5 m
East (X): 610952	**North (Y):** 9639220	**Altitude (masl):** 3 m
East (X): 610966	**North (Y):** 9639464	**Altitude (masl):** 1 m
East (X): 611047	**North (Y):** 9640244	**Altitude (masl):** 1 m
East (X): 611941	**North (Y):** 9639964	**Altitude (masl):** 2 m
East (X): 611608	**North (Y):** 9639609	**Altitude (masl):** 5 m
East (X): 611680	**North (Y):** 9639532	**Altitude (masl):** 8 m

MEMBERS OF THE TECHNICAL CONSULTING TEAM			
Name	**Training Professional**	**Component of Participation in the Study**	**Signature of Responsibility**
Claudia Cordero	Environmental Engineer	• Environmental Baseline Survey • Project Description • Impact Identification and Valuation • Risk Analysis • Environmental Management Plan Preparation	(illegible signature)
Alex Arias	Environmental Management Engineer	• Impact Identification and Valuation • Environmental Management Plan	(illegible signature)
Jorge Intriago	Biologist	• Biotic Component	(illegible signature)
Maria Fernanda Gonzalez	Geographer Engineer	• Cartography, Thematic Maps	(illegible signature)
Katy Perez	Sociologist	• Social Component • Social participation process	(illegible signature)

2. ACRONYMS AND ABBREVIATIONS

- **AAN:** National Environmental Authority
- **AAAr:** Responsible Environmental Enforcement Authority
- **AAAc:** Cooperating Environmental Enforcement Authority
- **AAC:** Environmental Compliance Audit
- **AISD:** Area of Direct Social Influence
- **AISI:** Area of Indirect Social Influence
- **APPB:** Puerto Bolívar Port Authority
- **BVP:** Forest and Protective Vegetation
- **CCAN:** Catalog of National Environmental Categorization
- **CI:** InterArticle Certificate
- **COIP:** Comprehensive Organization Criminal Code
- **CPAS:** Pacific Coast of South America
- **CIP:** Public Information Centers
- **dB:** Decibel
- **ESIA:** Environmental Impact Study
- **IMF:** International Monetary Fund
- **GADPEO:** Autonomous Province Government of El Oro
- **GEY:** Yildirim Group of Companies
- **GQM:** Laboratorio Grupo Químico Marcos
- **INEC:** National Census Institute
- **INOCAR:** Navy Oceanographic Institute.
- **IP:** Private Initiative
- **ISO:** International Organization for Standardization.
- **KM:** Kilometer
- **M:** meter
- **MAE:** Ministry of Environment of Ecuador
- **MAGAP:** Ministry of Agriculture, Livestock, Aquaculture and Fisheries.
- **MHC:** Mobile Harbor Cranes
- **MLWS:** Mean Low Water Spring
- **MN:** Nautical Miles
- **NC:** Nonconformity
- **OPB:** Port Vessel Operator
- **OPC:** Port Cargo Operator
- **OPP:** Port Passenger Operator
- **OPSC:** Port Related Services Operators
- **PA:** Abandonment Plan
- **PB:** Puerto Bolívar
- **PCC:** Communication and Training Plan
- **PDC:** Contingency Plan
- **EAP:** Economically Active Population
- **GDP:** Gross Domestic Product
- **PF:** State Forest Heritage
- **PMA:** Environmental Management Plan
- **PMD:** Waste Management Plan
- **PMS:** Monitoring and Follow-up Plan
- **PRC:** Community Relations Plan
- **PPP:** Public-Private Participation
- **PPM:** Prevention and Mitigation Plan
- **PPS:** Social Participation Process
- **PSS:** Health and Safety Plan
- **LA:** Environmental License

- **RI:** Information Meetings
- **RGDP:** Registry of Hazardous Waste Generator
- **RSC:** Corporate Social Responsibility
- **SNAP:** National System of Protected Areas
- **SUIA:** Single Environmental Information System
- **SUMA:** Single Environmental Management System
- **ToR:** Terms of Reference
- **TULAS:** Consolidated Text of Secondary Environmental Legislation
- **US EPA:** United States Environmental Protection Agency.
- **YILPORTECU:** YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A.
- **YPH:** Yilport Holding Inc.

3. INTRODUCTION

In 1970 the Puerto Bolívar Port Authority was created to operate and manage the International Maritime Port. Operations began on March 5, 1971. The Mission of the Puerto Bolívar Trading Port is to offer efficient logistic services for the transportation of products, with specialized human resources and quality technology, articulating the Southern Region with the world market.

By Executive Decree No. 674 dated May 12, 2015, the President of the Republic authorized, on an exceptional basis, the delegation of the private initiative for the management of the public port service of Puerto Bolívar, through a contractual modality. With this provision, by means of official letter APPB-CG-0257 dated June 5, 2015, the General Management appointed the Technical Commission in charge of carrying out the public bidding procedure for the ***"DESIGN, FINANCING, EXECUTION OF ADDITIONAL WORKS, EQUIPMENT, OPERATION AND MAINTENANCE OF THE PUERTO BOLÍVAR PORT TERMINAL"***

Once completed the Negotiation and Award Report dated February 22, 2016, the award Resolution was issued to company YILPORT HOLDING NV through Administrative Resolution No. 31 -2016 dated February 24, 2016.

The nature of the contract signed implies a Delegation to the private sector of the management of the public port service of the Puerto Bolívar Port Authority (APPB), under the modality of a Public-Private Partnership in accordance with the applicable legislation, whereby the APPB acts in its capacity as Delegating Entity and YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A. acts in its capacity as Private Manager, which will be in force for an ordinary term of 50 years.

YILPORTECU is an experienced Port Operator in first class multipurpose ports; it operates 20 ports and terminals around the world: 5 in Turkey, 7 in Portugal, 2 in Spain, 2 in Sweden, 1 in Peru, 1 in Malta, 1 in Norway and in Puerto Bolívar.

The YILPORTECU Development Plan foresees transforming Puerto Bolívar into a modern port facility, not only for current traffic, but also to incorporate new bulk traffic (cereals, clinker, coal, minerals, among others) and container traffic. To this end, YILPORTECU will carry out the development of a new network of port infrastructures as well as facilities and their corresponding auxiliary services such as cold storage and also facilities for the reception, storage, and delivery of bulk cargo.

In addition, the dock area will be designed to accommodate vessels of the maximum size operating in the region, with drafts of 16.5 m and lengths in excess of 400 m. This design aspect is critical for the terminal to be competitive in the environment.

The Development Plan will be carried out in phases that would respond to different scenarios of commodity growth and commitments.

In its final development phase, YILPORTECU proposes a terminal with specific areas dedicated to container, solid bulk and general cargo traffic, serving the industry, commerce and Ecuadorian society in general.

The total investment of the Puerto Bolívar Project is estimated at seven hundred and fifty million US dollars (USD$ 750 million) in infrastructure and equipment distributed in the 5 phases during the concession years.

The largest investment is at the beginning of the concession in Phase 1 with $230 million to ensure the success of the development from the outset.

The final product will be that the Puerto Bolívar Port Terminal will become an exemplary and leader in handling more than 5 types of goods with dedicated equipment.

According to Clause 49 of the Concession Contract, the Private Manager (YPH), must prepare and provide all the necessary studies and documents to obtain the Environmental License and other legal authorizations of the projects to be carried out in the concession, so the company YILPORTECU S.A. has planned to carry out the Environmental Impact Study of the Construction and Operation of the Puerto Bolívar Port Terminal to obtain the respective Environmental License, for which it has hired the services of the Environmental Consultant ECOSFERA CÍA. LTDA., with qualification registration MAE-SUIA-0010-CC.

Environmental Studies consist of a predictive estimate or a present identification of environmental damages or alterations, in order to establish preventive measures, mitigation activities and measures for the rehabilitation of environmental impacts produced by a probable or effective execution of a project of any of the phases, which will constitute technical tools for the regularization, control and environmental monitoring of a project that involves environmental risk.

The purpose of the Environmental Impact Study is to guarantee an adequate and well-founded prediction, identification, and interpretation of the environmental impacts of the project, as well as the technical adequacy of the control measures for the management of its environmental impacts and risks.

The methodology for the preparation of this Environmental Impact Study was based on diagnostics that allow us to obtain reliable, qualitative and quantitative information in short periods of time.

In the first instance, a bibliographic review was carried out by means of a research work that began with the search and analysis of existing bibliography and information.
In the first field investigation, primary data were obtained to characterize the area and to evaluate in situ the particular characteristics of the area and define the significant environmental impacts that may affect the physical, biotic and socioeconomic environment.

The field work provided a general understanding of the project's structure, functions and operational processes. Sufficient, competent and relevant objective evidence of the project was collected, such as photographs, process flows, forms, procedures, laboratory analysis, among others.

The research and field work was carried out by a multidisciplinary technical team of the consulting firm.

The environmental study has been carried out in a technical manner, and according to the scope and depth of the project, in accordance with the requirements of the applicable environmental regulations.

As a fundamental part of the Environmental Impact Study, an Environmental Management Plan has been designed, which is a document that establishes in detail and in chronological order the actions required to prevent, mitigate, control, correct and compensate the possible negative environmental impacts or accentuate the positive impacts caused by the development of a proposed action.

The Environmental Management Plan consists of several sub-plans, with their respective programs, budgets, responsible parties, means of verification and schedule.

a) Impact Prevention and Mitigation Plan
b) Contingency Plan
c) Training Plan
d) Occupational Health and Safety Plan
e) Waste Management Plan
f) Community Relations Plan
g) Rehabilitation Plan for Affected Areas
h) Area Abandonment and Handover Plan
i) Monitoring and Follow-up Plan.

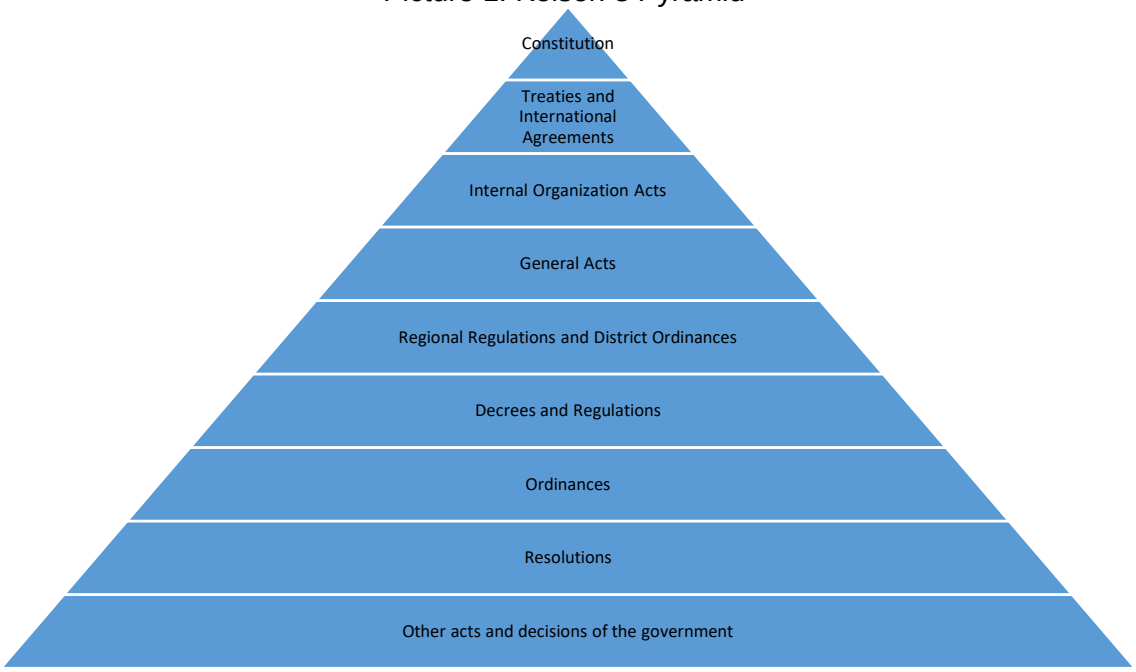
The Environmental Impact Study has been carried out under the responsibility of the developer (YILPORTECU), in accordance with the Terms of Reference, Guidelines and applicable Environmental Regulations.

4. LEGAL AND INSTITUTIONAL FRAMEWORK

The applicable legal-environmental framework is made up of a series of laws, rules, regulations and ordinances that are in force at the national, regional and local levels; for the Environmental Impact Study, the hierarchical order of precedence of the Law must be taken into account to establish the legal regulatory order of environmental protection, as established in the Political Constitution of Ecuador, in Article 424. The Political Constitution is the supreme rule and prevails over any other of the legal system. The rules and acts of the government shall be in line with the constitutional provisions; otherwise, they shall have no legal effect. The Political Constitution and international human rights treaties ratified by the State that recognize rights more favorable to those contained in the Constitution shall prevail over any other rule or act of the government.

Article 425 establishes that the hierarchical order for the application of laws shall be as follows: The Constitution; the international treaties and conventions; the internal organization acts, the ordinary acts; the regional regulations and district ordinances; the decrees and regulations; ordinances; agreements and resolutions; and the other acts and decisions of the public authorities. In case of conflict between rules of different hierarchy, the Constitutional Court, judges, administrative authorities and public servants shall settle it by applying the upper hierarchical law. The regulatory hierarchy shall consider, as appropriate, the principle of competence, especially the exercise of the exclusive competences of the decentralized autonomous governments.

Picture 1: Kelsen´s Pyramid



Source: *Hans Kelsen, jurist, politician and philosophy professor at the University of Vienna.*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Date: *April 20, 2017*

Table 2: Applicable Legal Framework

APPLICABLE LEGAL FRAMEWORK
Political Constitution of the Republic of Ecuador
Basel Convention
Stockholm Convention
Rotterdam Convention
Comprehensive Organization Criminal Code
Internal Organization Code of Territorial Organization, Autonomy and Decentralization
Environmental Management Act
Act on the Prevention and Control of Environmental Pollution
Ministerial Resolution 061 dated April 7, 2015.
Ministerial Resolution 134 dated September 25, 2012 (Forestry Inventory)
Ministerial Resolution 026
Ministerial Resolution 142
INEN Rule 2266 - 2013

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The nature of the signed contract implies a Delegation to the private sector of the management of the public service of the Puerto Bolívar Port Terminal, under the modality of a Public Private Partnership in accordance with the Political Constitution of the Republic of Ecuador, the Internal Organization Code of Production, Trade and Investments, the Internal Organization Act on Incentives for Public Private Partnerships and Foreign Investment, the Act on State Modernization, Privatization and Provision of Public Services, and the Law of Public Private Partnerships and Foreign Investment, and the Law of Modernization of the State, Privatization and Provision of Public Services by the private sector, the Regulations for the Application of the Special Public Transportation Service Delegation System, the General Regulations for Port Activity in Ecuador, the Regulations on the Public-Private Cooperation System, the regulation of the Port Services in Ecuador, and other applicable Laws and Regulations on this matter.

4.1. POLITICAL CONSTITUTION OF THE REPUBLIC OF ECUADOR

Approved by the National Constituent Assembly and the approval Referendum, which is published in the Official Gazette No. 449 dated Monday, October 20, 2008.

Title II: RIGHTS
CHAPTER II: RIGHTS OF THE GOOD WAY OF LIVING

- **Article 13.** Persons and community groups have the right to safe and permanent access to healthy, sufficient and nutritional food, preferably produced locally and in keeping with their various identities and cultural traditions. The Ecuadorian State shall promote food sovereignty.
- **Article 14.** The right of the population to live in a healthy and ecologically balanced environment that guarantees sustainability and the good way of living (sumak kawsay), is recognized. Environmental conservation, the protection of ecosystems, biodiversity and the integrity of the country's genetic assets, the prevention of environmental damage, and the recovery of degraded natural spaces are declared matters of public interest.
- **Article 15.** The State shall promote, in the public and private sectors, the use of environmentally clean technologies and nonpolluting and low-impact alternative sources of energy.
- **Article 32.** Health is a right guaranteed by the State and whose fulfillment is linked to the exercise of other rights, among which the right to water, food, education, sports, work, social security, healthy environments and others that support the good way of living.

CHAPTER VII: RIGHTS OF NATURE

- **Article 71.** Nature, or Pacha Mama, where life is reproduced and occurs, has the right to integral respect for its existence and for the maintenance and regeneration of its life cycles, structure, functions and evolutionary processes. All persons, communities, peoples and nations can call upon public authorities to enforce the rights of nature.
- **Article 72.** Nature has the right to be restored. This restoration shall be apart from the obligation of the State and natural persons or legal entities to compensate individuals and communities that depend on affected natural systems.
- **Article 73.** The State shall apply preventive and restrictive measures on activities that might lead to the extinction of species, the destruction of ecosystems and the permanent alteration of natural cycles.
- **Article 74.** Persons, communities, peoples, and nations shall have the right to benefit from the environment and the natural wealth enabling them to enjoy the good way of living.

- Environmental services shall not be subject to appropriation; their production, delivery, use and development shall be regulated by the State.

CHAPTER IX: RESPONSIBILITIES

- **Article 83.** Ecuadorians have the following duties and obligations, without detriment to others provided for by the Constitution or by law:
  - To defend the territorial integrity of Ecuador and its natural resources.
  - Respect the rights of nature, preserve a healthy environment and use natural resources in a rational, sustainable and sustainable mann To respect the rights of nature, preserve a healthy environment and use natural resources rationally, sustainably and durably.

Title VII: THE GOOD WAY OF LIVING SYSTEM

CHAPTER I. INCLUSION AND EQUITY

- **Article 389.** The State shall protect persons, communities and nature against the adverse impacts of natural or manmade disasters by risk prevention, disaster mitigation, restoration and improvement of social, economic and environmental conditions, for the purpose of minimizing the condition of vulnerability.

  The national decentralized system for risk management is comprised of risk management units from all local, regional, and national public and private institutions. The State shall exercise leadership of the technical body established by law. It shall have the following main duties, among others:

  1. To identify existing and potential internal and external risks affecting the territory of Ecuador.
  2. To generate, democratize the access to, and disseminate information that is sufficient and timely to adequately manage risk.
  3. To ensure that all public and private institutions obligatorily incorporate risk management as a cross-cutting issue in their planning and management.
  4. To build up among the citizenry and in public and private institutions capacities to identify risks that are inherent to their respective spheres of action, to report about them, and incorporate actions aimed at reducing them.
  5. To articulate institutions so they will coordinate actions to prevent and mitigate risks, as well as address them, recover and improve conditions prior to the occurrence of the emergency or disaster.
  6. To undertake and coordinate the actions needed to reduce vulnerabilities and prevent, mitigate, tackle, and recover from possible adverse impacts stemming from disasters or emergencies on the country's territory.
  7. To guarantee sufficient and timely funding to ensure functioning of the System and to coordinate international cooperation aimed risk management.
- **Article 390.** Risks shall be managed on the basis of the principle of subsidiary decentralization, which shall imply the direct responsibility of the institutions in their geographical area. When their capacities for risk management are insufficient, the institutions with the broadest territorial scope and greatest technical and financial capacity shall provide the support needed with respect to their authority in the territory and without relieving them of their responsibility.

CHAPTER I. BIODIVERSITY AND NATURAL RESOURCES

SECTION ONE: NATURE AND ENVIRONMENT

- **Article 395.** The Constitution recognizes the following environmental principles:
  1. The State shall guarantee a sustainable model of development, one that is environmentally balanced and respectful of cultural diversity, conserves

biodiversity and the natural regeneration capacity of ecosystems, and ensures meeting the needs of present and future generations.

2. Environmental management policies shall be applied cutting across all sectors and dimensions and shall be mandatorily enforced by the State at all of its levels and by all natural persons or legal entities in the country's territory.
3. The State shall guarantee the active and permanent participation of affected persons, communities, peoples and nations in the planning, implementation and monitoring of all activities exerting environmental impacts.
4. In the event of doubt about the scope of legal provisions for environmental issues, it is the most favorable interpretation of their effective force for the protection of nature that shall prevail.

- **Article 396.** The State shall adopt timely policies and measures to avoid adverse environmental impacts where there is certainty about the damage. In the case of doubt about the environmental impact stemming from a deed or omission, although there is no scientific evidence of the damage, the State shall adopt effective and timely measures of protection. Responsibility for environmental damage is objective. All damage to the environment, in addition to the respective penalties, shall also entail the obligation of integrally restoring the ecosystems and compensating the affected persons and communities. Each one of the players in the processes of production, distribution, marketing and use of goods or services shall accept direct responsibility for preventing any environmental impact, for mitigating and repairing the damages caused, and for maintaining an ongoing environmental monitoring system. The legal proceedings to prosecute and punish those responsible for environmental damages shall not be subject to any statute of limitations.
- **Article 397.** In case of environmental damages, the State shall act immediately and with a subsidiary approach to guarantee the health and restoration of ecosystems. In addition to the corresponding sanction, the State shall file against the operator of the activity that produced the damage proceedings for the obligations entailing integral reparation, under the conditions and on the basis of the procedures provided for by law. The responsibility shall also pertain to the public servants responsible for carrying out environmental monitoring. To guarantee the individual and collective right to live in a healthy and ecologically balanced environment, the State pledges:
  1. To permit any natural person or legal entity, human community or group, to file legal proceedings and resort to judicial and administrative bodies without detriment to their direct interest, to obtain from them effective custody in environmental matters, including the possibility of requesting precautionary measures that would make it possible to end the threat or the environmental damage that is the object of the litigation. The burden of proof regarding the absence of potential or real danger shall lie with the operator of the activity or the defendant.
  2. To establish effective mechanisms to prevent and control environmental pollution, restore degraded natural spaces, and to provide for the sustainable management of natural resources
  3. To regulate the production, import, distribution, use, and final disposal of materials that are toxic and hazardous to persons or the environment.
  4. To ensure the intangibility of protected natural areas, so as to guarantee the conservation of biodiversity and the maintenance of the ecological functions of the ecosystems. The State shall be in charge of management and administration of protected natural areas.
  5. To establish a national prevention, risk management and natural disaster system based on the principles of immediateness, efficiency, precaution, responsibility and solidarity.

- **Article 398.** All state decision or authorization that could affect the environment shall be consulted with the community, which shall be informed fully and on a timely basis. The consulting subject shall be the State. The law shall regulate prior consultation, public participation, time-limits, the subject consulted and the appraisal and objection criteria used with regard to the activity that is being submitted to consultation. The State shall take into consideration the opinion of the community on the basis of the criteria provided for by law and international human rights instruments. If the above-mentioned consultation process leads to majority opposition by the respective community, the decision whether to implement or not the project shall be adopted by a resolution that is duly substantiated by the corresponding higher administrative body in accordance with the law.
- **Article 399.** The full exercise of state guardianship over the environment and joint responsibility of the citizenry for its conservation shall be articulated by means of a National Decentralized Environmental Management System, which shall be in charge of defending the environment and nature.

SECTION TWO BIODIVERSITY

- **Article 400.** The State shall exercise sovereignty over biodiversity, whose administration and management shall be conducted on the basis of responsibility between generations. The conservation of biodiversity and all of its components are declared to be of public interest, especially agricultural and wildlife biodiversity and the country's genetic assets.
- **Article 402.** The granting of rights, including intellectual property rights, to byproducts or synthetics obtained from collective knowledge associated with national biodiversity is forbidden.
- **Article 403.** The State shall not make commitments to cooperation agreements or accords that include clauses that undermine the conservation and sustainable management of biodiversity, human health, collective rights and rights of nature.

SECTION THREE: CULTURAL ASSETS AND ECOSYSTEMS

- **Article 404.** The unique and priceless natural assets of Ecuador include, among others, the physical, biological and geological formations whose value from the environmental, scientific, cultural or landscape standpoint requires protection, conservation, recovery and promotion. Their management shall be subject to the principles and guarantees enshrined in the Constitution and shall be conducted in accordance with soil use planning and ecological zoning, in compliance with the law.
- **Article 405.** The national system of protected areas shall guarantee the conservation of biodiversity and the maintenance of ecological functions. The system shall be comprised of state, decentralized autonomous, community and private subsystems, and it shall be directed and regulated by the State. The State shall allocate the financial resources needed to ensure the system's financial sustainability and shall foster the participation of the communities, peoples, and nations who have their ancestral dwelling places in the protected areas in their administration and management.
- **Article 406.** The State shall regulate the conservation, management and sustainable use, recovery, and boundaries for the domain of fragile and threatened ecosystems, including among others, high Andean moorlands, wetlands, cloud forests, dry and wet tropical forests and mangroves, marine ecosystems and seashore ecosystems.

SECTION SIX: WATER

- **Article 411.** The State shall guarantee the conservation, recovery and comprehensive management of water resources, river basins and ecological flows associated with the water cycle. All activities that can affect the quality and amount

of water and the equilibrium of ecosystems shall be regulated, especially in water replenishment sources and zones. The sustainability of ecosystems and human consumption shall be priorities in water use and development.

- **Article 412.** The authority in charge of managing water shall be responsible for its planning, regulation, and control. This authority shall cooperate and coordinate with the authority in charge of environmental management to guarantee water management based on an ecosystemic approach.

4.2. INTERNATIONAL TREATIES AND CONVENTIONS

Article 425 of the Political Constitution of the Republic of Ecuador, approved in October 2008 establishes the following hierarchical order of application of the norms: The Political Constitution; the international treaties and conventions; the internal organization organic acts; the ordinary acts; the regional regulations and district ordinances; the decrees and regulations; ordinances; agreements and resolutions; and the other acts and decisions of the government.

According to the current Political Constitution, once approved and ratified, international treaties prevail over internal organization acts and ordinary acts.

4.2.1. INTERNATIONAL CONVENTION FOR THE PREVENTION OF THE POLLUTION FROM SHIPS, 1973 - MARPOL

- **Article 3**. Application
  1) The present Convention shall apply to:
     a) ships entitled to fly the flag of a Party to the Convention; and
     b) ships not entitled to fly the flag of a Party but which operate under the authority of a Party.
  2) Nothing in the present article shall be construed as derogating from or extending the sovereign rights of the Parties under international law over the sea-bed and subsoil thereof adjacent to their coasts for the purposes of exploration and exploitation of their natural resources.
  3) The present Convention shall not apply to any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service. However, each Party shall ensure by the adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable, with the present Convention.
- **Article 4. Violation**
  1) Any violation of the requirements of the present Convention shall be prohibited and sanctions shall be established therefor under the law of the Administration of the ship concerned wherever the violation occurs. If the Administration is informed of such a violation and is satisfied that sufficient evidence is available to enable proceedings to be brought in respect of the alleged violation, it shall cause such proceedings to be taken as soon as possible, in accordance with its law.
  2) Any violation of the requirements of the present Convention within the jurisdiction of any Party to the Convention shall be prohibited and sanctions shall be established therefor under the law of that Party. Whenever such a violation occurs, that Party shall either:
     c) cause proceedings to be taken in accordance with its law; or
     d) furnish to the Administration of the ship such information and evidence as may be in its possession that a violation has occurred.
  3) Where information or evidence with respect to any violation of the present Convention by a ship is furnished to the Administration of that ship, the Administration shall promptly inform the Party which has furnished the information or evidence, and the Organization, of the action taken.

4) The penalties specified under the law of a Party pursuant to the present article shall be adequate in severity to discourage violations of the present Convention and shall be equally severe irrespective of where the violations occur.

- **Article 5.** Certificates and special rules on inspection of ships
  1) Subject to the provisions of paragraph (2) of the present article a certificate issued under the authority of a Party to the Convention in accordance with the provisions of the regulations shall be accepted by the other Parties and regarded for all purposes covered by the present Convention as having the same validity as a certificate issued by them.
  2) A ship required to hold a certificate in accordance with the provisions of the regulations is subject, while in the ports or offshore terminals under the jurisdiction of a Party, to inspection by officers duly authorized by that Party. Any such inspection shall be limited to verifying that there is on board a valid certificate, unless there are clear grounds for believing that the condition of the ship or its equipment does not correspond substantially with the particulars of that certificate. In that case, or if the ship does not carry a valid certificate, the Party carrying out the inspection shall take such steps as will ensure that the ship shall not sail until it can proceed to sea without presenting an unreasonable threat of harm to the marine environment. That Party may, however, grant such a ship permission to leave the port or offshore terminal for the purpose of proceeding to the nearest appropriate repair yard available.
  3) If a Party denies a foreign ship entry to the ports or offshore terminals under its jurisdiction or takes any action against such a ship for the reason that the ship does not comply with the provisions of the present Convention, the Party shall immediately inform the consul or diplomatic representative of the Party whose flag the ship is entitled to fly, or if this is not possible, the Administration of the ship concerned. Before denying entry or taking such action the Party may request consultation with the Administration of the ship concerned. Information shall also be given to the Administration when a ship does not carry a valid certificate in accordance with the provisions of the regulations.
  4) With respect to the ship of non-Parties to the Convention, Parties shall apply the requirements of the present Convention as may be necessary to ensure that no more favourable treatment is given to such ships.
- **Article 6.** Detection of violations and enforcement of the Convention
  1) Parties to the Convention shall co-operate in the detection of violations and the enforcement of the provisions of the present Convention, using all appropriate and practicable measures of detection and environmental monitoring, adequate procedures for reporting and accumulation of evidence.
  2) A ship to which the present Convention applies may, in any port or offshore terminal of a Party, be subject to inspection by officers appointed or authorized by that Party for the purpose of verifying whether the ship has discharged any harmful substances in violation of the provisions of the regulations. If an inspection indicates a violation of the Convention, a report shall be forwarded to the Administration for any appropriate action.
  3) Any Party shall furnish to the Administration evidence, if any, that the ship has discharged harmful substances or effluents containing such substances in violation of the provisions of the regulations. If it is practicable to do so, the competent authority of the former Party shall notify the master of the ship of the alleged violation.
  4) Upon receiving such evidence, the Administration so informed shall investigate the matter, and may request the other Party to furnish further or better evidence of the alleged contravention. If the Administration is satisfied that sufficient evidence is available to enable proceedings to be brought in respect of the alleged violation, it shall cause such proceedings to be taken in accordance with its law as soon as possible. The Administration shall promptly inform the Party

which has reported the alleged violation, as well as the Organization, of the action taken.

5) A Party may also inspect a ship to which the present Convention applies when it enters the ports or offshore terminals under its jurisdiction, if a request for an investigation is received from any Party together with sufficient evidence that the ship has discharged harmful substances or effluents containing such substances in any place. The Articles 5, 6 7 report of such investigation shall be sent to the Party requesting it and to the Administration so that the appropriate action may be taken under the present Convention.

- **Article 7.** Undue delay to ships
  1) All possible efforts shall be made to avoid a ship being unduly detained or delayed under articles 4, 5 or 6 of the present Convention.
  2) When a ship is unduly detained or delayed under articles 4, 5 or 6 of the present Convention, it shall be entitled to compensation for any loss or damage suffered.
- **Article 8.** Reports on incidents involving harmful substances
  1) A report of an incident shall be made without delay to the fullest extent possible in accordance with the provisions of Protocol I to the present Convention.
  2) Each Party to the Convention shall:
     a) make all arrangements necessary for an appropriate officer or agency to receive and process all reports on incidents; and
     b) notify the Organization with complete details of such arrangements for circulation to other Parties and Member States of the Organization.
  3) Whenever a Party receives a report under the provisions of the present article, that Party shall relay the report without delay to:
     a) the Administration of the ship involved; and
     b) any other State which may be affected.
  4) Each Party to the Convention undertakes to issue instructions to its maritime inspection vessels and aircraft and to other appropriate services, to report to its authorities any incident referred to in Protocol I to the present Convention. That Party shall, if it considers it appropriate, report accordingly to the Organization and to any other Party concerned.
- **Article 9.** Other treaties and interpretation
  1) Upon its entry into force, the present Convention supersedes the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended, as between Parties to that Convention.
  2) Nothing in the present Convention shall prejudice the codification and development of the law of the sea by the United Nations Conference on the Law of the Sea convened pursuant to resolution 2750 C(XXV) of the General Assembly of the United Nations nor the present or future claims and legal views of any State concerning the law of the sea and the nature and extent of coastal and flag State jurisdiction.
  3) The term jurisdiction in the present Convention shall be construed in the light of international law in force at the time of application or interpretation of the present Convention.
- **Article 10.** Settlement of disputes: Any dispute between two or more Parties to the Convention concerning the interpretation or application of the present Convention shall, if settlement by negotiation between the Parties involved has not been possible, and if these Parties do not otherwise agree, be submitted upon request of any of them to arbitration as set out in Protocol II to the present Convention.
- **Article 11.** Communication of information
  1) The Parties to the Convention undertake to communicate to the Organization:
     a. the text of laws, orders, decrees and regulations and other instruments which have been promulgated on the various matters within the scope of the present Convention;

b. a list of non-governmental agencies which are authorized to act on their behalf in matters relating to the design, construction and equipment of ships carrying harmful substances in accordance with the provisions of the regulations;
c. a sufficient number of specimens of their certificates issued under the provisions of the regulations;
d. a list of reception facilities including their location, capacity and available facilities and other characteristics;
e. official reports or summaries of official reports in so far as they show the results of the application of the present Convention; and
f. an annual statistical report, in a form standardized by the Organization, of penalties actually imposed for infringement of the present Convention.

2) The Organization shall notify Parties of the receipt of any communications under the present article and circulate to all Parties any information communicated to it under subparagraphs (1)(b) to (f) of the present article.

- **Article 12.** Casualties to ships

1) Each Administration undertakes to conduct an investigation of any casualty occurring to any of its ships subject to the provisions of the regulations if such casualty has produced a major deleterious effect upon the marine environment.
2) Each Party to the Convention undertakes to supply the Organization with information concerning the findings of such investigation, when it judges that such information may assist in determining what changes in the present Convention might be desirable.

- **Article 13.** Signature, ratification, acceptance, approval and accession

1) The present Convention shall remain open for signature at the Headquarters of the Organization from 15 January 1974 until 31 December 1974 and shall thereafter remain open for accession. States may become Parties to the present Convention by:
   a. signature without reservation as to ratification, acceptance or approval; or
   b. signature subject to ratification, acceptance or approval, followed by ratification, acceptance or approval; or
   c. accession.
2) Ratification, acceptance, approval or accession shall be effected by the deposit of an instrument to that effect with the Secretary-General of the Organization.
3) The Secretary-General of the Organization shall inform all States which have signed the present Convention or acceded to it of any signature or of the deposit of any new instrument of ratification, acceptance, approval or accession and the date of its deposit.

- **Article 14.** Optional annexes

1) A State may at the time of signing, ratifying, accepting, approving or acceding to the present Convention declare that it does not accept any one or all of Annexes III, IV and V (hereinafter referred to as “Optional Annexes”) of the present Convention. Subject to the above, Parties to the Convention shall be bound by any Annex in its entirety.
2) A State which has declared that it is not bound by an Optional Annex may at any time accept such Annex by depositing with the Organization an instrument of the kind referred to in article 13(2).
3) A State which makes a declaration under paragraph (1) of the present article in respect of an Optional Annex and which has not subsequently accepted that Annex in accordance with paragraph (2) of the present article shall not be under any obligation nor entitled to claim any privileges under the present Convention in respect of matters related to such Annex and all references to Parties in the present Convention shall not include that State in so far as matters related to such Annex are concerned.

4) The Organization shall inform the States which have signed or acceded to the present Convention of any declaration under the present article as well as the receipt of any instrument deposited in accordance with the provisions of paragraph (2) of the present article.

- **Article 16.** Amendments
  1) The present Convention may be amended by any of the procedures specified in the following paragraphs.
  2) Amendments after consideration by the Organization:
     a. any amendment proposed by a Party to the Convention shall be submitted to the Organization and circulated by its Secretary-General to all Members of the Organization and all Parties at least six months prior to its consideration;
     b. any amendment proposed and circulated as above shall be submitted to an appropriate body by the Organization for consideration;
     c. Parties to the Convention, whether or not Members of the Organization, shall be entitled to participate in the proceedings of the appropriate body;
     d. amendments shall be adopted by a two-thirds majority of only the Parties to the Convention present and voting;
     e. if adopted in accordance with subparagraph (d) above, amendments shall be communicated by the Secretary-General of the Organization to all the Parties to the Convention for acceptance;
     f. an amendment shall be deemed to have been accepted in the following circumstances:
        - an amendment to an article of the Convention shall be deemed to have been accepted on the date on which it is accepted by two thirds of the Parties, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet;
        - an amendment to an Annex to the Convention shall be deemed to have been accepted in accordance with the procedure specified in subparagraph (f)(iii) unless the appropriate body, at the time of its adoption, determines that the amendment shall be deemed to have been accepted on the date on which it is accepted by two thirds of the Parties, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet. Nevertheless, at any time before the entry into force of an amendment to an Annex to the Convention, a Party may notify the Secretary-General of the Organization that its express approval will be necessary before the amendment enters into force for it. The latter shall bring such notification and the date of its receipt to the notice of Parties;
        - an amendment to an appendix to an Annex to the Convention shall be deemed to have been accepted at the end of a period to be determined by the appropriate body at the time of its adoption, which period shall be not less than ten months, unless within that period an objection is communicated to the Organization by not less than one third of the Parties or by the Parties the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet whichever condition is fulfilled;
        - an amendment to Protocol II to the Convention shall be subject to the same procedures as for the amendments to the Annexes to the Convention, as provided for in subparagraphs (f)(ii) or (f)(iii) above;
        - an amendment to Protocol II to the Convention shall be subject to the same procedures as for the amendments to an article of the Convention, as provided for in subparagraph f) above;

     g. the amendment shall enter into force under the following conditions:

- in the case of an amendment to an article of the Convention, to Protocol II, or to Protocol I or to an Annex to the Convention not under the procedure specified in subparagraph (f)(iii), the amendment accepted Article 16 13 in conformity with the foregoing provisions shall enter into force six months after the date of its acceptance with respect to the Parties which have declared that they have accepted it;
- in the case of an amendment to Protocol I, to an appendix to an Annex or to an Annex to the Convention under the procedure specified in subparagraph (f)(iii), the amendment deemed to have been accepted in accordance with the foregoing conditions shall enter into force six months after its acceptance for all the Parties with the exception of those which, before that date, have made a declaration that they do not accept it or a declaration under subparagraph (f)(ii), that their express approval is necessary.

3) Amendment by a Conference:
   a. Upon the request of a Party, concurred in by at least one third of the Parties, the Organization shall convene a Conference of Parties to the Convention to consider amendments to the present Convention.
   b. Every amendment adopted by such a Conference by a twothirds majority of those present and voting of the Parties shall be communicated by the Secretary-General of the Organization to all Contracting Parties for their acceptance.
   c. Unless the Conference decides otherwise, the amendment shall be deemed to have been accepted and to have entered into force in accordance with the procedures specified for that purpose in paragraph (2)(f) and (g) above.
   a. In the case of an amendment to an Optional Annex, a reference in the present article to a Party to the Convention shall be deemed to mean a reference to a Party bound by that Annex.
   b. Any Party which has declined to accept an amendment to an Annex shall be treated as a non-Party only for the purpose of application of that amendment.
4) The adoption and entry into force of a new annex shall be subject to the same procedures as for the adoption and entry into force of an amendment to an article of the Convention.
5) Unless expressly provided otherwise, any amendment to the present Convention made under this article, which relates to the structure of a ship, shall apply only to ships for which the building contract is placed, or in the absence of a building contract, the keel of which is laid, on or after the date on which the amendment comes into force.
6) Any amendment to a Protocol or to an Annex shall relate to the substance of that Protocol or Annex and shall be consistent with the articles of the present Convention.
7) The Secretary-General of the Organization shall inform all Parties of any amendments which enter into force under the present article, together with the date on which each such amendment enters into force.
8) Any declaration of acceptance or of objection to an amendment under the present article shall be notified in writing to the Secretary-General of the Organization. The latter shall bring such notification and the date of its receipt to the notice of the Parties to the Convention.

- **Article 17.** Promotion of technical cooperation

The Parties to the Convention shall promote, in consultation with the Organization and other international bodies, with assistance and coordination by the Executive Director of the United Nations Environment Programme, support for those Parties which request technical assistance for:

a. the training of scientific and technical personnel;

b. the supply of necessary equipment and facilities for reception and monitoring;
c. the facilitation of other measures and arrangements to prevent or mitigate pollution of the marine environment by ships; and
d. the encouragement of research; preferably within the countries concerned, so furthering the aims and purposes of the present Convention.

- **Article 18.** Denunciation
  1) The present Convention or any Optional Annex may be denounced by any Parties to the Convention at any time after the expiry of five years from the date on which the Convention or such Annex enters into force for that Party.
  2) Denunciation shall be effected by notification in writing to the Secretary-General of the Organization who shall inform all the other Parties of any such notification received and of the date of its receipt as well as the date on which such denunciation takes effect.
  3) A denunciation shall take effect 12 months after receipt of the notification of denunciation by the Secretary-General of the Organization or after the expiry of any other longer period which may be indicated in the notification.
- **Article 19.** Deposit and registration
  1) The present Convention shall be deposited with the Secretary General of the Organization who shall transmit certified true copies thereof to all States which have signed the present Convention or acceded to it.
  2) As soon as the present Convention enters into force, the text shall be transmitted by the Secretary-General of the Organization to the Secretary-General of the United Nations for registration and publication, in accordance with Article 102 of the Charter of the United Nations.

PROTOCOL OF 1978 RELATING TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973 MARPOL

- **Article 3.** Communication of information
  The text of article 11(1)(b) of the Convention is replaced by the following:
  "a list of nominated surveyors or recognized organizations which are authorized to act on their behalf in the administration of matters relating to the design, construction, equipment and operation of ships carrying harmful substances in accordance with the provisions of the regulations for circulation to the Parties for information of their officers. The Administration shall therefore notify the Organization of the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognized organizations"
- **Article 6.** Amendments
  The procedures set out in article 16 of the Convention in respect of amendments to the articles, an Annex and an appendix to an Annex of the Convention shall apply respectively to amendments to the articles, the Annex and an appendix to the Annex of the present Protocol.
- **Article 7.** Denunciation
  1. The present Protocol may be denounced by any Party to the present Protocol at any time after the expiry of five years from the date on which the Protocol enters into force for that Party.
  2. Denunciation shall be effected by the deposit of an instrument of denunciation with the Secretary-General of the Organization.
  3. A denunciation shall take effect 12 months after receipt of the notification by the Secretary-General of the Organization or after the expiry of any other longer period which may be indicated in the notification.
- **Article VIII.** Depositary
  1. The present Protocol shall be deposited with the Secretary-General of the Organization (hereinafter referred to as "the Depositary").

2. The Depositary shall:
   a. inform all States which have signed the present Protocol or acceded thereto of:
      - each new signature or deposit of an instrument of ratification, acceptance, approval or accession, together with the date thereof;
      - the date of entry into force of the present Protocol;
      - the deposit of any instrument of denunciation of the present Protocol together with the date on which it was received and the date on which the denunciation takes effect;
      - any decision made in accordance with article II (1) of the present Protocol;
   b. transmit certified true copies of the present Protocol to all States which have signed the present Protocol or acceded thereto.
3. As soon as the present Protocol enters into force, a certified true copy thereof shall be transmitted by the Depositary to the Secretariat of the United Nations for registration and publication in accordance with Article 102 of the Charter of the United Nations.

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1978 RELATING TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973. RESOLUTION MEPC.216 (63), adopted on March 2, 2012.

- Small Island Developing States may satisfy the requirements in paragraphs 1 to 3 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.
- The Government of each Party participating in the arrangement shall consult with the Organization, for circulation to the Parties of the present Convention:
  1. how the Regional Reception Facilities Plan takes into account the Guidelines;
  2. particulars of the identified Regional Ships Waste Reception Centres; and
  3. particulars of those ports with only limited facilities. 4bis Small Island
  4. Developing States may satisfy the requirements in paragraph 4 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.
- The Government of each Party participating in the arrangement shall consult with the Organization for circulation to the Parties of the present Convention:
  1. how the Regional Reception Facilities Plan takes into account the Guidelines;
  2. particulars of the identified Regional Ships Waste Reception Centres; and
  3. particulars of those ports with only limited facilities.
- Small Island Developing States may satisfy the requirements in paragraphs 1, 2 and 4 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.
- The Government of each Party participating in the arrangement shall consult with the Organization for circulation to the Parties of the present Convention:
  1. how the Regional Reception Facilities Plan takes into account the Guidelines;
  2. particulars of the identified Regional Ships Waste Reception Centres; and
  3. particulars of those ports with only limited facilities.

- Small Island Developing States may satisfy the requirements in paragraph 1 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.
- The Government of each Party participating in the arrangement shall consult with the Organization for circulation to the Parties of the present Convention:
  1. how the Regional Reception Facilities Plan takes into account the Guidelines;
  2. particulars of the identified Regional Ships Waste Reception Centres; and
  3. particulars of those ports with only limited facilities.
  4. a new paragraph 2bis is added to Regulation 8 of Annex V:1
     - Small Island Developing States may satisfy the requirements in paragraphs 1 and 2.1 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.
- The Government of each Party participating in the Arrangement shall consult with the Organization for circulation to the Parties of the present Convention:
  1. how the Regional Reception Facilities Plan takes into account the Guidelines;
  2. particulars of the identified Regional Ships Waste Reception Centres; and
  3. particulars of those ports with only limited facilities.

AMENDMENTS TO THE ANNEX TO THE PROTOCOL OF 1978 RELATING TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973. MEPC RESOLUTION 238 (65) adopted on May 17, 2013

- **Regulation 6**

  The existing text of the last sentence of paragraph 3.1 is replaced by the following:
  "Such organizations, including classification societies, shall be authorized by the Administration in accordance with the provisions of the present Convention and with the Code for Recognized Organizations (RO Code), consisting of Section 1 and Section 2 (the provisions of which shall be treated as mandatory) and Section 3 (the provisions of which shall be treated as recommendatory), as adopted by the Organization by resolution MEPC.237(65), as may be amended by the Organization, provided that:
  1. amendments to Section 1 and Section 2 of the RO Code are adopted, brought into force and take effect in accordance with the provisions of article 16 of the present Convention concerning the amendment procedures applicable to this annex;
  2. amendments to Section 3 of the RO Code are adopted by the Marine Environment Protection Committee in accordance with its Rules of Procedure; and;
  3. Any amendments referred to in .1 and .2, adopted by the Maritime Safety Committee and the Marine Environment Protection Committee, are identical and enter into force or become effective simultaneously, as appropriate."

Amendments to Annex II of the MARPOL Convention

- **Regulation 8**

  The existing text of paragraph 2.2 is replaced by the following:
  "Such organizations, including classification societies, shall be authorized by the Administration in accordance with the provisions of the present Convention and with the Code for Recognized Organizations (RO Code), consisting of Section 1 and Section 2 (the provisions of which shall be treated as mandatory) and Section 3 (the

provisions of which shall be treated as recommendatory), as adopted by the Organization by resolution MEPC.237(65), as may be amended by the Organization, provided that:

1. amendments to Section 1 and Section 2 of the RO Code are adopted, brought into force and take effect in accordance with the provisions of article 16 of the present Convention concerning the amendment procedures applicable to this annex;
2. amendments to Section 3 of the RO Code are adopted by the Marine Environment Protection Committee in accordance with its Rules of Procedure; and
3. any amendments referred to in .1 and .2 adopted by the Maritime Safety Committee and the Marine Environment Protection Committee are identical and come into force or take effect at the same time, as appropriate"

AMENDMENTS TO THE ANNEX TO THE PROTOCOL OF 1978 RELATING TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973. RESOLUTION MEPC.246 (66) adopted April 4, 2014

Rule 1.

- 35 Audit means a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.
- 36 Audit Scheme means the IMO Member State Audit Scheme established by the Organization and taking into account the guidelines developed by the Organization*
- 37 Code for Implementation means the IMO Instruments Implementation Code (III Code) adopted by the Organization by resolution A.1070(28).
- 38 Audit Standard means the Code for Implementation."

Regulation 44: Application

- Parties shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in this Annex.

Regulation 45: Verification of compliance

- Every Party shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of this Annex.
- The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization*.
- Every Party shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines developed by the Organization*.
- Audit of all Parties shall be: based on an overall schedule developed by the Secretary-General of the Organization, taking into account the guidelines developed by the Organization.

The following is added at the end of regulation 1:

- 18 Audit means a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.
- 19 Audit Scheme means the IMO Member State Audit Scheme established by the Organization and taking into account the guidelines developed by the Organization*
- 20 *Code for Implementation* means the IMO Instruments Implementation Code (III Code) adopted by the Organization by resolution A.1070(28).
- 21 *Audit Standard* means the Code for Implementation.

Regulation 19: Application

- Parties shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in this Annex.

Regulation 20: Verification of compliance

- Every Party shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of this Annex.
- The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization.
- Every Party shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines adopted by the Organization.
- Audit of all Parties shall be:
  1. based on an overall schedule developed by the Secretary-General of the Organization, taking into account the guidelines developed by the Organization; and
  2. conducted at periodic intervals, taking into account the guidelines developed by the Organization.

Regulation 10: Application

- Parties shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in this Annex.

Regulation 11: Verification of compliance

- Every Party shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of this Annex.
- The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization.
- Every Party shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines developed by the Organization.
- Audit of all Parties shall be:
  1. based on an overall schedule developed by the Secretary General of the Organization, taking into account the guidelines developed by the Organization; and
  2. conducted at periodic intervals, taking into account the guidelines developed by the Organization.

Regulation 15: Application

- Parties shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in this Annex.

Regulation 16: Verification of compliance

- Every Party shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of this annex.
- The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization.
- Every Party shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines developed by the Organization.

4.2.2. UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

To approve the United Nations Convention on the Law of the Sea (CONVEMAR) with the Declaration of Ecuador at the time of its accession to the United Nations Convention

on the Law of the Sea. Given and subscribed at the seat of the National Assembly, located in the Metropolitan District of Quito, province of Pichincha, on the twenty-second day of the month of May of the year two thousand twelve. Given by Legislative Resolution No. 00, published in Official Gazette Supplement 715 dated June 1, 2012.

- **Article 1.** Ratify the accession to the United Nations Convention on the Law of the Sea (UNCLOS), signed on December 10, 1982, with the Declaration made by the National Assembly.

SECTION II TERRITORIAL SEA AND CONTIGUOUS ZONE ARTICLE 1. GENERAL PROVISIONS

- **Article 2.** Legal status of the territorial sea, of the air space over the territorial sea and of its bed and subsoil. 1. The sovereignty of a coastal State extends, beyond its land territory and internal waters and, in the case of an archipelagic State, its archipelagic waters, to an adjacent belt of sea, described as the territorial sea. 2. This sovereignty extends to the air space over the territorial sea as well as to its bed and subsoil. 3. The sovereignty over the territorial sea is exercised subject to this Convention and to other rules of international law.

ARTICLE 2. LIMITS OF THE TERRITORIAL SEA

- **Article 3.** Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with this Convention.
- **Article 10.** Bays
  1. This article relates only to bays the coasts of which belong to a single State.
  2. For the purposes of this Convention, a bay is a well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain land-locked waters and constitute more than a mere curvature of the coast. An indentation shall not, however, be regarded as a bay unless its area is as large as, or larger than, that of the semi-circle whose diameter is a line drawn across the mouth of that indentation.
  3. For the purpose of measurement, the area of an indentation is that lying between the low-water mark around the shore of the indentation and a line joining the low-water mark of its natural entrance points. Where, because of the presence of islands, an indentation has more than one mouth, the semi-circle shall be drawn on a line as long as the sum total of the lengths of the lines across the different mouths. Islands within an indentation shall be included as if they were part of the water area of the indentation.
  4. If the distance between the low-water marks of the natural entrance points of a bay does not exceed 24 nautical miles, a closing line may be drawn between these two low-water marks, and the waters enclosed thereby shall be considered as internal waters.
- **Article 11 - Ports.** For the purpose of delimiting the territorial sea, the outermost permanent harbour works which form an integral part of the harbour system are regarded as forming part of the coast. Off-shore installations and artificial islands shall not be considered as permanent harbour works.
- **Article 12 - Roadsteads.** Roadsteads which are normally used for the loading, unloading and anchoring of ships, and which would otherwise be situated wholly or partly outside the outer limit of the territorial sea, are included in the territorial sea.

4.2.3. LONDON CONVENTION: CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER, 1972

- **Article 1.** Contracting Parties shall individually and collectively promote the effective control of all sources of pollution of the marine environment, and pledge themselves

specially to take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

- **Article 2.** Contracting Parties shall, as provided for in the following articles, take effective measures individually, according to their scientific, technical and economic capabilities, and collectively, to prevent marine pollution caused by dumping and shall harmonize their policies in this regard.
- **Article 3.** For the purposes of this Convention:
  a) "Dumping" means:
     - any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea;
     - any deliberate disposal at sea of vessels, aircraft, platforms or other manmade structures at sea.
  b) "Dumping" does not include:
     - the disposal at sea of wastes or other matter incidental to, or derived from the normal operations of vessels, aircraft, platforms or other man-made structures at sea and their equipment, other than wastes or other matter transported by or to vessels, aircraft, platforms or other man-made structures at sea, operating for the purpose of disposal of such matter or derived from the treatment of such wastes or other matter on such vessels, aircraft, platforms or structures;
     - placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention.
  c) The disposal of wastes or other matter directly arising from, or related to the exploration, exploitation and associated off-shore processing of sea-bed mineral resources will not be covered by the provisions of this Convention.

  1. "Vessels and aircraft" means waterborne or airborne craft of any type whatsoever. This expression includes air cushioned craft and floating craft, whether self-propelled or not.
  2. Sea" means all sea waters other than the internal waters of States.
  3. "Wastes or other matter" means material and substance of any kind, form or description.
  4. "Special permit" means permission granted specifically on application in advance and in accordance with Annex II and Annex III.
  5. "General permit" means permission granted in advance and in accordance with Annex III.
  6. "The Organization" means the Organization designated by the Contracting Parties in accordance with article XIV.
- **Article 4.**
  1. In accordance with the provisions of this Convention Contracting Parties shall prohibit the dumping of any wastes or other matter in whatever form or condition except as otherwise specified below:
     a) the dumping of wastes or other matter listed in Annex I is prohibited;
     b) the dumping of wastes or other matter listed in Annex II requires a prior special permit;
     c) the dumping of all other wastes or matter requires a prior general permit.
  2. Any permit shall be issued only after careful consideration of all the factors set forth in Annex III, including prior studies of the characteristics of the dumping site, as set forth in sections B and C of that Annex.
  3. No provision of this Convention is to be interpreted as preventing a Contracting Party from prohibiting, insofar as that Party is concerned, the dumping of wastes or other matter not mentioned in Annex I. That Party shall notify such measures to the Organization.

The purpose of the London Convention is to promote the effective control of all sources of pollution of the marine environment and the adoption of all practicable measures to prevent pollution of the sea by dumping of wastes and other matter. There are currently 87 States Parties to the Convention, including Spain, and the Secretariat of the Convention is hosted by the International Maritime Organization, based in London.
Unlike the OSPAR and Barcelona Conventions, the London Convention deals only with dumping from ships and not with those that reach the sea from land.
In 1996, the "Protocol to the London Convention" was adopted to modernize the Convention, which entered into force in March 2006. The '72 Convention establishes a list of substances and products that may not be dumped at sea, but under the new Protocol, the procedure known as the "reverse list" is established, i.e., all wastes are prohibited from being dumped at sea with the sole exception of those included in the list that constitutes Annex I of the Protocol.

Therefore, only the following materials are susceptible to dumping:

1. Dredging material
2. Sewage sludge
3. Dumping of fish discards or materials resulting from fish handling operations.
4. Vessels and platforms, or other offshore structures
5. Inorganic inert geological materials
6. Organic matter of natural origin
7. Harmless bulky items generated in isolated facilities (such as small islands) without the possibility of other disposal options

Subsequently, in 2007, amendments were approved to include a new category of material suitable for dumping at sea, CO2 streams for sequestration in submarine geological structures.
This amending protocol also incorporates the advances and prescriptions originating from the Rio de Janeiro Conference (1992) and the precautionary and polluter-pays principles, as well as prohibiting incineration at sea and the export of waste.
Within the scope of the Protocol, "General Guidelines" and "Specific Guidelines" have been drafted for some of the wastes that are allowed to be dumped. They detail in detail the procedures for waste assessment, selection of the disposal area, monitoring and characterization procedures, etc.

4.2.4. BASEL CONVENTION

Article 4(2)(a) of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Disposal states that each Party shall take appropriate measures to minimize the generation of hazardous wastes and other wastes within it, taking into account social, technological and economic aspects.
Article 4(2)(b) of the Basel Convention states that each Party shall take appropriate measures to establish adequate disposal facilities for the environmentally sound management of hazardous wastes and other wastes, wherever their disposal takes place, which, as far as practicable, shall be located within it;
Article 4(2)(c) of the Basel Convention states that each Party shall ensure that persons involved in the management of hazardous wastes and other wastes within it take the necessary measures to prevent such management from giving rise to pollution and, if pollution does occur, to minimize its consequences for human health and the environment.

4.2.5. STOCKHOLM CONVENTION

- **Article 1.** Each Party shall:
  a) Prohibit and/or take the legal and administrative measures necessary to eliminate: (i) Its production and use of the chemicals listed in Annex A subject to

the provisions of that Annex; and (ii) Its import and export of the chemicals listed in Annex A in accordance with the provisions of paragraph 2; and

b) Restrict its production and use of the chemicals listed in Annex B in accordance with the provisions of that Annex.

- **Article 2.** Paragraph a. Protect human health and the environment by taking the necessary measures to minimize or prevent releases;

4.2.6. ROTTERDAM CONVENTION

- **Article 1.** The objective of this Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties.

4.2.7. AGENDA 21

The United Nations Conference on Environment and Development, held in Rio de Janeiro in June 1992, adopted "Agenda 21", which consists of a broad set of action plans on sustainable development to be implemented by the countries in the 21st century. The Rio Declaration, the Declaration on Forest Principles and the United Nations Framework Conventions on Biological Diversity, Climate Change and Combating Desertification were also adopted at the Conference.

4.2.8. CONVENTION ON BIOLOGICAL BIODIVERSITY

The Convention is the first comprehensive global agreement to address all aspects of biological diversity: genetic resources, species and ecosystems. It recognizes, for the first time, that biodiversity conservation is "a common concern of humankind" and an integral part of the development process.

The objectives of the Convention on Biological Diversity are "the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilization of genetic resources".

4.2.9. KYOTO PROTOCOL

The Kyoto Protocol on climate change is an international agreement that aims to reduce emissions of six global warming gases: carbon dioxide (CO_2), methane gas (CH_4) and nitrous oxide (N_2O), as well as three fluorinated industrial gases: hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6), by approximately 5 percent between 2008 and 2012, compared to 1990 emissions.

4.2.10. FRAMEWORK CONVENTION ON CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in New York on May 9, 1992 and entered into force on March 21, 1994. Among other things, it strengthens global public awareness of climate change issues.

In 1997, governments agreed to incorporate an addition to the treaty, known as the Kyoto Protocol, with stronger (and legally binding) measures.

In 2006, this Protocol was amended in Nairobi to the United Nations Framework Convention on Climate Change and a new protocol was scheduled to be adopted in 2009 in Copenhagen, which had to be delayed and moved to Mexico in 2010. The objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system and within a time frame sufficient to allow ecosystems to adapt naturally to climate change, ensuring that food production is not threatened and allowing economic development to proceed in a sustainable manner.

In defining this objective, it is important to highlight two aspects:

1) The concentration levels of GHGs that are considered dangerous anthropogenic interference in the climate system are not determined, thus recognizing that at that time there was no scientific certainty as to what should be understood as non-dangerous levels.
2) It is suggested that climate change is already inevitable and therefore, not only preventive actions (to slow down climate change), but also adaptation to the new climatic conditions must be addressed.

4.3. LAWS

4.3.1. ENVIRONMENTAL MANAGEMENT ACT

Published in the RO, supplement No. 418 dated September 10, 2004. Prior to its current codified status, the issuance of the Environmental Management Act (D.L. No. 99-37: 22-07-99 R.O. No. 245: 30-O7-99) regulates for the first time the environmental management of the State, and gives a new institutional structuring. In addition, it establishes the principles and guidelines of an environmental policy, determining the obligations of the public and private sectors in environmental management, and establishes the permissible limits, controls and sanctions in this matter.

TITLE I: SCOPE AND PRINCIPLES OF ENVIRONMENTAL MANAGEMENT

- **Article 1.** This Act establishes the principles and guidelines of environmental policy; determines the obligations, responsibilities, levels of participation of the public and private sectors in environmental management and establishes the permissible limits, controls and sanctions in this matter.
- **Article 2.** Environmental management is subject to the principles of solidarity, co-responsibility, cooperation, coordination, recycling and reuse of waste, use of environmentally sustainable alternative technologies and respect for traditional cultures and practices.

TITLE II. INSTITUTIONAL ENVIRONMENTAL MANAGEMENT SYSTEM
CHAPTER I. SUSTAINABLE DEVELOPMENT

- **Articles 7 and 8.** Sustainable development is established as a principle for the conservation of the Natural Assets and the sustainable use of natural resources. The Ministry of the Environment is established as the national environmental authority, acting as the governing, coordinating and regulatory body of the "Decentralized Environmental Management System". This regulatory institution must, among other things, determine the works, projects and investments that require approved environmental impact studies.

CHAPTER IV. PARTICIPATION OF STATE INSTITUTIONS

The various state agencies and sectoral entities are actively involved in the decentralization of environmental management, as evidenced by the fact that the Ministry of the Environment assigns responsibility for executing plans to all state institutions involved in environmental issues. Currently, municipalities act in this field by issuing environmental ordinances. With this measure, the State hopes to broaden its scope of action and improve its effectiveness.

TITLE III: ENVIRONMENTAL MANAGEMENT INSTRUMENTS
CHAPTER II. ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL CONTROL

- **Article 19.** Private or mixed public works and public or private investment projects that may cause environmental impacts shall be qualified prior to their execution, by the decentralized control agencies, in accordance with the Consolidated Environmental Management System, whose guiding principle shall be precautionary.

- **Article 21.** The environmental management systems shall include baseline studies; environmental impact assessment; risk assessment; management plans; risk management plans; monitoring systems; contingency and mitigation plans; environmental audits and abandonment plans. Once these requirements have been met and according to the qualification of the same, the Ministry may grant or deny the corresponding license.
- **Article 22.** The environmental management systems in the contracts that require environmental impact studies and in the activities for which an environmental license has been granted, may be evaluated at any time, at the request of the Ministry of the branch of the affected persons".
- **Article 23.** The environmental impact assessment shall include:
  a) The estimate of the effects caused to the human population, biodiversity, soil, air, water, landscape and the structure and function of the ecosystems present in the foreseeably affected area;
  b) The conditions of public order, such as: noise, vibrations, odours, luminous emissions, thermal changes and any other environmental detriment derived from its execution, and,
  c) The impact that the project, work or activity will have on the elements that make up the historical, scenic and cultural heritage.
- **Article 28.** Establishes that citizens have the right to participate in environmental management, through consultations, public hearings, initiatives, proposals or any form of association between the public and private sectors. Article 29 also states that citizens have the right to be timely and sufficiently informed about any activity that may cause environmental impacts. At the same time, RO. 1040 was issued.

CHAPTER V: INSTRUMENTS FOR THE APPLICATION OF ENVIRONMENTAL REGULATIONS

- **Article 33.** The following are established as instruments for the enforcement of environmental regulations: environmental quality parameters, effluent and emission regulations, technical product quality standards, administrative permits and licenses, environmental impact assessments, lists of polluting and harmful products for human health and the environment, certifications of environmental quality of products and services and others that shall be regulated in the respective regulations.
- **Article 34.** Contributions and fines for environmental protection and sustainable use of natural resources, as well as risk insurance and deposit systems, shall also serve as instruments for the enforcement of environmental norms, and may be used to encourage actions favourable to environmental protection.

TITLE V: ENVIRONMENTAL INFORMATION AND SURVEILLANCE

- **Article 40.** Any individual or legal entity who, in the course of its business or industrial activities, establishes that it may produce or is producing environmental damage to ecosystems, is obliged to report this to the Ministry of the branch or to the institutions of the autonomous sectional regime.

TITLE VI: PROTECTION OF ENVIRONMENTAL RIGHTS

- **Article 41.** In order to protect individual or collective environmental rights, public action shall be granted to individuals, legal entities or human groups to denounce the violation of environmental regulations, without prejudice to the action of constitutional protection provided for in the Political Constitution of the Republic"**.**

CHAPTER I. CIVIL ACTIONS

- **Article 43.** Individuals or legal entities or human groups linked by a common interest and directly affected by the damaging action or omission may file before the

competent Judge, actions for damages and losses and for the deterioration caused to health or the environment, including biodiversity with its constituent elements.

CHAPTER II. ADMINISTRATIVE AND CONTENTIOUS-ADMINISTRATIVE ACTIONS

- **Article 46.** When the individuals, by action or omission fail to comply with the environmental protection norms, the competent authority shall adopt the sanctions foreseen in this Law, and the following administrative measures: It shall demand the regularization of the authorizations, permits, studies and evaluations; as well as it shall verify the compliance of the measures adopted to mitigate and compensate environmental damages, within a term of thirty days.

4.3.2. ACT ON THE PREVENTION AND CONTROL OF ENVIRONMENTAL POLLUTION

CHAPTER I: AIR POLLUTION PREVENTION AND CONTROL

- **Article 1.** It is prohibited to expel into the atmosphere or discharge into it, without being subject to the corresponding technical standards and regulations, pollutants which, in the judgment of the Ministries of Health and Environment, in their respective areas of competence, may harm human health and life, flora, fauna and the resources or property of the State or of private individuals, or constitute a nuisance.
- **Article 2.** For the purposes of this Law, the following shall be considered as potential sources of air pollution:
  a) Artificial, originated by technological development and human action, such as factories, boilers, steam generators, workshops, thermoelectric plants, oil refineries, chemical plants, airplanes, automobiles and similar, incineration, open burning of garbage and waste, exploitation of construction materials and other activities that produce or may produce contamination; and,
- **Article 5.** The public or private institutions interested in the installation of industrial projects, or others that could cause alterations in the ecological systems and that produce or could produce air pollution, shall submit to the Ministries of Health and Environment, as appropriate, for their prior approval, studies on the environmental impact and the control measures to be applied.

CHAPTER II: WATER POLLUTION PREVENTION AND CONTROL

- **Article 6.** It is forbidden to discharge, without being subject to the corresponding technical standards and regulations, into sewage networks, or into streams, ditches, rivers, natural or artificial lakes, or sea waters, as well as to infiltrate into land, wastewater containing pollutants that are harmful to human health, fauna, flora and properties.

CHAPTER III: SOIL POLLUTION PREVENTION AND CONTROL

- **Article 10.** It is prohibited to discharge, without being subject to the corresponding technical standards and regulations, any type of pollutants that may alter the quality of the soil and affect human health, flora, fauna, natural resources and other assets.

4.3.3. INTERNAL ORGANIZATION ACT ON WATER RESOURCES, USES AND DEVELOPMENT

- **Article 1. Nature.** Water resources are part of the natural assets of the State and shall be under its exclusive competence, which shall be exercised concurrently between the Central Government and the Autonomous Decentralized Governments, in accordance with the Law.
- Water is a strategic national asset of public use, inalienable, imprescriptible, unseizable, and essential for life, a vital element of nature and fundamental to guarantee food sovereignty.

- **Article 2. Scope of application.** This Internal Organization Act shall apply throughout the national territory, being subject to its rules the persons, nationals or foreigners who are in it.
- **Article 3. Purpose of the Act.** The purpose of this Act is to guarantee the human right to water as well as to regulate and control the authorization, management, preservation, conservation, restoration, of water resources, use and development of water, comprehensive management and its recovery, in its different phases, forms and physical states, in order to guarantee the sumak kawsay or good living and the rights of nature established in the Constitution.
- **Article 4. Principles of the Act.** This Act is based on the following principles:
  a) The integration of all waters, whether surface, ground or atmospheric, in the hydrological cycle with ecosystems;
  b) Water, as a natural resource, must be conserved and protected through sustainable management that guarantees its permanence and quality;
  c) Water, as a public property, is inalienable, imprescriptible and unseizable;
  d) Water is a national and strategic asset at the service of the needs of citizens and an essential element for food sovereignty; consequently, any type of private ownership of water is prohibited;
  e) Access to water is a human right;
  f) The State guarantees equitable access to water;
  g) The State guarantees comprehensive, integrated and participatory water management; and,
  h) Water management is public or communal.
- **Article 5. Strategic sector.** Water constitutes national heritage, a strategic sector of exclusive decision and control of the State through the Single Water Authority. Its management shall be oriented to the full exercise of rights and the public interest, in view of its decisive social, community, cultural, political, environmental and economic influence.
- **Article 6. Prohibition of privatization.** Any form of privatization of water is prohibited, due to its importance for life, the economy and the environment; therefore, it may not be the object of any commercial agreement with any government, multilateral entity or national or foreign private company. Its management shall be exclusively public or communal. No form of appropriation or individual or collective possession of water, whatever its state, shall be recognized. Consequently, the following is prohibited:
  a) Any delegation to the private sector of water management or of any of the powers constitutionally or legally assigned to the State through the Single Water Authority or the Autonomous Decentralized Governments;
  b) Indirect management, delegation or outsourcing of the provision of public services related to the full water cycle by private initiative;
  c) Any commercial agreement imposing a profit-based economic regime for water management;
  d) Any form of commodification of environmental services over water for profit;
  e) Any form of agreement or cooperation agreement that includes clauses that undermine conservation, sustainable water management, biodiversity, human health, the human right to water, food sovereignty, human rights and the rights of nature; and,
  f) The granting of perpetual or indefinite authorizations for the use or development of water.
- **Article 7. Activities in the strategic water sector.** The provision of the public water service is exclusively public or communal. Exceptionally, the private initiative and the social and inclusive economy may participate in the following cases:
  a) Declaration of emergency adopted by the competent authority, in accordance with the legal system; or,

b) Development of sub-processes of the public service administration when the competent authority does not have the technical or financial conditions to do so. The maximum term will be ten years, subject to audit.

- **Article 8. Comprehensive management of water resources.** The Single Water Authority is responsible for the integrated and comprehensive management of water resources with an eco-systemic approach and by river basin or river basin systems, which shall be coordinated with the different levels of government according to their areas of competence.
  A river basin is defined as the territorial unit delimited by the dividing line of its waters that drain superficially into a common channel, including populations, infrastructure, conservation and protection areas, and productive zones.
  Where groundwater boundaries do not coincide with the surface water boundary line, such delineation shall include the projection of groundwater recharge water flowing into the surface bounded basin.
  The Single Water Authority will approve the specific delimitation of river basins and their possible grouping for planning and management purposes, as well as the allocation of groundwater to the corresponding basin.
  The integrated and comprehensive management of water resources will be a crosscutting axis of the decentralized national system of participatory planning for development.
- **Article 9.** Guarantee of rights and public policies. The State shall allocate in an equitable and supportive manner the public budget for the execution of policies and provision of public services in accordance with the Law.
- **Article 57. Definition.** The human right to water is the right of all persons to have access to clean, sufficient, safe, acceptable, accessible and affordable water for personal and domestic use in quantity, quality, continuity and coverage. This right includes access to environmental sanitation that ensures human dignity, health, avoids contamination, and guarantees the quality of water supplies for human consumption.
  The human right to water is fundamental and inalienable. No person can be deprived and excluded or deprived of this right.
  The exercise of the human right to water shall be sustainable, so that it can be exercised by future generations. The Single Water Authority shall define quality water reserves for the human consumption of present and future generations and shall be responsible for the execution of policies related to the effectiveness of the human right to water.
- **Article 58. Enforceability of the human right to water.** Individuals, communities, peoples, nationalities, groups, and communities may demand from the corresponding authorities the compliance with and observance of the human right to water, which shall attend to their requests as a matter of priority and progressively. The authorities that fail to comply with the exercise of this right shall be subject to sanctions in accordance with the law.
- **Article 59. Vital amount and minimum fees.** The Single Water Authority shall establish, in accordance with national and international standards and guidelines, the vital amount of water per person, to meet their basic needs and domestic use, access to which constitutes the essential content of the human right to water.
  The vital amount of raw water intended for processing for human consumption is free of charge as a guarantee of the human right to water. When it exceeds the minimum vital quantity established, the corresponding fee will be applied. The vital amount of processed water per person will have a tariff that guarantees the sustainability of the provision of the service.
- **Article 60. Free access to and use of water.** The human right to water implies free access to and use of surface or groundwater for human consumption, provided that it is not diverted from its course or discharged, nor is there any alteration in its

quality or significant decrease in its quantity, nor does it affect the rights of third parties, and in accordance with the limits and parameters established by the National Environmental Authority and the Single Water Authority. The Single Water Authority shall keep a record of the use of groundwater for human consumption.

CHAPTER III: RIGHTS OF NATURE

- **Article 64. Conservation of water.** Nature or *Pacha Mama* has the right to the conservation of water with its properties as an essential support for all forms of life. In the conservation of water, nature has the right to:
  a) The protection of its sources, catchment areas, regulation, recharge, upwelling and natural watercourses, particularly snow-capped mountains, glaciers, moorlands, wetlands and mangroves;
  b) The maintenance of the ecological flow as a guarantee of preservation of ecosystems and biodiversity;
  c) The preservation of the natural dynamics of the comprehensive water cycle or hydrological cycle;
  d) The protection of river basins and ecosystems from pollution; and,
  e) The restoration and recovery of ecosystems as a result of imbalances caused by water pollution and soil erosion.
- **Article 65. Integrated water management.** Water resources shall be managed in an integrated and comprehensive manner, with an eco-systemic approach that guarantees biodiversity, sustainability and their preservation in accordance with the provisions of the Regulations of this Law.

CHAPTER V: COLLECTIVE RIGHTS OF COMMUNES, COMMUNITIES, PEOPLES AND NATIONALITIES

- **Article 71. Collective rights over water.** The indigenous communes, communities, peoples and nationalities, Afro-Ecuadorian and Montubio peoples, from their own worldview, enjoy the following collective rights over water:
  a) Preserve and protect the water that flows through their lands and territories where they live and develop their collective life;
  b) Participate in the use, usufruct and community management of the water that flows through their lands and territories and is necessary for the development of their collective life;
  c) Conserve and protect their water management practices in direct relation to the right to health and food;
  d) Maintain and strengthen their spiritual relationship with Water
  e) Safeguard and disseminate their collective knowledge, sciences, technologies and ancestral knowledge about water;
  f) Be consulted in a mandatory, prior, free, informed manner and within a reasonable period of time, on any relevant regulatory decision or state authorization that may affect the management of water flowing through their lands and territories;
  g) Participate in the formulation of environmental impact studies on activities that affect ancestral uses and forms of water management in their lands and territories;
  h) Have access to accurate and complete water information within a reasonable time; and,
  i) Participate in the social control of any public or private activity susceptible to generate impact or affections on the ancestral uses and forms of water management in their properties and territories. The communes, communities, peoples and nationalities shall exercise these rights through their representatives under the terms provided in the Political Constitution and the law.

- **Article 72. Participation in water conservation.** The communes, communities, peoples and nationalities have the right that the State, through its institutions, articulate policies and programs for the conservation, protection and preservation of the water that flows through their lands and territories. The exercise of this right shall not prevail nor shall it imply any impairment of the State's powers over water.
- **Article 73. Use, usufruct and community management of water.** The communes, communities, peoples and nationalities have the right to participate in the use, usufruct and community management of the water flowing through their lands and territories as a means to strengthen their identity, culture, traditions and rights, in accordance with the legal system. For this purpose, through the representatives of their organizations and in accordance with this Law, they shall participate in the comprehensive planning and community management of the water flowing through their lands and territories, as well as form part of the organizations that are established in the basins in which their lands and territories are located.
- **Article 74. Conservation of water management practices.** The application of traditional forms of administration and management of the hydrological cycle, practiced by indigenous communes, communities, peoples and nationalities, Afro-Ecuadorian and Montubio peoples and nationalities is guaranteed, and their own forms, uses and customs for the internal distribution and distribution of authorized water flows are respected.

CHAPTER VI: PREVENTIVE GUARANTEES

Section One: Ecological Flow and Water Protection Areas

- **Article 76. Ecological flow.** For the purposes of this Law, ecological flow is the quantity of water, expressed in terms of magnitude, duration, time and frequency of the specific flow and the quality of water expressed in terms of range, frequency and duration of the concentration of parameters required to maintain an adequate level of health in the ecosystem. The Single Water Authority in coordination with the National Environmental Authority shall establish by regulation the criteria, parameters and methodologies for the determination of the ecological flow according to the conditions and characteristics of the water bodies, which shall be considered within the national water planning.
- **Article 73. Use, usufruct and community management of water.** The communes, communities, peoples and nationalities have the right to participate in the communal use, usufruct and management of the water flowing through their lands and territories as a means to strengthen their identity, culture, traditions and rights, in accordance with the legal system.
  For this purpose, through the representatives of their organizations and in accordance with this Law, they shall participate in the comprehensive planning and community management of the water flowing in their lands and territories, as well as form part of the organizations that are established in the basins in which their lands and territories are located.
- **Article 74. Conservation of water management practices.** The application of traditional forms of management and management of the hydrological cycle, practiced by communes, communities, indigenous peoples and nationalities, Afro-Ecuadorian and Montubio peoples and nationalities is guaranteed, and their own forms, uses and customs for the internal distribution and distribution of authorized water flows are respected.
- **Article 78. Water protection areas.** Water protection areas are those territories where there are water sources declared to be of public interest for their maintenance, conservation and protection, which supply human consumption or guarantee food sovereignty, which shall be part of the National System of Protected Areas.
  The Single Water Authority, following a technical report issued by the National Environmental Authority and in coordination with the Decentralized Autonomous

Governments within the scope of their competencies, shall establish and delimit the water protection areas necessary for the maintenance and conservation of the public water domain.

The use of water protection areas shall be regulated by the State to guarantee their adequate management. The protection regime established for water protection areas shall respect the spiritual uses of peoples and nationalities. The Regulations of this Law shall determine the procedure for establishing these water protection areas, as long as they are not wetlands, forests and protective vegetation.

When soil use affects the protection and conservation of water resources, the Single Water Authority, in coordination with the Decentralized Autonomous Governments and territorial districts, will establish and delimit water protection areas in order to prevent and control water pollution on riverbanks, river beds, lakes, lagoons, reservoirs, estuaries and groundwater.

Section Two
Water Pollution Prevention and Control Objectives

- **Article 79. Water prevention and conservation objectives:** The Single Water Authority, the National Environmental Authority and the Decentralized Autonomous Governments shall work in coordination to meet the following objectives:
  a) Guarantee the human right to water for good living or sumak kawsay, the recognized rights to nature and the preservation of all forms of life, in a healthy, ecologically balanced and pollution-free environment;
  b) Preserve water quantity and improve water quality;
  c) Control and prevent the accumulation in soil and subsoil of toxic substances, wastes, spills and other elements capable of contaminating surface or groundwater;
  d) Control activities that may cause degradation of water and related aquatic and terrestrial ecosystems and, when degraded, provide for their restoration;
  e) Prohibit, prevent, control and sanction water pollution by dumping or depositing solid, liquid and gaseous wastes; organic, inorganic compounds or any other toxic substance that alters water quality or affects human health, fauna, flora and the balance of life;
  f) Guarantee the integral conservation and care of the delimited water sources and the balance of the hydrological cycle; and,
  g) Avoid degradation of ecosystems related to the hydrological cycle.
- **Article 80. Dumping: prohibitions and control.** Discharges of wastewater directly or indirectly into the public water domain are considered dumping. The direct or indirect discharge of wastewater or waste products, sewage, untreated sewage and leachates susceptible of contaminating the waters of the public water domain is prohibited.

  The National Environmental Authority will exercise the control of dumping in coordination with the Single Water Authority and the Decentralized Autonomous Governments accredited in the single environmental management system. It is the responsibility of the autonomous municipal governments to treat sewage and solid waste to prevent water pollution in accordance with the law.
- **Article 81. Administrative authorization for dumping.** The authorization for dumping shall be included in the environmental permits issued for such purpose. The parameters of the quality of the water to be discharged and the procedure for the granting, suspension and revision of the authorization shall be regulated by the National Environmental Authority or accredited, in coordination with the Single Water Authority.

  The Decentralized Autonomous Governments within the scope of their competence and within their jurisdiction shall issue the administrative dumping authorization provided for in this Law subject to the public policies dictated by the National Environmental Authority.

- **Article 82. Citizen Participation and Oversight.** Individuals, peoples and nationalities and social groups may carry out oversight processes, observatories and other mechanisms for social control over water quality and pollution prevention and control plans and programs, in accordance with the Law.

CHAPTER VII: STATE OBLIGATIONS FOR THE HUMAN RIGHT TO WATER

ARTICLE ONE: OBLIGATIONS AND PROGRESSIVITY

- **Co-responsibility obligations -** The State at its different levels of government is co-responsible with users, consumers, communes, communities, peoples and nationalities for the fulfilment of the following obligations:
  a) Reduce unsustainable extraction, diversion or damming of water flows;
  b) Prevent, reduce and reverse water pollution
  c) Monitor and protect declared water reserves of optimum quality;
  d) Contribute to the analysis and study of water quality and availability;
  e) Identify and promote technologies to improve water use efficiency;
  f) Reduce water wastage during catchment, conveyance and distribution;
  g) Adopt measures for the restoration of degraded ecosystems;
  h) Support projects for the collection, storage, management and rational, efficient and sustainable use of water resources; and,
  i) Develop and promote training and scientific and technological research in the water sector.

SECTION TWO
Water Uses

- **Article 86. Water and its priority.** In accordance with the constitutional provision, the order of priority among the different uses or functions of water is:
  a) Human consumption;
  b) Irrigation that guarantees food sovereignty;
  c) Ecological flow; and,
  d) Productive activities.

  Water for irrigation that guarantees food sovereignty includes animal watering, aquaculture and other domestic agricultural and livestock food production activities, in accordance with the Regulations of this Law.
- **Article 87. Types and terms of authorizations.** The granting, suspension or cancellation of authorizations is the responsibility of the Single Water Authority. Authorizations, according to the nature of their purpose, are classified as follows:
  1. Authorizations for water use. It is the administrative act issued by the Single Water Authority by means of which it favourably attends a request submitted by natural or legal persons for the use of a water flow, intended for human consumption or irrigation that guarantees food sovereignty, also including the watering of animals and aquaculture production activities in the manner and under the conditions provided for in this Law.
  2. Authorizations for the productive use of water. It is the administrative act issued by the Single Water Authority, by means of which it favourably attends an application submitted by individuals or legal entities for the productive use of a water flow destined for any of the economic uses in the manner and under the conditions provided for in this Law.
- **Article 88. Use.** The use of water is understood as its utilization in basic activities indispensable for life, such as human consumption, irrigation, aquaculture and animal watering to guarantee food sovereignty under the terms established in the Law.
- **Article 89. Authorization of use.** The use of water as defined in the preceding Article shall be subject to the respective authorization granted in accordance with this Law, its Regulations and water planning. The authorization for the use of water

for human consumption and irrigation for food sovereignty, animal watering and aquaculture, confers to the user thereof, in an exclusive manner, the capacity for the collection, treatment, conduction and use of the flow to which the authorization refers.

- **Article 90. Conditions for granting water use authorizations.** Prior to the granting of authorizations for the use of water, the Single Water Authority shall verify compliance with the following conditions:
  a) That the order of priority established in the Constitution and this Law be respected;
  b) That the availability of water of sufficient quality and quantity has been certified. Regarding water quality, the Single Water Authority will implement the certification processes progressively;
  c) That the studies and projects of hydraulic infrastructure necessary for its use have been previously approved by the Single Water Authority;
  d) That the beneficiary is responsible for the prevention and mitigation of the environmental damages caused, and is obliged to contribute to the good management of the authorized water; and,
  e) That the use of the water is immediate or within a determined period of time for the purpose for which it was authorized according to the respective technical report.
- **Article 91. Recreational and sports use.** Recreational events and aquatic competitions involving non-consumptive use of water shall not require prior authorization from the Single Water Authority.
- **Article 92. Cultural and sacred practices.** The Single Water Authority shall guarantee the integrity and permanence of the places where communes, communities, peoples and nationalities traditionally practice water rites, cultural and sacred values.
  The Single Water Authority together with the communes, communities, peoples and nationalities shall carry out and keep duly updated a participatory and comprehensive National Inventory of sacred sites and water rituals.
  The administration and conservation of sacred sites in relation to water shall be carried out by the entities or organizations of peoples and nationalities in whose lands or territories they are located, with the support of national programs and projects of public agencies and the Decentralized Autonomous Governments, in accordance with the Constitution and their own rights.

4.3.4. INTERNAL ORGANIZATION LAW ON LAW

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CHAPTER III: RIGHTS AND DUTIES OF INDIVIDUALS AND OF THE STATE WITH REGARD TO HEALTH

- **Article 7** paragraph c) refers to the right of people to live in a healthy, ecologically balanced and pollution-free environment.

BOOK II: ENVIRONMENTAL HEALTH AND SAFETY. COMMON PROVISION

- **Article 95.** that the national sanitary authority shall coordinate with the MAE the basic rules for the preservation of the environment in matters of human health.

SINGLE TITLE: CHAPTER I. WATER FOR HUMAN CONSUMPTION

- **Article 96** establishes the obligation of any individual or legal entity to protect any aquifer, source or basin used to supply water for human consumption and prohibits any activity that may contaminate said water catchment source.

CHAPTER II: COMMON, INFECTIOUS AND SPECIAL WASTES AND IONIZING AND NON-IONIZING RADIATION

- **Article 103**. It is forbidden for any person, individual or legal entity, to dump or deposit sewage and waste waters, without the appropriate treatment, as provided for in the corresponding regulation, in rivers, seas, channels, streams, lagoons, lakes and other similar places. Its use in animal husbandry or agricultural activities is also prohibited.
  Infectious, special, toxic and hazardous waste must be technically treated prior to disposal and the final deposit will be made in special sites established for this purpose by the country's municipalities. For the disposal of domestic waste, the provisions established for this purpose shall be complied with.
  The health authorities, in coordination with the municipalities, will be responsible for enforcing these provisions.
- **Article 104**. Every industrial, commercial or service establishment has the obligation to install systems for the treatment of contaminated water and toxic waste produced as a result of its activities. The health authorities, in coordination with the municipalities, shall be responsible for enforcing this provision.

CHAPTER III: AIR QUALITY AND NOISE POLLUTION

- **Article 111.** refers to air quality and noise pollution and provides that the national health authority shall coordinate with the MAE all types of emanations that affect the respiratory, auditory and visual systems, in order to avoid air and noise pollution affecting human health.
- **Article 113.** All labour, productive, industrial, commercial, recreational and amusement activities, as well as dwellings and other facilities and means of transportation, must comply with the provisions of the respective rules and regulations on prevention and control, in order to avoid noise pollution affecting human health.

CHAPTER V: OCCUPATIONAL HEALTH AND SAFETY

- **Article 117**. establishes that the national health authority, in coordination with the Ministry of Labour and Employment and the Ecuadorian Institute of Social Security, shall establish occupational health and safety standards to protect the health of employees.
- **Article 118.** Employers shall protect the health of their employees, providing them with sufficient information, protective equipment, appropriate clothing, safe working environments, in order to prevent, diminish or eliminate risks, accidents and the occurrence of occupational diseases.
- **Article 119.** Employers have the obligation to notify the competent authorities of work accidents and occupational diseases, without prejudice to the actions taken by both the Ministry of Labour and Employment and the Ecuadorian Institute of Social Security.
- **Article 120.** The national health authority, in coordination with the Ministry of Labour and Employment and the Ecuadorian Institute of Social Security, shall monitor and control the working conditions, so that they are not harmful or unhealthy during the periods of pregnancy and lactation of working women.
  Employers have the obligation to comply with the regulations and adapt the work activities of pregnant and breastfeeding women.

BOOK III: SURVEILLANCE AND SANITARY CONTROL

- **Article 129.** Compliance with the sanitary surveillance and control regulations is mandatory for all public and private institutions, organizations and establishments that carry out activities of production, importation, exportation, storage,

transportation, distribution, commercialization and sale of products for human use and consumption.

- **Article 130.** The establishments subject to sanitary control for their operation must have a permit granted by the national sanitary authority. The operation permit shall be valid for one calendar year.
- **Article 132.** The activities of sanitary surveillance and control include the control of quality, safety and security of processed products for human use and consumption, as well as the verification of compliance with the technical and sanitary requirements in the establishments dedicated to the production, storage, distribution, commercialization, importation and exportation of the indicated products.

SINGLE TITLE: CHAPTER I: SANITARY REGISTRATION

- **Article 137.** Processed foods, food additives, medicines in general, nutraceutical products, biological products, natural processed products for medicinal use, homeopathic medicines and dental products; medical devices, biochemical and diagnostic reagents, hygienic products, pesticides for domestic and industrial use, manufactured in the national territory or abroad, for their import, export, commercialization, dispensation and sale, including those received as donations, are subject to sanitary registration.
- **Article 138.** The national sanitary authority through its competent organism, National Institute of Hygiene and Tropical Medicine, Leopoldo Izquieta Perez, MD, who shall exercise its functions in a deconcentrated manner, shall grant, suspend, cancel or re-register the sanitary registration certificate, prior compliance with the procedures, requirements and terms indicated in this Law and its regulations, according to the guidelines and norms issued by the national sanitary authority, which shall establish the payment of an amount for the registration and re-registration of said sanitary registration certificate, whose values shall be destined to the institutional development, which shall include as a priority a national program of quality control and post-registration innocuousness.
- **Article 139.** The sanitary registration shall be valid for five years, counted from the date of its concession. Any change in the condition in which the product was approved in the sanitary registration must be mandatorily notified to the national sanitary authority through the National Institute of Hygiene and Tropical Medicine, Leopoldo Izquieta Pérez, MD, and shall give rise to the procedure indicated by the law and its regulations.
- **Article 140.** The importation, exportation, commercialization and sale of processed products for human use and consumption that do not comply with the prior obtaining of the sanitary registration is prohibited, except for the exceptions foreseen in this Law.
- The sanitary registration shall be suspended or cancelled by the national sanitary authority through the National Institute of Hygiene and Tropical Medicine, Leopoldo Izquieta Pérez, MD, at any time if it is proven that the product or its manufacturer does not comply with the requirements and conditions established in this Law and its regulations or when the product could cause damage to health, and the other sanctions indicated in this Law shall be applied.
  In all cases, the owner of the registration or the natural or legal person responsible shall fully compensate any damage caused to third parties, without prejudice to any other legal actions that may arise.
- **Article 142.** The national sanitary authority, through its competent agencies, shall periodically carry out post-registration controls of all products subject to sanitary registration by taking samples for quality and safety control analysis, whether in the places of manufacture, storage, transportation, distribution or sale.

CHAPTER II: FOOD

- **Article 145.** It is the responsibility of producers, retailers and other agents involved during the production-consumption cycle to comply with the standards established in this Law and other provisions in force to ensure the quality and safety of food for human consumption.
- **Article 146.** In matters of food, the following is prohibited:
  a) The use of additives to disguise, attenuate or correct technological deficiencies in production, handling or preservation and to fraudulently highlight their characteristics;
  b) The use, importation and commercialization of raw materials unfit for human consumption;
  c) The inclusion of harmful substances that make them dangerous or potentially harmful to the health of consumers;
  d) The use of raw materials and products treated with ionizing radiation or that have been genetically modified in the production of infant formula and baby food;
  e) The processing and handling under unhygienic conditions;
  f) The use of containers that do not comply with the technical specifications approved for this purpose;
  g) Offering a processed food with names, marks, graphics or labels that make false claims or omit data in a manner that confuses or misleads the consumer;
  h) The storage of raw materials or processed foods in premises where harmful or hazardous substances are present;
  i) Any form of falsification, contamination, alteration or adulteration, or any procedure that produces the effect of rendering them harmful or dangerous to human health; and,
  j) The display and sale of products whose shelf life has expired.
- **Article 147.** The national sanitary authority, in coordination with the municipalities, shall establish sanitary education programs for producers, handlers and consumers of food, promoting hygiene, individual and collective health and environmental protection.
- **Article 152.** The national sanitary authority, in coordination with the competent agencies, shall establish and implement an integrated national system to guarantee food safety.

In conclusion, the Internal Organization Act on Health provides for interinstitutional coordination between health and environmental authorities at the national level to prevent contamination of resources and, in turn, to avoid any threat to human health of the inhabitants.

4.3.5. GENERAL PORT LAW

- **Article 1**. All port, sea and river facilities of Ecuador, as well as the activities related to their operations carried out by organizations, entities and individuals or legal entities shall be governed by the provisions contained in this Law.
- **Article 2**. The functions of planning, direction, coordination, orientation and control of the national shipping and port policy shall be exercised through the following Organisms: a) National Council of the Merchant Navy and Ports. b) Bureau of the Merchant and Coast Navy c) Port Entities.
  Note: Article 11 of Executive Order 1111 (R.O. 358, 12-VI-2008) establishes the substitution of any reference to the General Bureau of the Merchant and Coastal Navy - DIGMER, for the "Subsecretariat of Ports and Sea and Inland Waterway Transportation". However, and since through a decree it is not possible to introduce reforms to hierarchically superior regulations, we have maintained the original text of this provision.

- **Article 3**. **(Amended by Article 28 of Law 12, R.O. 82-S, 9-VI-1997)** The National Council of Merchant Navy and Ports shall be composed of the following members: the Minister of National Defence, who shall preside over it; the General Commander of the Navy; the Ministers or Assistant Secretaries of Foreign Affairs, Public Works, Finance, Foreign Trade, Industrialization and Fisheries; the President or Technical Director of the National Planning and Economic Coordination Board; the Chief of the First Naval Zone and the Director of the Maritime Development of the Navy. The Director of the Merchant and Coast Navy will be part of the Council as an Advisor with the right to speak but not to vote.
- **Article 4**. The National Council of Merchant Navy and Ports is the highest advisory body of the Government in shipping and port matters and has the following faculties:
  a. Approve the Fee Regulations of the port entities and the changes or modifications that are submitted to its consideration.
  b. Decide on the convenience of establishing new ports, in accordance with national interests, taking into account the areas of influence, the National Transportation Policy and the Development Plan.
  c. Authorize the use for commercial purposes of ports or sea or river facilities by private or public individuals or legal entities.
  d. Know and approve the annual programming of activities of the National Port System, which must be submitted by the Bureau of the Merchant and Coastal until December 31 of each year.
  e. Arrange for studies and projections on the influence of port facilities on the National Transportation System.
  f. Approve the General Investment Plan of the National Port System and the annual budgets of the port entities, which shall be submitted for consideration by the Bureau of the Merchant and Coastal Navy, no later than December 31 of each year.
  g. Know and rule on the report of Activities of the National Port System that will be presented by the Bureau of the Merchant and Coastal Navy in the first quarter of each year.
  h. Determine the jurisdiction of the Port Entities.
  i. Submit to the President of the Republic the proposal in a slate, from among whose components the President of the Republic shall elect the Chairman of the Board of Directors of each of the Port Entities.
  j. Any other duties conferred by the Law or the Regulations.
- **Article 6**. The Bureau of the Merchant and Coastal Navy shall have in its organization the National Ports Department, which shall be in charge of the study and analysis of port activities in administrative, operational, exploitation, construction and improvement of Ecuadorian commercial ports, and the technical administrative bodies that may be necessary for the fulfilment of its mission.
  Note: Article 11 of Executive Order 1111 (R.O. 358, 12-VI-2008) prescribes the substitution of any reference to the General Bureau of the Merchant and Coastal Navy - DIGMER, for the "Subsecretariat of Ports and Sea and Inland Waterway Transportation". However, since a decree cannot introduce reforms to hierarchically superior regulations, we have maintained the original text of this provision.

4.3.6. HEALTH CODE: OFFICIAL REGISTRY 158 DATED FEBRUARY 8, 1971

This document "prohibits the discharge of solid, liquid or gaseous waste without treatment; noxious and undesirable substances that pollute or affect water quality; excreta, sewage, industrial waste in any watercourse for domestic or agricultural use, industrial discharges in public sewers without the corresponding permit. Article 12, 17, 25 and 28. Articles 03, 04, 06, 06, 07, 08, 10 and 11 also apply.

- **Article 6** of the Health Code determines that environmental sanitation is the best set of activities aimed to condition and control the environment in which man lives, in order to protect his health.
- **Article 12.** No person shall dispose of solid, liquid or gaseous waste into the air, soil or water without prior treatment to render them harmless to health.
- **Article 17.** No person may discharge, directly or indirectly, noxious or undesirable substances in such a way that they may contaminate or affect the sanitary quality of the water and obstruct, totally or partially, the supply routes.
- **Article 25.** Excreta, sewage, industrial wastes may not be discharged, directly or indirectly, into streams, rivers, lakes, irrigation ditches, or any watercourse for domestic, agricultural, industrial or recreational use, unless previously treated by methods that make them harmless to health.
- **Article 29.** Possession, production, importation, sale, transportation, distribution, use and disposal of toxic substances and products of a corrosive or irritating, flammable or oxidizing, explosive or radioactive nature, which constitute a health hazard, must be carried out under sanitary conditions that eliminate such risk and be subject to the control and requirements of the pertinent regulations.
- **Article 35.** It is incumbent upon the owner of a property or the person responsible for the occupation of a public road or site, to remove or destroy junk, debris, unusable objects, or any heap of undesirable materials.
- **Article 56.** The worksites must meet the conditions of hygiene and safety for its personnel. The health authority shall also provide for the adoption of appropriate sanitary measures for the benefit of the employees hired during the construction of a worksite.
- **Article 59.** The owners or possessors of open or closed places, to which people have regular access, shall maintain them in conditions that prevent the existence or reproduction of arthropods, rodents, ophidians and other species of animals that act as transmitting agents of diseases, or that are harmful to man. The health authority will dictate the instructions of the case for the use of means and the opportunity in the fulfilment of this obligation. Exceptions are scientific experimentation centres and other establishments that have the corresponding permit.

4.3.7. COMPREHENSIVE INTERNAL ORGANIZATION CRIMINAL CODE

CHAPTER FOUR: CRIMES AGAINST THE ENVIRONMENT AND NATURE OR PACHA MAMA

Section One: Biodiversity Offenses

- **Article 245.** Invasion of areas of ecological importance. The person who invades the areas of the National System of Protected Areas or fragile ecosystems, shall be punished with one to three-year imprisonment. The maximum punishment shall be applied when: As a consequence of the invasion, serious damage is caused to biodiversity and natural resources. The invasion is promoted, financed or directed by taking advantage of the people through deceit or false promises.
- **Article 247**

  Offenses against wild flora and fauna. The person who hunts, fishes, captures, collects, extracts, has, transports, traffics, benefits from, exchanges or commercializes specimens or their parts, their constituent elements, products and derivatives, of flora or wild terrestrial, marine or aquatic fauna, of threatened, endangered and migratory species, listed at national level by the National Environmental Authority as well as international instruments or treaties ratified by the State, shall be punished with imprisonment from one to three years.

  The maximum punishment shall be applied if any of the following circumstances apply:

  1. The act is committed in the period or zone of seed production or reproduction or of incubation, nesting, birth, breeding or growth of the species.

2. The event is carried out within the National System of Protected Areas. Only hunting, subsistence fishing or capture, traditional medicine practices, as well as the domestic use and consumption of wood by the communities in their territories, whose purposes are not commercial or for profit, are exempted from this provision, which must be coordinated with the National Environmental Authority.

ARTICLE TWO
OFFENSES AGAINST NATURAL RESOURCES

- **Article 251. Offenses against water:** The person who, in contravention of the regulations in force, pollutes, depletes or alters the bodies of water, springs, sources, ecological flows, natural upwelling or subway waters of the hydrographic basins and in general the hydrobiological resources or discharges into the sea causing serious damage, shall be punished with a prison sentence of three to five years.
  The maximum punishment shall be applied if the infraction is perpetrated in an area of the National System of Protected Areas or if the infraction is perpetrated for profit or with methods, instruments or means that result in extensive and permanent damage.
- **Article 252. Offenses against soil:** The person who, in contravention of the regulations in force, in relation to land and environmental management plans, changes the use of forest soil or soil intended for the maintenance and conservation of native ecosystems and their ecological functions, affects or damages their fertile layer, causes erosion or desertification, causing serious damage, shall be punished with three to five-year imprisonment.
  The maximum punishment shall be applied if the infraction is perpetrated in an area of the National System of Protected Areas or if the infraction is perpetrated for profit or with methods, instruments or means that result in extensive and permanent damage.
- **Article 253. Air pollution:** The person who, in contravention of the regulations in force or by not adopting the measures required by the regulations, pollutes the air, the atmosphere or other components of the airspace at levels that result in serious damage to natural resources, biodiversity and human health, shall be punished with imprisonment for a term of one to three years.
- **Article 254. Prohibited or unauthorized management of products, residues, wastes or hazardous substances:** The person who, contrary to the provisions of the regulations in force, develops, produces, has, disposes, burns, markets, introduces, imports, transports, stores, deposits or uses products, residues, wastes and chemical or hazardous substances, and thereby causes serious damage to biodiversity and natural resources, shall be punished with deprivation of liberty for a term of one to three years. It shall be punished with deprivation of liberty for three to five years in the case of:
  1. Chemical, biological or nuclear weapons.
  2. Prohibited chemicals and agrochemicals, highly toxic persistent organic pollutants and radioactive substances.
  3. Dissemination of diseases or pests.
  4. Technologies, experimental biological agents or genetically modified organisms that are harmful and detrimental to human health or that threaten biodiversity and natural resources. If as a consequence of these crimes death is produced, it will be punished with imprisonment of sixteen to nineteen years.
- **Article 255. Falsehood or concealment of environmental information:** The person who issues or provides false information or conceals information that supports the issuance and granting of environmental permits, environmental impact studies, environmental audits and diagnoses, forest exploitation permits or licenses,

which cause the environmental authority to commit an error, shall be punished with imprisonment from one to three years. The maximum punishment shall be applied if the public servant, by reason of his or her functions or taking advantage of his or her capacity as a public servant or his or her responsibilities to carry out control, processes, issues or approves with false information environmental permits and the others established in this article.

4.3.8. ORGANIC CODE OF TERRITORIAL ORGANIZATION, AUTONOMY AND DECENTRALIZATION

- **Article 136. Item two.** It is the responsibility of the autonomous decentralized provincial governments to govern, direct, order, arrange or organize environmental management, the defence of the environment and nature, within the scope of their territory; these actions shall be carried out within the framework of the decentralized national system of environmental management and in accordance with the policies issued by the national environmental authority. For the granting of environmental licenses, they must be accredited as the environmental enforcement authority responsible for their circumscription.

4.4. CONSOLIDATED TEXT OF SECONDARY ENVIRONMENTAL LEGISLATION

PRELIMINARY TITLE

BASIC ENVIRONMENTAL POLICIES OF ECUADOR

- **Article 1.** The following basic environmental policies of Ecuador are hereby established:

Ecuador's basic environmental policies

1. Recognizing that the fundamental principle that should transcend all policies is the commitment of society to promote development towards sustainability. Ecuadorian society should permanently observe the concept of minimizing negative environmental risks and impacts while maintaining the social and economic opportunities of sustainable development.
2. Recognizing that sustainable development can only be achieved when its three elements, social, economic and environmental, are treated harmoniously and in balance at every moment and for every action. Every inhabitant in Ecuador and its public and private institutions and organizations should carry out every action, at every moment, in a way that tends simultaneously to be socially just, economically profitable and environmentally sustainable.
3. Recognizing that environmental management corresponds to everyone at every moment of life and that no one can substitute the responsibility of each person in this management in his or her field of action: Through the coordination in charge of the Ministry of the Environment, in order to ensure due national coherence, the entities of the public sector and the private sector in Ecuador, without prejudice that each one shall attend to the specific area that corresponds to it, shall contribute, within the framework of the present policies, to identify, for each case, the specific policies and strategies, the necessary orientations and guidelines in order to ensure by all an adequate environmental management permanently aimed at achieving sustainable development, as well as shall collaborate in the necessary aspects to achieve that each inhabitant of Ecuador adapts his or her conduct to this purpose.
4. Recognizing that the environment has to do with everything and is present in every human action: Environmental considerations must be explicitly present in all human activities and in every field of action of public and private entities, particularly as a mandatory and indissoluble part of decision making; therefore, the environment should not be considered in any case as an independent sector separated from social, economic, political, cultural and, in general, any other kind

of considerations. This is without prejudice to the fact that, for purely methodological reasons, analyses and training on so-called "environmental issues" should be carried out.

5. Recognizing that each issue related to environmental management has several important actors, directly linked or with particular interests in them: Environmental management in Ecuador will be based basically on solidarity, co-responsibility, cooperation and coordination among all the inhabitants of Ecuador, aimed at guaranteeing sustainable development, based on balance and harmony between the social, economic and environmental. Similar criteria will guide Ecuador in its relations with other countries and peoples of the world so that the activities carried out within its jurisdiction and competence or outside it does not harm other States and areas without jurisdiction, nor that it is harmed by the actions of others. Particular mention is made of its decision to promote the rational and sustainable co-management of shared resources with other countries.
6. Recognizing that, without prejudice to necessary and advisable complements and legal and institutional systematizations, there are sufficient laws and institutions in Ecuador to carry out and maintain an adequate environmental management, but that the laws and regulations are only partially complied with and that many institutions are going through crises in several orders: their decision to tend to the rational and sustainable co-management of resources shared with other countries.

BOOK IV
BIODIVERSITY
CHAPTER VII: PROHIBITIONS

- **Article 103.** It is forbidden, on any day or time of the year, to hunt the species, birds or mammals, which compose the wild fauna and which are listed in Annex 1 of the present Title, classified as threatened or in danger of extinction. Hunting is also not allowed in specific areas or zones and during the closed seasons.
- **Article 109.** It is forbidden to disturb and attempt against the life of wild animals in the whole country, with the exceptions foreseen in this regulation.
- **Article 110.** The collection of eggs, capture or apprehension of neonates and young of wild animals, without the corresponding authorization, is prohibited.
- **Article 114.** All kinds of hunting are prohibited in National Heritage Areas, such as: National Parks, ecological reserves, wildlife refuges, existing biological reserves and those that may be created in the future.

4.5. MINISTERIAL RESOLUTIONS

4.5.1. MINISTERIAL RESOLUTION 061
RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF THE ENVIRONMENT (TULSMA)

BOOK VI ON ENVIRONMENTAL QUALITY
TITLE I PRELIMINARY PROVISIONS

- **Article 1 SCOPE -** This book establishes the procedures and regulates the activities and public and private responsibilities in matters of environmental quality. Environmental quality is understood as the set of characteristics of the environment and nature, including air, water, soil and biodiversity, in relation to the absence or presence of harmful agents that may affect the maintenance and regeneration of life cycles, structure, functions and evolutionary processes of nature.
- **Article 2 PRINCIPLES -** Without prejudice to those contained in the Constitution of the Republic of Ecuador and the laws and secondary regulations of any hierarchy that govern on the matter, the principles contained in this Book are of mandatory application and constitute the conceptual elements that originate, sustain, govern

and inspire all decisions and public and private activities of natural and juridical persons, peoples, nationalities and communities with respect to the management of environmental quality, as well as the responsibility for environmental damages.
For the application of this Book, the administrative authorities and judges shall observe the principles of environmental legislation and in particular the following:

- **Preventive or Prevention:** The obligation of the State, through its institutions and bodies and in accordance with the public powers assigned by law, to adopt the appropriate policies and measures to avoid negative environmental impacts, when there is certainty of damage.
- **Precautionary or Precaution:** The obligation of the State, through its institutions and bodies and in accordance with the public powers assigned by law, to adopt effective and timely protective measures when there is a danger of serious or irreversible damage to the environment, even when there is doubt about the environmental impact of an action or omission, or when there is no scientific evidence of damage. The precautionary principle is applied when it is necessary to make a decision or choose between alternatives in a situation where technical and scientific information is insufficient or there is a significant level of doubt in the conclusions of the technical-scientific analysis. In such cases the precautionary principle requires that the decision be made that has the least risk of causing, directly or indirectly, damage to the ecosystem.
- **Polluter-Pays or Polluter-Pays -** The obligation of all operators of activities involving environmental risk to internalize environmental costs, assuming the costs of prevention and control of pollution as well as those necessary to restore ecosystems in case of environmental damage, taking due account of the public interest, the rights of nature and the right to live in a healthy and ecologically balanced environment. The aforementioned principle is also applied in sanctioning procedures or in the determination of administrative or tax payment obligations.
- **Correction at the Source -** The obligation of the Controlled Entities to adopt all pertinent measures to avoid, minimize, mitigate and correct environmental impacts from the origin of the production process. This principle shall be applied in projects and in addition to management plans or of any nature provided for in this Book.
- **Co-responsibility in environmental matters:** When compliance with environmental obligations corresponds to several persons jointly, there will be shared responsibility for the infractions committed in the case and for the penalties imposed.
- **From the cradle to the grave:** The responsibility of the Control Subjects covers, in an integral, shared and differentiated manner, all phases of the comprehensive management of hazardous chemical substances and the adequate management of waste, hazardous and/or special wastes from their generation to their final disposal.
- **Strict liability:** Liability for environmental damage is strict. Any damage to the environment, in addition to the corresponding sanctions, will also imply the obligation to fully restore the ecosystems and compensate the affected persons and communities.
- **Extended Producer and/or Importer Responsibility:** Producers and/or importers have responsibility for the product throughout its entire life cycle, including the impacts inherent in the selection of materials, the production process, as well as those related to the use and final disposal of these after their useful life.
- **Best available technology:** Any activity that may produce an environmental impact or risk must be carried out in an efficient and effective manner, that

is, using the most appropriate technical procedures available to prevent and minimize the environmental impact or risk.

- **Primary or In Natura Remediation -** The obligation to fully restore ecosystems when there is any damage to the environment, without prejudice to the corresponding sanctions, seeking a return to the initial or pre-damage condition*.

TITLE III: SINGLE ENVIRONMENTAL MANAGEMENT SYSTEM

CHAPTER I: INSTITUTIONAL SYSTEM

- **Article 6 General Obligations -** All new works, activities or projects and any expansion or modification thereof that may cause environmental impact shall be subject to the Single Environmental Management System, in accordance with the provisions of the applicable legislation, this Book and the administrative and technical regulations issued for such purpose.
  All actions related to environmental management should be planned and executed based on the principles of sustainability, equity, social participation, validated representativeness, coordination, precaution, prevention, mitigation and remediation of negative impacts, co-responsibility, solidarity, cooperation, waste minimization, reuse, recycling and utilization of waste, conservation of resources in general, use of clean technologies, environmentally responsible alternative technologies, good environmental practices and respect for cultures and traditional practices and ancestral possessions. The environmental impacts of any product, whether industrialized or not, should also be considered during its life cycle.
- **Article 7 Competence for environmental impact assessment -** The National Environmental Authority is responsible for the environmental impact assessment process, which may be delegated to the Autonomous Decentralized Provincial, metropolitan and/or municipal governments through an accreditation process in accordance with the provisions of this Book.
  The result of the environmental impact assessment process is an environmental administrative authorization, the scope and nature of which depends on the management tool used in each case.
  Both the environmental authorization and the environmental impact assessment tools are described in this book.

CHAPTER II: SINGLE ENVIRONMENTAL INFORMATION SYSTEM

- **Article 12 -** Single Environmental Information System (SUIA) - This is the computerized tool of mandatory use for the entities that make up the National Decentralized Environmental Management System; it shall be administered by the National Environmental Authority and shall be the only online means used to carry out the entire environmental regularization process, in accordance with the principles of speed, simplification of procedures and transparency.
- **Article 14** - Regularization of the project, work or activity - The projects, works or activities included in the catalogue issued by the National Environmental Authority shall be regularized through the SUIA, which shall automatically determine the type of environmental permit: Environmental Registration or Environmental License.

CHAPTER III: ENVIRONMENTAL REGULARIZATION

- **Article 21 General objective:** To authorize the execution of public, private and mixed projects, works or activities, according to their particular characteristics and the magnitude of the environmental impacts and risks.
- **Article 22 Catalogue of projects, works or activities:** It is the list of projects, works or activities that require to be regularized through the environmental permit according to the magnitude of the impact and risk generated to the environment.

- **Article 25 Environmental License** - This is the environmental permit granted by the Competent Environmental Authority through the SUIA, and is mandatory for those projects, works or activities considered of medium or high environmental impact and risk. The Subject of control shall comply with the obligations arising from the environmental permit granted.

CHAPTER IV: ENVIRONMENTAL STUDIES

- **Article 27 Objective:** Environmental studies serve to guarantee an adequate and well-founded prediction, identification and interpretation of the environmental impacts of the projects, works or activities existing or to be developed in the country, as well as the technical suitability of the control measures for the management of their environmental impacts and risks; the environmental study must be carried out in a technical manner, and according to the scope and depth of the project, work or activity, in accordance with the requirements set forth in the applicable environmental regulations.
- **Article 28 Environmental impact assessment -** The environmental impact assessment is a procedure that allows predicting, identifying, describing and evaluating the potential environmental impacts that a project, work or activity may cause to the environment; and with this analysis, determining the most effective measures to prevent, control, mitigate and compensate the negative environmental impacts, within the framework of the provisions of the applicable environmental regulations.
  For the evaluation of environmental impacts, the relevant environmental variables of the media or matrices are observed, among these:
  a) Physical (water, air, soil and climate);
  b) Biotic (flora, fauna and their habitats);
  c) Socio-cultural (archaeology, socio-economic organization, among others);
  Civil society and public officials are guaranteed access to environmental information on projects, works or activities that are in process or have environmental licenses.
- **Article 29 Responsible for the environmental studies:** The environmental studies of the projects, works or activities shall be carried out under the responsibility of the regulated party, in accordance with the applicable environmental guidelines and regulations, who shall be responsible for the truthfulness and accuracy of their contents.
  Environmental studies for environmental licenses must be carried out by consultants qualified by the Competent Authority, which will periodically evaluate, together with other competent entities, the technical and ethical capacities of the consultants to carry out such studies.
- **Article 30 Terms of reference -** These are preliminary standardized or specialized documents that determine the content, scope, focus, methods, and techniques to be applied in the preparation of environmental studies. The terms of reference for conducting an environmental study shall be available online through the SUIA for the promoter of the project, work or activity; the Competent Environmental Authority shall focus the studies on the basis of the activity to be regularized.
- **Article 31 Project description and analysis of alternatives:** Projects or activities requiring environmental licenses shall be described in detail in order to predict and evaluate their potential or real impacts.
  In the evaluation of the project or work, the environmental, social and economic components must be fairly assessed; this information will complement the viable alternatives for the analysis and selection of the most appropriate one. Non-execution of the project will not be considered as an alternative in the analysis.
- **Article 32 Environmental Management Plan -** The Environmental Management Plan consists of several sub-plans, depending on the characteristics of the activity or project. The Environmental Management Plan will contain the following sub-plans,

with their respective programs, budgets, responsible parties, means of verification and schedule.

a) Impact Prevention and Mitigation Plan;
b) Contingency Plan;
c) Training Plan;
d) Occupational Health and Safety Plan;
e) Waste Management Plan;
f) Community Relations Plan;
g) Rehabilitation Plan for Affected Areas;
h) Area Abandonment and Handover Plan;
i) Monitoring and Follow-up Plan.

In the case of Environmental Impact Studies for activities in operation (Ex post EIA), in addition to the aforementioned plans, an action plan will be included to correct the non-conformities (NC) found during the process.

- **Article 33 Scope of environmental studies:** Environmental studies shall cover all phases of the life cycle of a project, work or activity, except when, due to the nature and characteristics of the activity and based on environmental regulations, different phases are established and within these, different stages of their execution.
- **Article 35 Ex Post Environmental Studies (EsIA Ex Post) -** These are environmental studies that have the same purpose as the ex ante studies and that allow the regularization in environmental terms of the execution of a work or activity in operation, in accordance with the provisions of this legal instrument.
- **Article 36 - Observations to the environmental studies -** During the review and analysis of the environmental studies, prior to the favourable pronouncement, the Competent Environmental Authority may request, among others:
  a) Modification of the proposed project, work or activity, including the corresponding alternatives;
  b) Incorporation of alternatives not initially foreseen in the environmental study, as long as they do not substantially change the nature and/or dimensioning of the project, work or activity;
  c) Corrections to the information presented in the environmental study;
  d) Performing complementary or new analyses.

  The Competent Environmental Authority will review the environmental study, issue one-time observations, notify the proponent to accept its observations, and based on these responses, the Competent Environmental Authority may require additional information from the proponent for final approval. If these observations are not absolved in the second review cycle, the process will be archived.
- **Article 37 - Favourable pronouncement of environmental studies -** If the Competent Environmental Authority considers that the environmental study submitted satisfies the requirements and complies with the requirements set forth in the applicable environmental regulations and in the pertinent technical norms, it shall issue a favourable pronouncement by means of an official letter.
- **Article 38 - Establishment of the policy or performance bond with the Environmental Management Plan -** The environmental regularization for projects, works or activities that require environmental licenses shall include, among other conditions, the establishment of a policy or performance bond with the Environmental Management Plan, equivalent to one hundred percent (100%) of the cost thereof, to face possible non-compliance with the same, related to the execution of the licensed activity or project, whose endorsement shall be in favour of the Competent Environmental Authority.

  This performance bond or policy will not be required when the executors of the project, work or activity are public sector entities or companies whose subscribed capital belongs, at least two thirds, to public law entities or private law entities with a social or public purpose. However, the executing entity shall be administratively and

civilly liable for the full and timely compliance with the Environmental Management Plan of the licensed project, work or activity and for the contingencies that may cause environmental damage or affect third parties, in accordance with the provisions of the applicable regulations.

- **Article 39 - Issuance of environmental permits -** The projects, works or activities requiring environmental permits, in addition to the favourable pronouncement, shall make the corresponding payments for administrative services, according to the requirements foreseen for each case.
- The projects, works or activities that require an environmental license must submit the performance bonds and policies established in the applicable environmental regulations; once the Competent Environmental Authority verifies this information, it will proceed to issue the corresponding environmental license.
- **Article 40 Resolution -** The Competent Environmental Authority shall notify the subjects of control of the projects, works or activities with the issuance of the Resolution of the environmental license, which shall clearly detail the conditions to which the project, work or activity shall be subject, during all its phases, as well as the legal and regulatory powers for the operation of the project, work or activity: it shall contain:
  a) Legal considerations that served as the basis for the pronouncement and approval of the environmental study
  b) The technical considerations on which the Resolution is based;
  c) Considerations on the Social Participation Process, in accordance with applicable environmental regulations;
  d) The approval of the corresponding environmental studies, the granting of the environmental license and the conditions regarding the suspension and/or revocation of the environmental license in case of non-compliance;
  e) Obligations to be fulfilled during all phases of the life cycle of the project, work or activity.
- **Article 41 Environmental permits for activities and projects in operation (ex post studies) -** Projects, works or activities in operation that must obtain an environmental permit pursuant to the provisions of this Book, shall begin the regularization process as of the date of publication of these Regulations in the Official Gazette.
- **Article 42 - Registry of Environmental Permits -** The National Environmental Authority shall keep a registry of the environmental permits granted at the national level through the SUIA.
- **Article 43 - Closure of operations and abandonment of the area or project:** The Control subjects that for any reason require the closure of operations and/or abandonment of the area, shall execute the closure and abandonment plan as approved in the respective Environmental Management Plan; additionally, they shall submit Environmental Reports, Environmental Audits or other documents in accordance with the guidelines established by the Competent Environmental Authority.

CHAPTER V: SOCIAL PARTICIPATION

- **Article 44 Social participation:** It is governed by the principles of legitimacy and representativeness and is defined as an effort of the State Institutions, the citizenry and the subject of control interested in carrying out a project, work or activity.
  The Competent Environmental Authority will inform the population about the possible implementation of activities and/or projects, as well as the possible expected socio-environmental impacts and the relevance of the actions to be taken. In order to gather their opinions and observations, and incorporate those that are technically and economically feasible into the Environmental Studies. The social participation process is mandatory as part of obtaining the environmental license.

- **Article 45 Participation mechanisms**: These are the procedures that the Competent Environmental Authority applies to make Social Participation effective. For the application of these mechanisms and systematization of their results, it shall act in accordance with the provisions of the Instructions or Instruments issued by the National Environmental Authority for this purpose.
  The mechanisms for social participation will be defined considering: the level of impact generated by the project and the level of conflict identified; and if necessary, they will generate greater opportunities for participation.
- **Article 46 Moments of participation -** Social Participation shall be carried out during the review of the environmental study, in accordance with the procedure established in the regulations issued for this purpose, and shall be carried out in a mandatory manner by the Competent Environmental Authority in coordination with the promoter of the activity or project, taking into account the particularities of each case.

CHAPTER VI: COMPREHENSIVE MANAGEMENT OF NON-HAZARDOUS SOLID WASTES AND HAZARDOUS AND/OR SPECIAL WASTES

- **Article 47 National Priority:** The Ecuadorian State declares the comprehensive management of non-hazardous solid waste and hazardous and/or special waste as a national priority and as such, of public interest and subject to State protection. The public interest and state guardianship on the matter implies the assignment of the steering role and guardianship in favour of the National Environmental Authority, for the issuance of policies on the comprehensive management of non-hazardous solid waste, hazardous and/or special waste. It also implies the extended and shared responsibility of the whole society, with the purpose of contributing to sustainable development through a set of national intersectorial policies, in all management areas, as defined and established in this Book and particularly in this Chapter. The comprehensive regime is complemented by the set of public policies, institutional framework and specific regulations applicable at the national level. By virtue of this declaration, both the policies and the regulations contained in the pertinent legislation, as well as those contained in this Book and in the technical norms derived from it, are of priority execution at the national level; their noncompliance shall be sanctioned by the National Environmental Authority, according to the sanctioning procedure established in this Book.

SECTION I COMPREHENSIVE MANAGEMENT OF NON-HAZARDOUS SOLID WASTES AND/OR RESIDUES

- **Article 55 Comprehensive management of non-hazardous solid wastes and/or residues:** Comprehensive management constitutes the set of regulatory, operative, economic, financial, administrative, educational, planning, monitoring and evaluation actions and dispositions, which have the purpose of giving non-hazardous solid wastes the most adequate destination from the technical, environmental and socioeconomic point of view, according to their characteristics, volume, origin, treatment costs, possibilities of recovery and use, commercialization or finally their final disposal. It is aimed at implementing the phases of solid waste management, which are minimization of waste generation, separation at the source, storage, collection, transportation, collection and/or transfer, treatment, recovery and final disposal. Appropriate waste management contributes to the reduction of environmental impacts associated with each of the waste management stages.
- **Article 56 Technical standards -** The National Environmental Authority shall establish the technical standards for the comprehensive management of non-hazardous solid waste and/or residues, in all its phases.

PARAGRAPH I
THE GENERATION

- **Article 60 The Generator -** Every generator of non-hazardous solid waste and/or residues must:
  a) Be responsible for their management until they are delivered to the collection service and deposited in authorized sites determined by the competent authority.
  b) Take measures to reduce, minimize and/or eliminate waste generation at source by optimizing the processes that generate waste.
  c) Carry out separation and classification at the source as established in the specific regulations.
  d) Temporary storage of waste under technical conditions established in the regulations issued by the National Environmental Authority.
  e) Large generators such as industry, commerce and services must have adequate and technically constructed facilities for the temporary storage of non-hazardous solid waste, with easy accessibility for their transfer.
  f) Large generators such as industry, commerce and services must keep a monthly record of the type and quantity or weight of waste generated.
  g) Large generators such as industry, commerce and services must deliver the non-hazardous solid waste already classified to environmental managers authorized by the National Environmental Authority or Accredited Responsible Enforcement Authority for approval, to guarantee its use and/or correct final disposal, as the case may be.
  h) The Autonomous Decentralized Municipal Governments must submit an annual declaration of the generation and management of non-hazardous waste and/or residues to the National Environmental Authority or the Environmental Enforcement Authority responsible for its approval.
  i) Place the containers at the collection site, according to the established schedule.
- **Article 61 Prohibitions:** Not to deposit liquid, pasty or viscous substances, excrement, or hazardous or special handling wastes in the containers destined for the collection of non-hazardous solid wastes.

PARAGRAPH II
SEPARATION AT SOURCE

- **Article 62 Separation at the source -** The generator of non-hazardous solid waste is obliged to separate it at the source, classifying it according to the Integrated Waste Management Plan, as established in the applicable environmental regulations.

PARAGRAPH III TEMPORARY STORAGE

- **Article 63 Temporary urban storage.** - The parameters for the temporary storage of non-hazardous solid waste already classified are established, without prejudice to others established by the National Environmental Authority, according to the following:
  a) Non-hazardous solid waste should be temporarily disposed of in closed containers or garbage cans (with lids), identified, classified, in order and, if possible, with a plastic cover inside.
  b) Containers for the temporary storage of non-hazardous solid waste must comply at least with: be covered and adequately located, have adequate capacity according to the volume generated, be built with resistant materials and have identification according to the type of waste.
  c) Temporary storage of non-hazardous waste will be carried out under the conditions established in the INEN technical standard.

- **Article 65 Prohibitions -** Bags and/or containers with solid waste shall not remain on public roads and sites on days and at times other than those established by the collection service.

ARTICLE II COMPREHENSIVE MANAGEMENT OF HAZARDOUS AND/OR SPECIAL WASTES

- **Article 78 Scope:** This Chapter regulates the phases of management and the mechanisms for the prevention and control of contamination by hazardous and/or special wastes in the national territory, in accordance with the procedures and technical standards set forth in the applicable regulations and in the International Agreements related to this matter, signed and ratified by the Ecuadorian State.
  Within this framework, the present regulatory body rules in a differentiated manner, the phases of comprehensive management and administrative and technical norms corresponding to each one of them. Without prejudice to the state protection of the environment, all citizens, and especially the promoters of hazardous and/or special waste management, have the responsibility to collaborate in their respective areas of action with the safety and control measures for such materials. When risks are managed under the principle of subsidiary decentralization, it will imply the direct responsibility of the institutions within their geographical scope. When their capacities for risk management are insufficient, the institutions with greater territorial scope and greater technical and financial capacity will provide the necessary support with respect to their authority in the territory and without relieving them of their responsibility.
- **Article 79 Hazardous waste:** For the purposes of this Book, the following shall be considered hazardous waste:
  a) Solid, pasty, liquid or gaseous wastes resulting from a production, extraction, transformation, recycling, utilization or consumption process and which contain any substance that has corrosive, reactive, toxic, flammable, biological-infectious and/or radioactive characteristics, which represent a risk to human health and the environment in accordance with the applicable legal provisions; and,
  b) Those that are determined in the national lists of hazardous wastes, unless they do not have any of the characteristics described in the previous numeral. These lists will be established and updated by ministerial resolutions.

  In order to determine whether or not a waste should be considered hazardous, its characterization must be carried out in accordance with the technical standards established by the National Environmental Authority and/or the National Standardization Authority or, failing that, by internationally accepted technical standards expressly accepted by the National Environmental Authority.
  The management of hazardous wastes containing radioactive material, whether of natural or artificial origin, will be regulated and controlled by the specific regulations issued by the National Electricity and Renewable Energy Authority or the one that replaces it, which does not exempt the generator from providing information on the environmentally adequate management of these wastes to the National Environmental Authority, nor from the need to have the corresponding environmental permit under the regularization process established in this Book.
- **Article 80 Special wastes:** For the purposes of this Book, the following shall be considered special wastes:
  a) Those wastes that are not hazardous, but by their nature, can impact the environment or health, due to the volume of generation and/or difficult degradation, and for which a system of recovery, reuse and/or recycling must be implemented in order to reduce the amount of waste generated, avoid its inadequate management and disposal, as well as the oversaturation of municipal sanitary landfills;

b) Those whose content of substances with corrosive, reactive, toxic, flammable, biological-infectious and/or radioactive characteristics do not exceed the concentration limits established in the national environmental regulations or, in their absence, the applicable international regulations.
c) Those determined in the national list of special wastes. These lists will be established and updated by ministerial resolutions.

In order to determine whether or not a waste should be considered special, it must be characterized according to the technical standards established by the National Environmental Authority and/or the National Standardization Authority or, failing that, according to internationally accepted technical standards.

- **Article 81 Obligatory nature:** All individuals or legal entities, public or private, national or foreign, that within the national territory participate in any of the phases and activities of hazardous and/or special waste management, under the terms of the preceding articles hereof, are subject to the compliance and application of the provisions herein.

  It is an obligation for all natural or legal persons, public or private, national or foreign, involved in one, several or all phases of the comprehensive management of hazardous and/or special wastes, to ensure that the personnel in charge of handling these wastes have the necessary training and have the appropriate protective equipment, in order to protect their health.

PARAGRAPH IV: NATIONAL MARITIME AND INLAND WATERWAY TRANSPORTATION

- **Article 120 Obligatory nature:** Whoever transports hazardous and/or special wastes by sea or river in the national territory, must obtain an environmental permit from the National Environmental Authority, under the procedures established for this purpose. The personnel in charge of the operation of maritime and inland waterway transportation of hazardous and/or special materials must be trained in the subject; the training must be through courses endorsed by the National Directorate of Aquatic Spaces or the one that replaces it, and/or the International Maritime Organization. The Control Subjects must comply with the applicable provisions that regulate the transport of dangerous goods by water, established in the International Maritime Dangerous Goods Code (IMDG) for each substance, material or article that may be transported, international conventions to which Ecuador is a party, as well as the applicable national and international maritime regulations in force.
- **Article 121 Coordination -** For the purposes of control and compliance with the requirements established for the transportation of hazardous materials, the National Environmental Authority shall coordinate actions with the National Directorate of Aquatic Spaces or the one that replaces it and other local and national authorities competent in maritime and inland waterway transportation, for which purpose the pertinent mechanisms shall be established.

CHAPTER VIII: QUALITY OF BIOTIC AND ABIOTIC COMPONENTS

ARTICLE I: GENERAL PROVISIONS

- **Article 192 Obligation -** All individuals or legal entities, public or private, community or mixed, national or foreign, are under the obligation to submit to the norms contained in this Book, prior to the development of a work or activity or project that may negatively alter the biotic and abiotic components with the purpose of preventing and minimizing the impacts, whether said work, activity or project is their responsibility, or when it is executed by a third party.
- **Article 194 - Evaluation, control and follow-up -** The National Environmental Authority, the Environmental Authorities of Application responsible or the entities of the Decentralized National System of Environmental Management, within the framework of their competencies, shall evaluate and control the quality of the biotic

and abiotic components, by means of the environmental control and follow-up mechanisms established in this Book, in accordance with the technical norms issued for such purpose.

- **Article 195 Responsibility:** The Competent Environmental Authority shall in no case be responsible for emissions, discharges and spills that contain different components or that do not comply with the established limits reported by the Control Subject, who shall be liable in the administrative, civil or criminal sphere. In addition to the imposition of administrative, civil or criminal penalties for non-compliance with applicable environmental regulations, non-compliance with contingency measures for the clean-up, remediation and restoration of a contaminated area, which in turn becomes a source of environmental contamination, may lead to the generation of environmental liabilities, the responsibility for which will fall on the person or persons who generated the contamination, on the Control Entity that fails to take immediate corrective measures and on whoever prevents the application of the pertinent corrective measures, as the case may be.
- **Article 196 - Authorizations for emissions, discharges and spills -** The Control subjects shall comply with this Book and its technical standards. Likewise, they shall obtain the corresponding environmental administrative authorizations from the Competent Environmental Authority.
  In no case shall the Competent Environmental Authority grant environmental administrative authorizations when emissions, discharges and spills exceed the permissible limits or the corresponding quality criteria established in this Book, in the technical standards or in the applicable annexes.
  In case the activity exceeds the permissible limits, it shall be subject to the sanctioning procedure established in this Book.
  No discharge, whether sewage or industrial, will be authorized on water bodies whose minimum annual flow cannot support the discharge, i.e., exceeds the carrying capacity of the water body. The determination of the carrying capacity of the water body shall be established by the Single Water Authority in coordination with the National Environmental Authority.
- **Article 199 Contingency plans -** Contingency plans shall be implemented, maintained, and evaluated periodically through drills. The drills shall be documented and their records shall be available to the Competent Environmental Authority. The lack of records shall constitute evidence of non-compliance with this provision. The execution of contingency plans must be immediate. In case of delay, it shall be considered as an aggravating factor at the time of resolving the administrative procedure.

ARTICLE II: QUALITY OF BIOTIC COMPONENTS

- **Article 202 Biotic components:** Comprised by the flora, fauna and other living organisms in their different levels of organization. According to the area and characteristics of the regulated activity, the environmental quality will be evaluated and controlled additionally, by means of biotic studies through the tools established in the existing environmental regulation and control mechanisms, the scope and focus of the studies of the biotic component will be determined in the corresponding Terms of Reference.
- **Article 203 Minimization of impacts:** For those projects that directly or indirectly affect areas with primary vegetation cover, native forests, protected areas, sensitive ecosystems, all existing national and international technological alternatives shall be analysed to minimize impacts; the analysis of alternatives shall mainly consider the environmental aspect.
  When it is required to install oil pipelines, gas pipelines, mining pipelines, flow lines, electric transmission lines, heliports and/or carriageable accesses in areas with primary forests, Protective Forests and by exception and with the limitations

established in the Constitution in protected areas, the planning of rights of way must include, among others, the following provisions:

a) Avoid felling large trees, sensitive and threatened species and sensitive sites.
b) Use a single right-of-way that includes: carriageway access, electric transmission lines, flow lines, oil pipelines, gas pipelines, mineral pipelines or pipelines for transporting other materials.
c) The maximum clearing allowed on average for the right-of-way is ten (10) meters wide**,** and construction technology must be applied to minimize clearing.

- **Article 209 Water quality:** The physical, chemical and biological characteristics that establish the composition of water and make it suitable to satisfy the health and welfare of the population and the ecological balance. The evaluation and control of water quality shall be carried out with analytical procedures, sampling and monitoring of discharges, discharges and receiving bodies; said guidelines are detailed in Annex I. In any case, the Competent Environmental Authority may order the Control Entity responsible for discharges and spills to carry out sampling of its discharges as well as of the receiving water body.

  All anthropic activities must take the necessary preventive actions to avoid altering and ensure the quality and quantity of water in the watersheds. Alteration of the physical-chemical and biological composition of water sources due to discharges and liquid spills or waste disposal in general or other negative actions on their components will result in the corresponding penalties in each case.

PARAGRAPH II: OF THE SOIL

- **Article 212 Soil Quality -** In order to carry out an adequate characterization of this component in environmental studies, as well as an adequate control, sampling and monitoring must be carried out following the methodologies established in Annex II and other corresponding regulations.

  The Competent Environmental Authority and the entities of the Decentralized National System of Environmental Management, within the framework of their competences, will carry out the control of soil quality in accordance with the technical standards issued for this purpose. They constitute soil quality standards, physicochemical and biological characteristics that establish the composition of the soil and make it acceptable to ensure the ecological balance, health and welfare of the population.

PARAGRAPH III: SEDIMENTS

- **Article 215 Sediment Quality -** Sediments may be of natural origin, such as those existing in the sea, lake and lagoon beds, rivers, streams and other bodies of water, whether they are of permanent or temporary flow; and those of industrial origin, such as those coming from treatment plants, storage tanks or others.

  In order to evaluate environmental quality through sediment analysis, sampling and monitoring of the areas directly influenced by the regulated activity must be carried out, following the protocols established by the National Environmental Authority and, if they do not exist, following internationally accepted protocols.
- **Article 216 Technical Standards -** The National Environmental Authority or the entities of the National Decentralized Environmental Management System, within the framework of their competencies, shall issue technical standards for sediment quality, by means of the corresponding legal figure.
- **Article 217 Evaluation, monitoring and control -** Without prejudice to the application of the control mechanisms established in this Book, the National Environmental Authority shall evaluate and control the environmental quality by means of sediment analysis or shall order the Control Subjects to carry out the pertinent studies.

- **Article 218** Treatment of contaminated sediments - It is carried out by means of procedures accepted by the Competent Environmental Authority and in accordance with the provisions of the technical sediment standard and hazardous waste regulations, as the case may be.

CHAPTER XV
ENVIRONMENTAL TECHNICAL REGULATIONS. GENERAL CONSIDERATIONS OF THE TECHNICAL REGULATIONS FOR ENVIRONMENTAL QUALITY, EMISSIONS, DISCHARGES AND DUMPING.

- **Article 319 – Drafting of regulations:** The technical regulations on environmental quality, emissions and discharges shall be prepared through participatory processes of discussion and analysis in the National Decentralized Environmental Management System.
  These regulations will be dictated by administrative act of the Competent Environmental Authority.
- **Article 320 - Stages for the elaboration of regulations:** For the elaboration of environmental quality, emission, discharge and dumping regulations, the provisions of Article 4 of the Environmental Management Act shall be observed, according to the following stages:
  a) Development of the necessary scientific, technical and economic studies;
  b) Consultations at the level of the National Decentralized Environmental Management System, as well as with competent public, private and civil society organizations;
  c) Analysis of the comments received.

4.5.2. MINISTERIAL RESOLUTION 103: INSTRUCTION TO THE REGULATIONS OF APPLICATION OF THE MECHANISMS FOR SOCIAL PARTICIPATION ESTABLISHED IN EXECUTIVE DECREE 1040

CHAPTER I: DEFINITION AND SCOPE OF APPLICATION OF THE SOCIAL PARTICIPATION PROCESS (PPS)

- **Article 1.** Social Participation Process shall be understood as the actions through which the Competent Environmental Authority shall inform the population about the possible implementation of projects, works or activities, as well as the possible expected socio-environmental impacts and the pertinence of the actions to be taken, with the purpose of gathering their opinions and observations, and incorporating those that are technically and economically viable into the Environmental Studies.
- **Article 2.** The Social Participation Process (PPS) shall be mandatory for all projects, works or activities that require an Environmental Study for their regularization. The National Environmental Authority, through the Single Environmental Information System, shall determine the Social Participation procedure to be applied, which may be developed with or without a Socio-environmental Facilitator according to the level of impact of the project, work or activity.
- **Article 3.** The National Environmental Authority shall be in charge of the institutional control and administration of the Social Participation Processes (PPS) in those projects or activities in which it intervenes as competent authority.
  If there are duly accredited Responsible Environmental Enforcement Authorities, they will be in charge of applying these instructions. In both cases, the Environmental Study will be published in the Single Environmental Information System, where observations from the public will also be registered.
- **Article 4.** Without prejudice to other mechanisms established in the Constitution of the Republic of Ecuador and in the Law, for the adequate application of this instrument, the following mechanisms and definitions shall be taken into account:
  1) Public Presentation Assembly (PPA): Central event of the Social Participation Process that convenes all stakeholders involved in the project and in which the

Impact Study and the Environmental Management Plan for the project, work or activity are presented in a didactic manner and adapted to local socio-cultural conditions. The assembly is a space for dialogue where concerns about the project are answered and observations, criteria, and recommendations are received from the participants.

2) **Information Meetings (RI):** In the IMs, the developer will inform about the main characteristics of the project, its foreseeable environmental impacts and the respective mitigation measures in order to clarify questions and doubts about the project and to receive comments and criteria from the participants.
3) **Public Information Centres (PIC):** The Impact Study and Environmental Management Plan, as well as didactic and visualized documentation will be made available to the public in an easily accessible location; personnel familiar with the project, work or activity must be present in order to explain its contents. The Information Centres may be fixed or itinerant.
4) **Website:** A mechanism through which any interested party can access information on the project, work or activity online. The address of the Website will be widely disseminated.
5) **Social Participation Procedure:** The National Environmental Authority will determine through the Single Environmental Information System SUIA, the procedure to be applied according to the level of impact that the project, work or activity may generate.
6) **Participatory workshops:** To complement and reinforce the effect of the RIs, workshops may be held to allow the promoter to identify perceptions and local development plans in order to insert its proposal for mitigation and/or compensation measures in its Environmental Management Plan, according to the reality of the environment where the activity, work, or project is proposed to be developed.
7) **Socio-environmental Facilitator:** Professional in free exercise, without any relationship of dependence with a public or private institution, that the Ministry of Environment recognizes as qualified and registered for the organization, coordination and conduction of Social Participation Processes; in the management of discussion groups and in the systematization, analysis and interpretation of social dialogue processes among diverse actors: companies, local governments, State, civil society.
8) **Area of Direct Social Influence:** Space resulting from the direct interactions of one or several elements of the project, work or activity with one or several elements of the social context where it will be implemented. The direct relationship between the project, work or activity and the social environment occurs at least two levels of social integration: individual units (farms, houses, land, and their corresponding owners) and first and second order social organizations (communes, precincts, neighbourhoods, associations of organizations and communities).

   In the event that the definitive location of the elements and/or activities of the project is subject to factors external to those considered in the Study or other subsequent technical and/or environmental aspects, duly substantiated justifications must be presented for evaluation and validation by the Competent Environmental Authority; for which purpose the determination of the area of direct influence will be made at least at the level of first and second order social organizations.
9) Area of Indirect Social Influence: Social and institutional space resulting from the relationship of the project with the political-territorial units where the project, work or activity is developed: parish, canton and/or province.

   The reason for the relationship is the role of the project, work or activity in local territorial planning. Although it is based on the political-administrative location of the project, work or activity, there may be other territorial units that are relevant

to the socio-environmental management of the project, such as indigenous territorial districts, protected areas and commonwealths.

CHAPTER III: SOCIAL PARTICIPATION PROCESS WITHOUT A SOCIO-ENVIRONMENTAL FACILITATOR

- **Article 27.** The social participation process without a Socio-environmental facilitator shall be carried out through the publication of the Environmental Study on the Website of the Single Environmental Information System; if there is a Website, it shall also be published online on the proponent's page. Observations, comments and recommendations from the public will be collected on the SUIA page, which will be incorporated into the Environmental Studies when they are technically and economically feasible.

  The proponent shall upload to the SUIA website the Environmental Study of the project, work or activity with all its annexes, and the executive summary of the same, which shall describe in understandable and simple language the main characteristics of the project, work or activity, its impacts and proposed Environmental Management Plan.
- **Article 28.** Once the Environmental Study, its annexes, and the executive summary have been published online, the proponent of the project, work or activity shall inform the population about the socialization of the same through the following means:
  1) Publication in a mass media with coverage in the areas of influence of the project, work or activity (press, radio, or television).
  2) Informative posters located in the implementation of the project, work or activity on the billboards of the sectional governments and in the places of greatest public affluence in the communities involved.
  3) Written communications addressed to the subjects of social participation indicated in the Regulations for the Application of the Social Participation Mechanisms established in the Environmental Management Act, to which the executive summary of the Environmental Study will be attached, applying the principles of legitimacy and representativeness. For the issuance of such communications, the following shall be considered:
     a) Authorities of the central and sectional governments related to the project, work or activity;
     b) Members of community, indigenous, Afro-Ecuadorian and gender organizations legally existing and duly represented; and,
     c) People living in the area of direct influence where the project, work or activity involving environmental impact will be carried out.

  The communication will include an extract of the project, work or activity and the address of the Website where the Environmental Study and the executive summary will be published. In the case of projects, works or activities to be developed in areas with the presence of communities of indigenous peoples and nationalities, the communication of the Social Participation Process must be made in Spanish and in the languages of these communities residing in the Area of Direct Influence of the project, work or activity. Likewise, written communications must be accompanied by an extract of the project, work or activity translated into the language of the nationalities.

  The means of verification of the call will be delivered by the proponent for the review of the competent Environmental Authority, who will verify that the same has been carried out in accordance with the provisions of these Instructions. The publication of the Environmental Study will be for 7 days from the date of the communication to the social actors of the project, work or activity, period during which the observations, comments and recommendations of the citizenship will be received online.
- **Article 29.** The competent Environmental Authority, considering the level of impact of the project, work or activity, may additionally order the proponent, through the SUIA, to hold an Informative Meeting in the area of influence of the project, which

shall be carried out under the supervision of the Competent Environmental Authority. The social actors related to the project, work or activity shall be summoned to the meeting in accordance with Article 29 of this instrument. The information on the place and date of the Informative Meeting shall be included in the means of convocation established in the aforementioned article.

The promoter of the project, work or activity must submit to the competent Environmental Authority the report of the Information Meeting held, including the list of questions and the systematization of the observations, comments and suggestions of the community, as well as all supporting documents that allows verification of compliance with this social participation mechanism: minutes of the meeting, record of attendees, photographic record, at least.

- **Article 30.** The competent Environmental Authority, during the review of the Environmental Study, shall verify that the criteria, observations and recommendations received, which are technically and economically feasible, are considered by the promoter of the project, work or activity and included in the Environmental Study with the corresponding technical support.

4.5.3. MINISTERIAL RESOLUTION 097 A

The Annexes to the Consolidated Text of Secondary Legislation of the Ministry of the Environment

- **Article 1.** Annex 1, regarding the Environmental Quality and Effluent Discharge Standard for the Water Resource, is hereby approved.
- **Article 2.** Annex 2, regarding the Environmental Quality Standard for the Soil Resource and Remediation Criteria for Contaminated Soils, is hereby approved.
- **Article 3.** Annex 3, regarding the Air Emissions Standard from Fixed Sources, is hereby approved.
- **Article 4.** Annex 4, regarding the Ambient Air Quality Standard or Immission Level, is hereby approved.
- **Article 5**. Annex 5, regarding the Maximum Noise Emission Levels and Methodology for Fixed and Mobile Sources and Maximum Vibration Emission Levels and Measurement Methodology, is hereby approved.

4.5.4. MINISTERIAL RESOLUTION -026

Procedure for Registration of Hazardous Waste Generators

R.O. 334, dated May 12, 2008, establishes the procedures for the registration of hazardous waste generators, hazardous waste management prior to environmental licensing, and for the transportation of hazardous materials.

4.6. REGULATIONS

4.6.1. OCCUPATIONAL HEALTH AND SAFETY REGULATIONS

Issued by Resolution No. 172 of the Superior Council of the Ecuadorian Social Security Institute. It establishes specific provisions to minimize labour risks and promotes the use of safety and protection equipment for employees, in addition to establishing appropriate work environment specifications.

4.6.2. OCCUPATIONAL HEALTH AND SAFETY REGULATIONS AND IMPROVEMENT OF THE WORKSITE ENVIRONMENT OF THE MINISTRY OF LABOR AND EMPLOYMENT

Issued by Executive Decree No. 2393 and published in the Official Gazette # 565 dated November 17, 1986. The provisions of these regulations apply to all work activities and in all work centres, with the objective of preventing, reducing or eliminating occupational hazards and improving the work environment.

This regulation shall apply to all work activities since its objective is the prevention, reduction or elimination of occupational hazards and the improvement of the work

environment. It shall also apply to all public companies, as prescribed in its article 11. The subjects regulated by this legal norm, in general terms, refer to:

- **TITLE I:** General Provisions
- **TITLE II:** Rules relating to the general conditions of work centres, project safety, structural safety, permanent services, temporary facilities, constructions, environment, occupational hazards.
- **TITLE III:** Regulations on machines, tools, installations, protections, control devices, use and maintenance.
- **TITLE IV:** Material Handling and Transportation, Cargo Vehicles, Forklifts
- **TITLE V:** Collective Protection, Fire Prevention, Exit Signs, Fire Prevention, Evacuation of Premises, Safety Signs.
- **TITLE VI:** Personal protection for skull, face, eyes, hearing, respiratory tract and others;
- **TITLE VII:** Incentives, Responsibilities and Penalties

4.6.3. GENERAL REGULATIONS OF THE LAW ON CULTURAL HERITAGE

Published in the Official Gazette No. 787 dated July 16, 1984. Articles 37, 38 and 39 of these regulations refer to the power of the National Director of the Cultural Heritage Institute to order the suspension or restoration of works that affect the cultural heritage of the Nation; Article 38 establishes solidarity between the owner of the property, those who have authorized or ordered the execution of the work and the contractors or those in charge of executing it; according to Article 39 the Municipalities or public or private entities must order the suspension or overthrow of works that affect the cultural heritage of the Nation and in case they are part of an environmental setting these must be restored".

4.7. TECHNICAL STANDARDS

The following technical standards shall apply:

4.7.1. INEN ISO 3864:2013 STANDARD

GRAPHICAL SYMBOLS, SAFETY COLORS AND SAFETY SIGNS

This standard replaces NTE INEN 439:1984 Safety colours, signs and symbols. ISO 3864 consists of the following parts, under the general heading Graphical Symbols-Safety Colours and safety signs:

- Part 1: Design principles for safety signs and safety indications
- Part 2: Design principles for product safety labels
- Part 3: Design principles for graphic symbols used on safety signs and signals
- Part 4: Colorimetric and photometric properties of safety sign materials

This part of ISO 3864 establishes the safety identification colours and design principles for safety signs and safety indications to be used in workplaces and public areas for the purposes of accident prevention, fire protection, health hazard information and emergency evacuation. It also establishes the basic principles to be applied when drafting standards containing safety signs.

4.7.2. NEN STANDARD 2841 ENVIROMENTAL MANAGEMENT. COLOR STANDARDIZATION FOR DEPOSIT CONTAINER AND SOLID WASTE TEMPORARY STORAGE

- **PURPOSE**
  This standard establishes the colours for solid waste deposit and temporary storage containers in order to encourage separation at the source of generation and selective collection.
- **FIELD OF APPLICATION**
  This standard applies to the identification of all containers for the deposit and temporary storage of solid waste generated in the various sources: domestic, industrial, commercial, institutional and services. Hazardous and special solid waste is excluded.
- **REQUIREMENTS**
  Waste separation at the source is the responsibility of the generator, and containers must be used to facilitate its identification for subsequent separation, collection, use (recycling, recovery or reuse), or adequate final disposal. Separation guarantees the quality of usable waste and facilitates its classification; therefore, the containers that contain it must be clearly differentiated.
  Collection procedures should be carried out safely, avoiding spillage of waste as much as possible and should not cause the separation previously made to be lost, for which the waste should be packaged in such a way as to avoid contact with the environment and the people in charge of collection.
  The containers for collection at the source of generation can be returnable or disposable and must be placed in the established collection sites.
  The infrastructure in the collection and stockpiling areas must be properly signposted and evacuation and internal transportation systems will be taken into account according to the provisions of NTE INEN 2266.
  Once the waste has been separated into its respective containers, it should be stored according to its real feasibility of use and compatibility, which will facilitate its collection and transportation.
  Containers
  The coloured containers must comply with the requirements established in this standard, depending on their location and type of waste.

4.8. OTHER BODIES OF LAW

- General Regulations of the Labour Risks Insurance, issued by Resolution No. 741 of the Superior Council of the Ecuadorian Institute of Social Security dated May 30, 1990.
- Fire Prevention Regulations. Official Gazette No. 47, March 21, 2007.
- Regulations on Occupational Safety and Hygiene, issued by Resolution No. 172 of the Superior Council of the Ecuadorian Institute of Social Security.
- Regulation on occupational safety and health and improvement of the working environment. Ministry of Labour and Employment. Official Records 137 dated August 9, 2000.

4.9. INSTITUTIONAL FRAMEWORK

The purpose of YILPORT HOLDINGS is to plan and manage Puerto Bolívar in coordination with all the Public Bodies involved, in order to improve the Governance of the whole Port Cluster. This requires a clear, transparent and stable mutual relationship. YPH is part of the YILDIRIM Group, which has activities in the fields of Port Development and Operation, Energy, Mining, Fertilizers, Shipyards, Shipping (Bulk), etc. Thus, it hopes that the relationship initiated with this port project may give rise to new opportunities for collaboration of mutual interest.

YPH wishes to develop a respectful and open behaviour towards all the institutions and Administrations of the Government of Ecuador involved in this project, especially with the Ministry of Transport and Public Works, with the Government of El Oro, with the absolute conviction that they all represent the interests of Ecuador, and with the aim of

achieving a respectful relationship, public and private, through the Concession of Puerto Bolívar to YPH.
In Ecuador, the Norms that regulate port services only contemplate direct and indirect provision: "*Directly, by the State, through its institutions, by means of contracting port operators, under a competitive bidding modality. Indirectly, through delegation by the State, through its institutions (under the legal form of concession or authorization), according to the procedure determined in the "Regulations for the application of the exceptional regime of delegation of public transport services"; or, by port operators contracted by the private company when it does not involve the occupation, usufruct of existing state property, infrastructure and facilities.*"

Therefore, in public ports such as Puerto Bolívar there is a permanent dichotomy between the public and the private sector. While companies always emanate from mercantile and economic interests, whoever the owner may be, the public sector seeks the economic and social welfare of the country and is obliged both to look after the community, i.e. the public interest, and to facilitate the private sector to make the best use of the ports in terms of benefit to the community. It is difficult to achieve a balance without falling into port dogmas; to do so, it is necessary to know as much as possible about one's own relationship model and local casuistry, and to establish comparisons with the outside, as well as best practices. Similarly, it is necessary to understand what a port is and the role it plays in the world in the three economic, social and environmental spheres, and to be aware of the potential for change.

4.9.1. MINISTRY OF THE ENVIRONMENT OF ECUADOR

Article 8 of the Environmental Management Act states that the national environmental authority will be exercised by the Ministry of the Environment, which will act as the governing, coordinating and regulatory body of the National Decentralized Environmental Management System, without prejudice to other competencies of other State institutions. It is in charge of dictating the policies, norms and instruments of promotion and control, in order to achieve the sustainable use and conservation of natural resources aimed at ensuring the right of the inhabitants to live in a healthy environment and to support the development of the country.

Article 9, paragraph g) of the Environmental Management Act establishes the powers of the Ministry of the Environment. Among them is that of settling conflicts of competence that arise between the agencies that are part of the Decentralized National System of Environmental Management. This Ministry, in accordance with Article 20 of the Environmental Management Act, must issue environmental licenses without prejudice to the competences of the entities accredited as responsible environmental enforcement authorities.

4.9.2. AUTONOMOUS DECENTRALIZED PROVINCIAL GOVERNMENT OF EL ORO

The Autonomous Decentralized Provincial Government of El Oro aims to develop local capacities to generate knowledge of the provincial reality and its resources, as well as an administrative, business and corporate culture. It emphasizes the adequacy of the necessary legal framework, coordination and responsibility in the management and preservation of natural resources, empowering human resources in their management at local, provincial, national and international levels, to achieve the harmonious development of the province in the perspective of providing welfare and quality of life to its inhabitants.

4.9.3. SUB SECRETARIAT OF PORTS AND MARITIME AND INLAND WATERWAY TRANSPORT

The objective of the Sub Secretariat of Ports and Maritime and Inland Waterway Transportation is to "Promote the development of maritime and river activity by optimizing port services in Ecuador, with the aim of positioning it as one of the main players in cargo handling in our region".

To promote the development of maritime and fluvial activity, means to plan, regulate and control the shipping and port system in the national territory, ensuring compliance with objectives and priorities defined in the current legal framework. The attributions and responsibilities are to inform the highest authorities of the Ministry of Transportation and Public Works about the convenience of establishing new ports of national character or about the use of ports or maritime or fluvial facilities, for commercial purposes, by natural, juridical, private or public persons.

5. DEFINITION OF THE STUDY AREA

The Puerto Bolívar Port Terminal operated by YILPORTECU S.A., is located in the parish of Puerto Bolívar, Machala Canton, province of El Oro, at the following coordinates:

Table 3: Project Location Coordinates

COORDINATES WGS84		
POINTS	**X**	**Y**
1	**East (X):** 611290	**North (Y):** 9639124
2	**East (X):** 610952	**North (Y):** 9639220
3	**East (X):** 610966	**North (Y):** 9639464
4	**East (X):** 611047	**North (Y):** 9640244
5	**East (X):** 611941	**North (Y):** 9639964
6	**East (X):** 611608	**North (Y):** 9639609
7	**East (X):** 611680	**North (Y):** 9639532

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

This location strategically places it 13 nautical miles from the main international traffic routes that connect the West Coast of South America with the Atlantic Ocean through the Panama Canal. Its docks are 4.5 nautical miles from the sea buoy.

The Puerto Bolívar Port Terminal has the following boundaries:

- North: National Navy land
- South: Transversal unnumbered street leading to the boardwalk
- East: Bolívar Madero Vargas Avenue
- West: Santa Rosa Estuary in front of Jambeli Island.

PROVINCE OF EL ORO

The province of El Oro is the most southern province of the Ecuadorian coast, with several zones: mountainous, rainforest, dry forest, coast and archipelago.

Geographically, it is located in the extreme west of Ecuador, one part of its territory is located in the foothills of the foothills of the Western Cordillera of the Andes and the other majority in the Coastal Region and a third, the Insular Region.

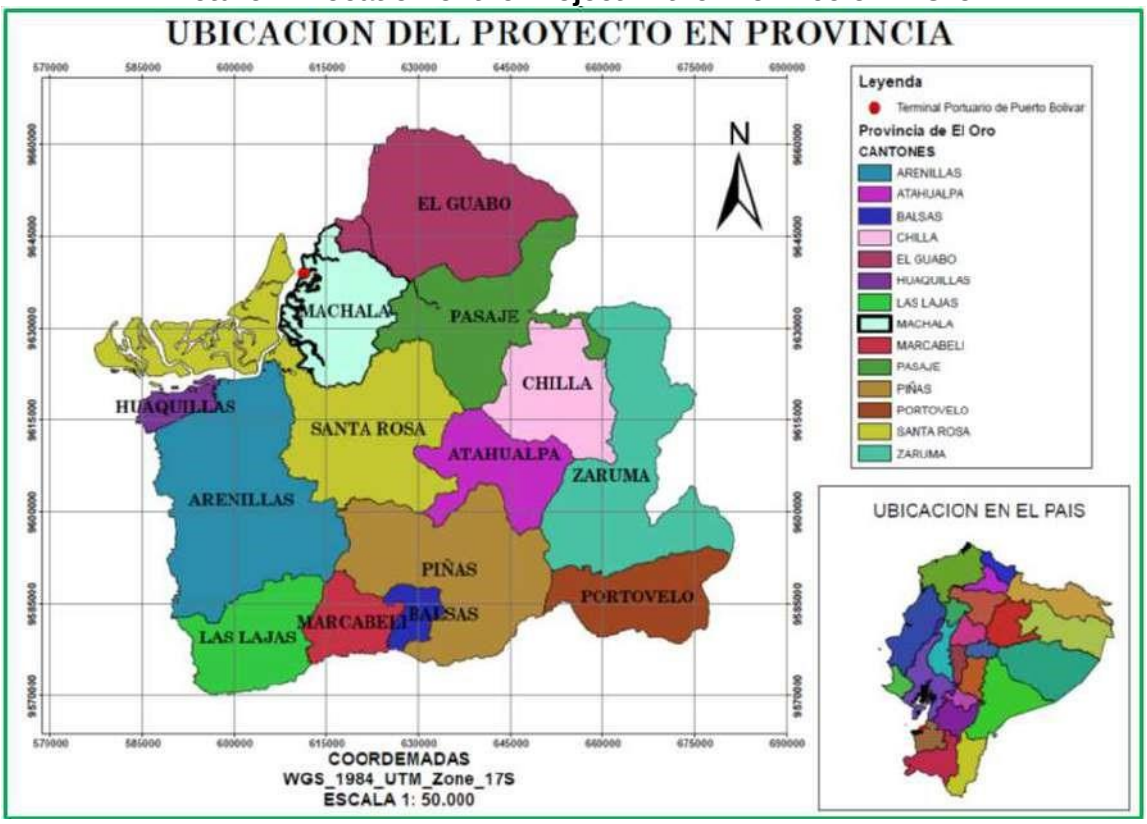
The province covers an area of 5,791.85 km², which represents 2.15% of the national surface. The provincial boundaries are to the north the provinces of Guayas and Azuay,

to the south the province of Loja and Peru, to the east the provinces of Azuay and Loja and to the west Peru and the Pacific Ocean.
Much of the coastal sector of the province, especially at the mouth of Santa Rosa Estuary, has a landscape of estuaries, palm trees and mangroves; in front of it there is a set of channels that separate it from the Jambelí archipelago.

El Oro has a great natural, cultural, archaeological, ecological, scenic and gastronomic diversity and richness.

The province is divided into 14 cantons:
1. Machala
2. Arenillas
3. Atahualpa
4. Balsas
5. Chilla
6. El Guabo
7. Huaquillas
8. Las Lajas
9. Marcabelí
10. Pasaje
11. Piñas
12. Portovelo
13. Santa Rosa
14. Zaruma

Picture 2: Location of the Project in the Province of El Oro



Source: *www.geoportaligm.gob.ec, Military Geography Institute*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *April 6, 2017*

MACHALA CANTON

Machala is the capital of the Province of El Oro and is among the main cities of Ecuador, offering a significant contribution to the country's economy.

Machala is geographically located in the lowlands near the Gulf of Guayaquil, on the Pacific Ocean (thanks to its Puerto Bolívar); specifically, at the western end of the Jambelí Archipelago. Therefore, the city is located between 0 and 10 meters above sea level.

Within the province of El Oro, Machala is located in the Central East. It is bordered to the north by the Pacific Ocean and Canton El Guabo; to the south by Canton Santa Rosa, to the east by Canton Pasaje and to the west by Canton Santa Rosa and its Jambelí Archipelago.

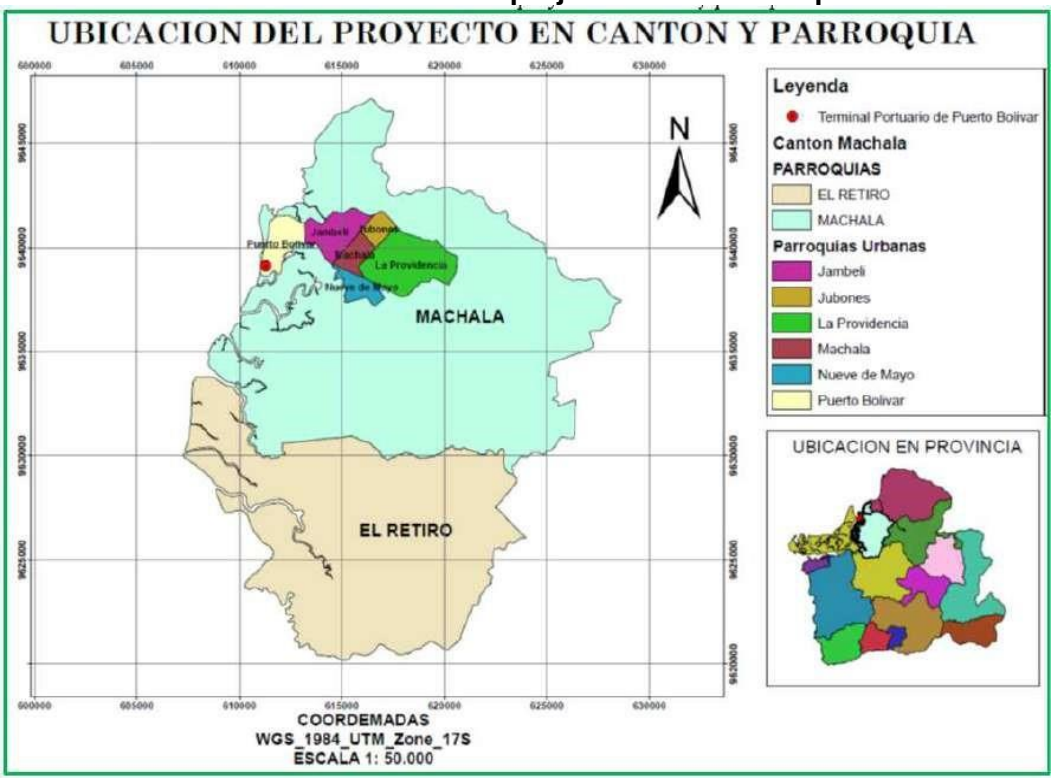
Machala has a territorial extension or area of 349.9 Km^2, representing 6% of the province.

The Machala canton was created on June 25, 1824, by the Territory Distribution Act of Gran Colombia.

The Machala canton has a total of 8 parishes, 7 of which are urban and 1 rural, as follows:

- Machala (canton capital)
- Puerto Bolívar
- La Providencia
- 9 de mayo
- Jambelí
- Jubones
- El Cambio
- El Retiro (rural)

Picture 3: Location of the project in canton and parish



Source: *www.geoportaligm.gob.ec, Military Geography Institute*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *April 6, 2017*

PUERTO BOLÍVAR PARISH

The first seaport of Machala was founded by the Cantonal Council on December 18, 1883, which was named "Puerto Bolívar".

Later, after five years, the "Municipal Dock" was inaugurated on May 9, 1902, which is currently known as " Old Cabotage Dock". In 1946, a wooden mooring was built to ship the fruit, its rustic environment was constituted by a long platform, on which the ships in charge of receiving the fruit were loaded. In 1960, the first dredging and pile driving works were carried out.

The parish of Puerto Bolívar is located 5.5 km from the city of Machala and offers tourist, economic and commercial alternatives.

Puerto Bolívar is located at the entrance of the Santa Rosa Estuary, located south of the Gulf of Guayaquil, and the natural shelter of Jambelí Island.

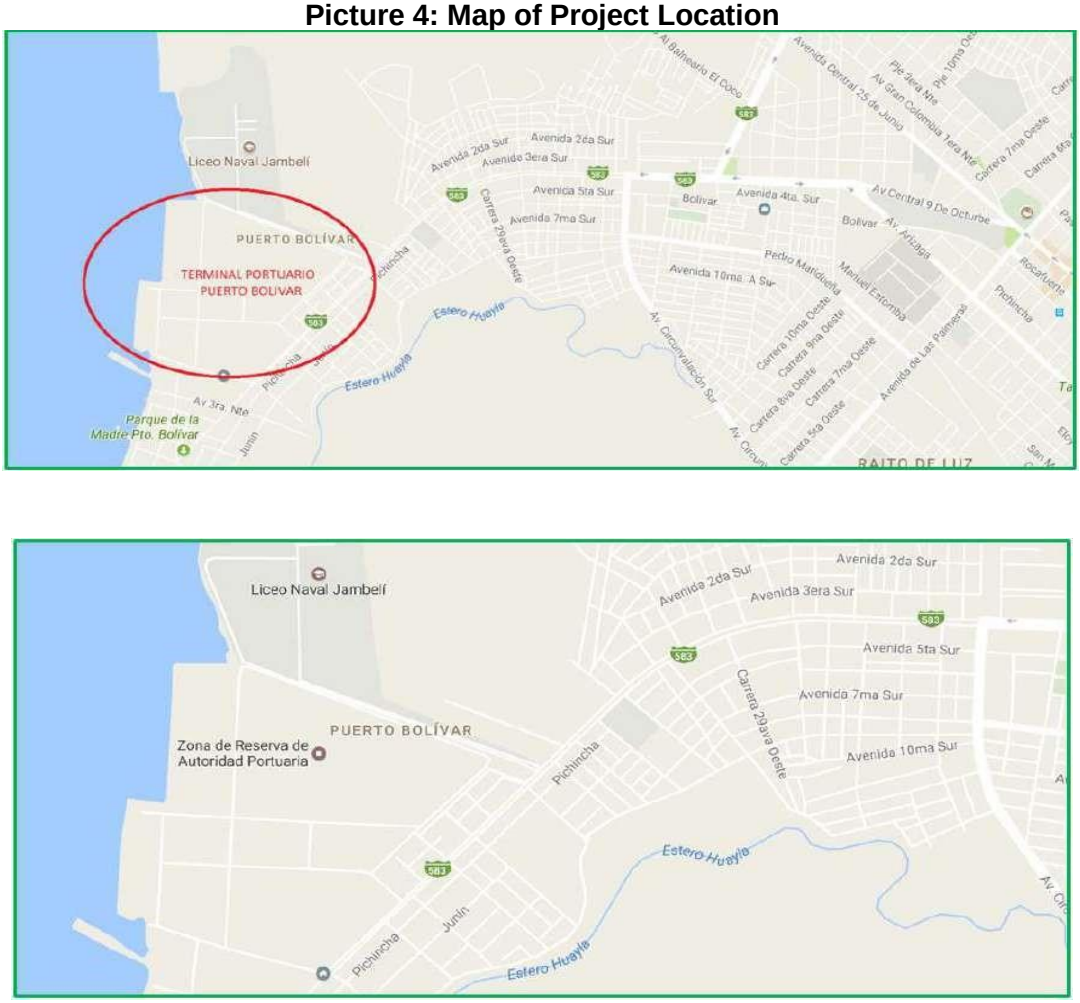
Puerto Bolívar's privileged location in the Santa Rosa Estuary, sheltered by the island of Jambelí, provides the port with natural protection and makes it a safe place for the docking and operation of ships. In addition, the 200-meter wide access channel, marked with lighted buoys, provides access to the port and serves as an anchorage area.

Due to its geographic location, it is a natural port for the southern region of the country. Approximately 500 ships enter Puerto Bolívar annually and the main source of income is the fees paid by vessels to use the port facilities. The port has a semi-mechanized system for shipping banana boxes.

The aquatic space comprises from the sea buoy that is 4.5 miles to the anchorage area and also the area occupied by the breakwater docks with a length of 130 meters and a width of 30 meters, which has the facilities of 2 berths, having a draft of 12.5 meters at low tide; it also has a marginal dock, being its length 360 meters with a width of 25 meters and a draft of 12.5 meters, in which 2 ships of up to 20,000 DWT can dock. In addition, an extension of the marginal wharf of 300 meters in length and a draft of 14.5 meters was recently built, with a continuous platform on piles, which joins it to the storage yards on land.

On the other hand, there is a breakwater dock known as "cabotage dock", which has been destined to the operation of boats dedicated exclusively to tourist service, whose extension is 60 meters long, and a draft of 5.7 meters.

Picture 4: Map of Project Location



Source: *www.googlemaps.com*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *April 6, 2017*

Picture 5: Satellite Image of Project Location

Source: *www.googleearth.com*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *April 6, 2017*

In order to obtain the Intersection Certificate of the project with the National System of Protected Areas (SNAP), State Forest Heritage (PFE), Forest and Protective Vegetation (BVP), the pertinent documentation was submitted through the platform of the Single

Environmental Information System of the Ministry of Environment for the project ***"CONSTRUCTION AND OPERATION OF THE PUERTO BOLÍVAR PORT TERMINAL"*** located in the province/s of (EL ORO), from which it was determined that the project **DOES NOT INTERSECT** with the National System of Protected Areas (SNAP), State Forest Heritage (PFE), Forest and Protective Vegetation (BVP); according to the Resolution issued MAE - SUIA -RA -DPAEO - 2017 - 208188.

Photograph 1: Puerto Bolívar Port Terminal

Source: *Photograph taken with MAVIC Drone (7 km transmission range, flight speed 64km/h*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala, El Oro*
Date: *April 28, 2017*

6. ENVIRONMENTAL DIAGNOSIS - BASELINE OF THE STUDY AREA

The environmental assessment was carried out in two stages:

1. Compilation of specialized information in the area of studies carried out by public and private institutions (Territorial Development and Planning Plans of Machala canton and Puerto Bolívar parish).
2. Updating of the required information and verification of the information obtained, through a reconnaissance of the site where the project will be implemented and its direct area of influence.

Subsequently, with the information from the field and office with the consulting team, we proceeded to characterize the components of the physical, biotic and socioeconomic environment.

All information regarding the geographic location of the research points of the different environmental components is presented in the WGS84 reference system and ellipsoid, which is an internationally recognized and accepted system.

6.1. PHYSICAL ENVIRONMENT

The methodology used in the baseline study of the physical component included a desk and a field research phase.

For the cabinet phase, reports and maps of Ecuador were used, including maps from INERHI, INAMHI, INECEL, CLIRSEN ORSTOM, CEPE, the Geological Sheets of the

DGGM (scale 1:50,000), the Geological Map of the Republic of Ecuador from the British Mission (scale 1:500.00), Agrarian Regionalization Program (PRONAREG), Seismic Studies of PETROECUADOR, INECEL, Seismic Catalogue CERESIS, 1985, Studies by the National Bureau of Renewable Natural Resources (DINAREN), National Water Resources Council (CNRH), Ministry of the Environment (MAE), Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), among others.

The information gathered for the study was corroborated in the field, in a general way, and used for the preparation of the maps presented in the study, for each of the physical aspects evaluated.

6.1.1. CLIMATOLOGY

The climate of the Ecuadorian coast is influenced by changes in the ocean and the movement of the Intertropical Convergence Zone (ITCZ). There are two well-defined seasons. One of rains (warm and humid season) from December to May, and one of absence of rains (cold and dry season) from June to November. These conditions are given by the ocean-atmospheric interaction and the variations in the same that cause changes in the climate.

To obtain the climatological data of the project area, information was taken from the Oceanographic Institute of the Ecuadorian Navy (INOCAR), which was created by Official Register No. 108 - July 25, 1972, at the request of the Ministry of National Defence.

The Oceanographic Institute of the Navy of Ecuador is in charge of a network of seven (7) Coastal Meteorological Stations, having updated its Meteorological Data Bank and knowing the climatic conditions of the coastal area. The stations are:

1. San Lorenzo (Esmeraldas)
2. Emeralds
3. Manta (Manabí)
4. La Libertad (La Libertad)
5. Guayaquil (Guayas)
6. Puna (Guayas)
7. Puerto Bolívar (El Oro)

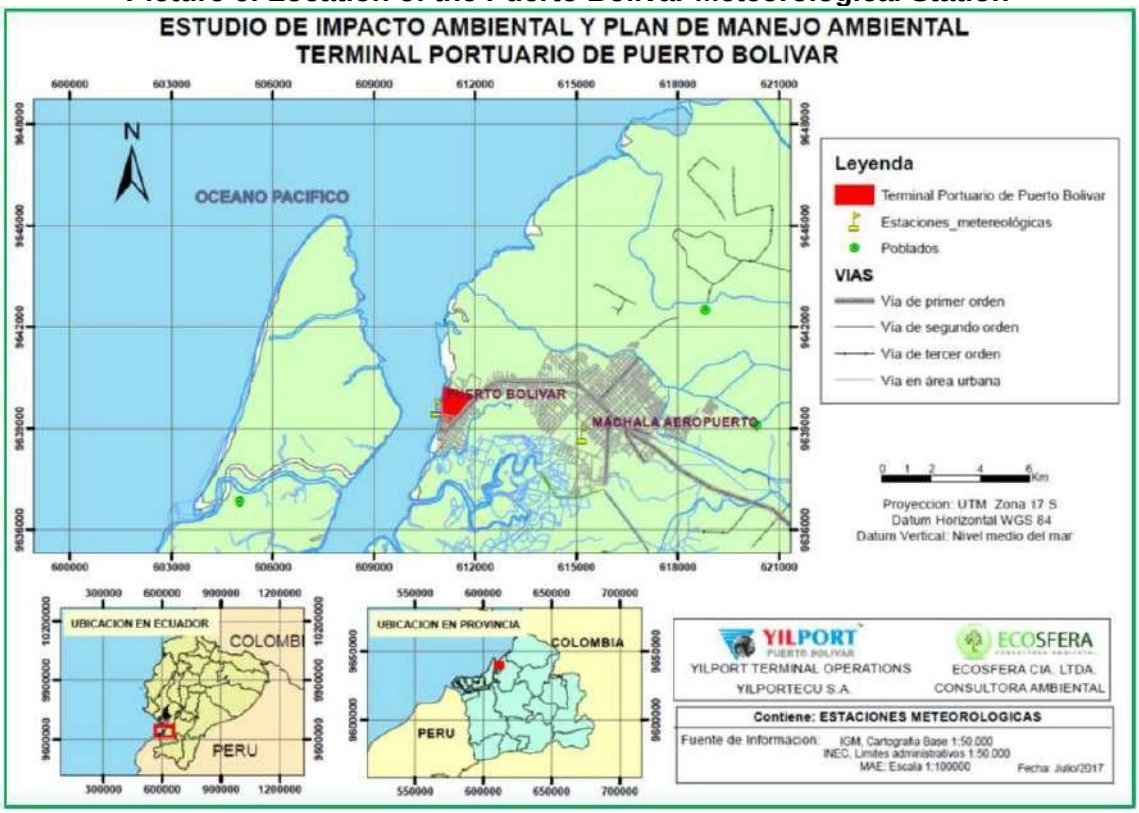
Therefore, for the description of this component we have taken the data of the Puerto Bolívar Meteorological Station located within the Port complex at the following coordinates:

Table 4: Coordinates of Puerto Bolívar Meteorological Station

	Geographic	WGS84
Latitude S	03° 15’ 30’’	610976
Longitude W	80° 00’ 03’’	9639449

Source: *www.inocar.com*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala, El Oro*
Date: *April 28, 2017*

Picture 6: Location of the Puerto Bolívar Meteorological Station



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Photograph 2: Puerto Bolívar Weather Station

Source: *Photograph taken by the Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro* ***Date:*** *April 20, 2017*

The characteristic climate type in the study area corresponds to Tropical Mega Thermal Semi - Arid.

Picture 7: Map of Climate Types

Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.1.1. TEMPERATURE:

Temperature refers to the degree of specific heat of the air at a given place and time, as well as the temporal and spatial evolution of this element in different climatic zones.

Temperature constitutes the most important meteorological element in the delimitation of most of the climatic types. The monthly average air temperature, average maximum temperature and average minimum air temperature for the last five years are presented in the following tables:

AVERAGE TEMPERATURE

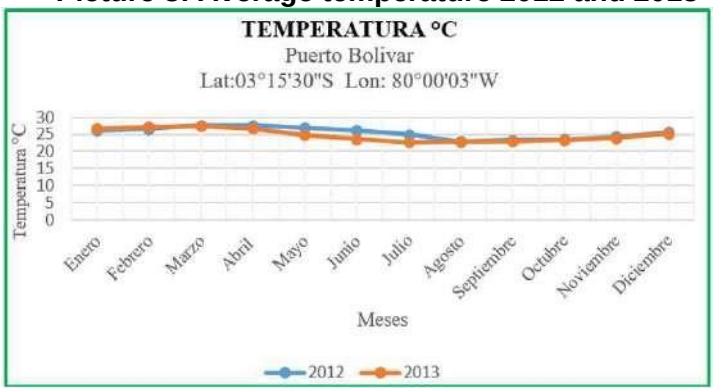
Table 5: Average monthly air temperatures

MONTH	2012	2013	2014	2015	2016
January	26,18	26,68	26,98	27,08	27,73
February	26,54	27,23	27,24	27,62	28,1
March	27,58	27,52	27,25	27,56	27,9
April	27,55	26,72	27,55	27,97	28,32
May	26,99	24,87	26,87	28,02	27,92
June	26,12	23,61	26,33	27,24	26,14
July	24,92	22,67	25,28	26,2	25,17
August	22,98	22,79	23,88	24,73	24,19
September	23,35	22,92	23,94	25,67	
October	23,51	23,31	23,77	25,74	

November	24,35	23,84	24,8	26,6	
December	25,55	25,24	26,24	28,1	

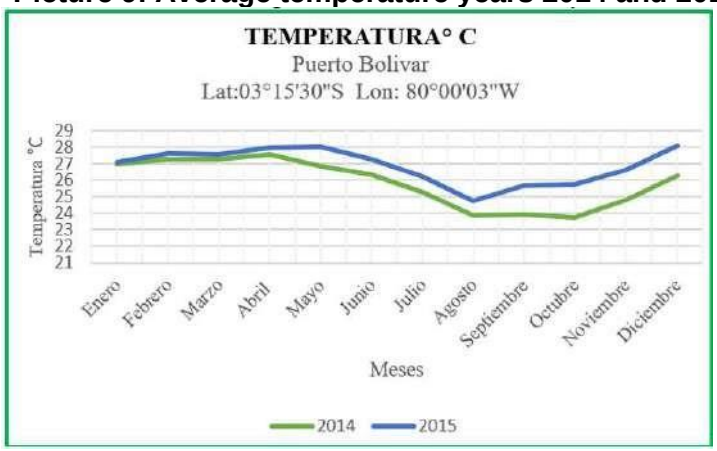
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda., 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 8: Average temperature 2012 and 2013



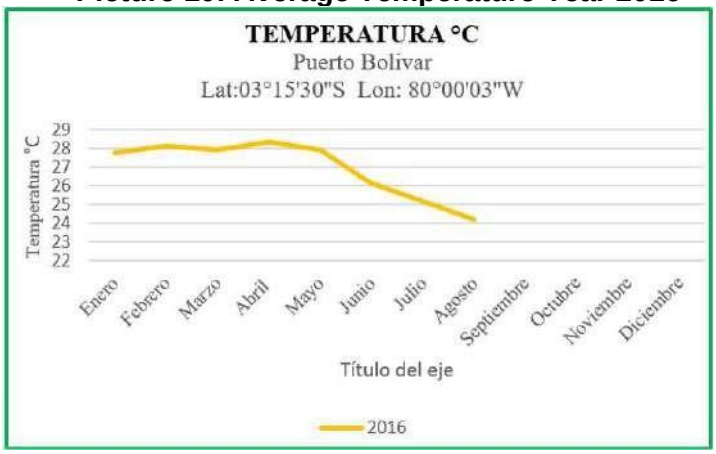
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 9: Average temperature years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 10: Average Temperature Year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

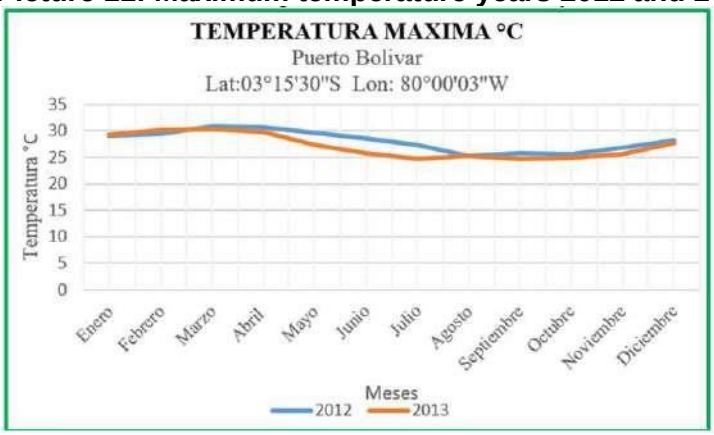
AVERAGE MAXIMUM TEMPERATURE ºC:

Table 6: Monthly average of maximum air temperature ºC

MONTH	2012	2013	2014	2015	2016
January	29,09	29,3	29,31	29,58	30,16
February	29,48	30,13	29,63	30,44	30,56
March	30,84	30,27	30,08	30,26	30,32
April	30,69	29,81	30,13	30,67	31,08
MONTH	**2012**	**2013**	**2014**	**2015**	**2016**
May	29,7	27,29	29,49	30,79	30,56
June	28,59	25,78	28,66	29,69	29,73
July	27,39	24,68	27,52	28,51	29,17
August	25,24	25,21	25,68	26,75	27,56
September	25,79	24,76	26,11	27,84	
October	25,6	24,91	25,77	27,51	
November	26,81	25,59	27,28	28,56	
December	28,21	2766	28,57	30,38	

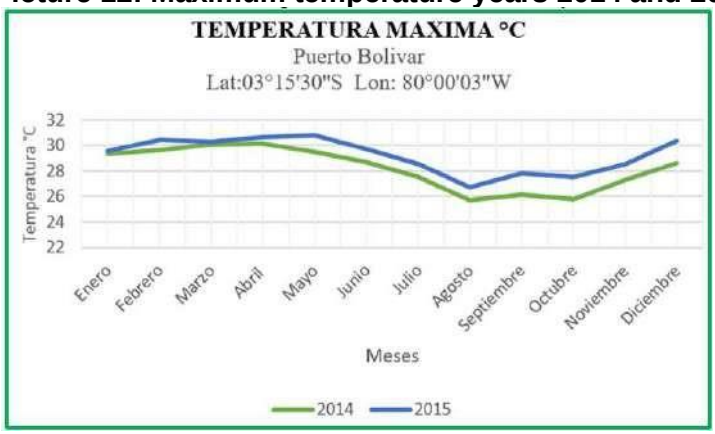
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 11: Maximum temperature years 2012 and 2013



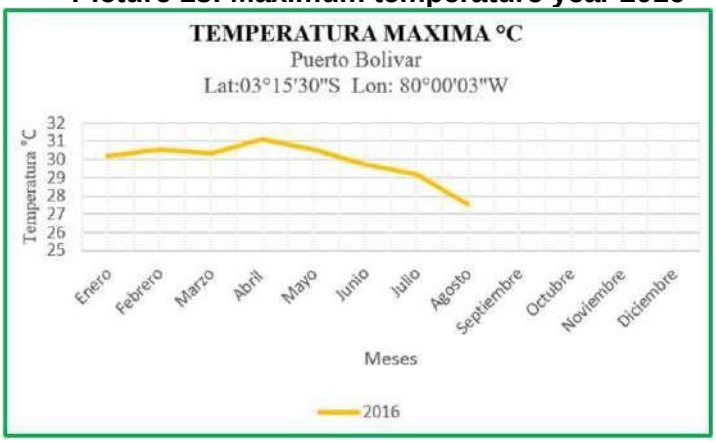
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 12: Maximum temperature years 2014 and 2015.



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 13: Maximum temperature year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

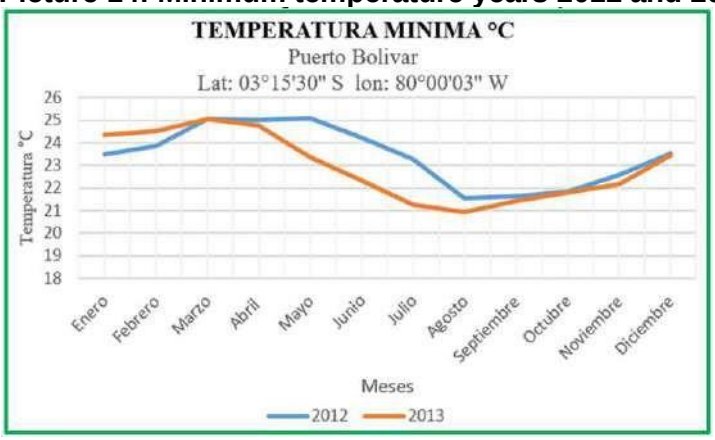
AVERAGE MINIMUM TEMPERATURE:

Table 7: Monthly average of minimum air temperature ºC

MONTH	2012	2013	2014	2015	2016
January	23,49	24,35	24,24	24,5	25,42
February	23,86	24,53	24,53	24,81	25,45
March	25,03	25,06	24,73	25,03	25,46
April	24,99	24,76	25,36	25,34	25,73
MONTH	**2012**	**2013**	**2014**	**2015**	**2016**
May	25,1	23,34	24,38	25,44	25,85
June	24,22	22,34	24,29	24,79	23,41
July	23,29	21,26	23,36	24,12	23,3
August	21,56	20,95	22	22,97	22,35
September	21,65	21,41	21,83	23,83	

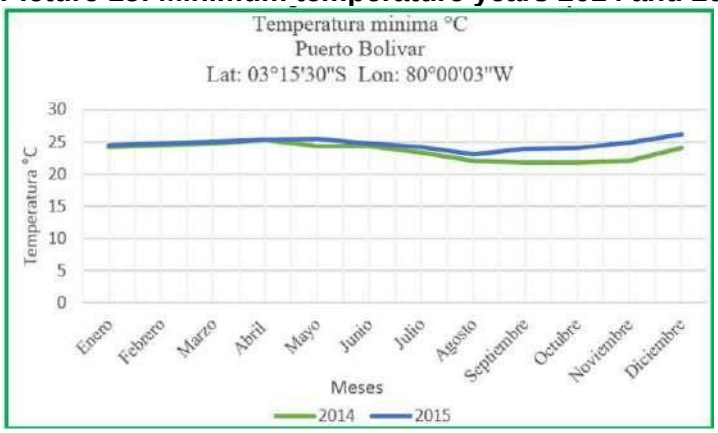
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 14: Minimum temperature years 2012 and 2013



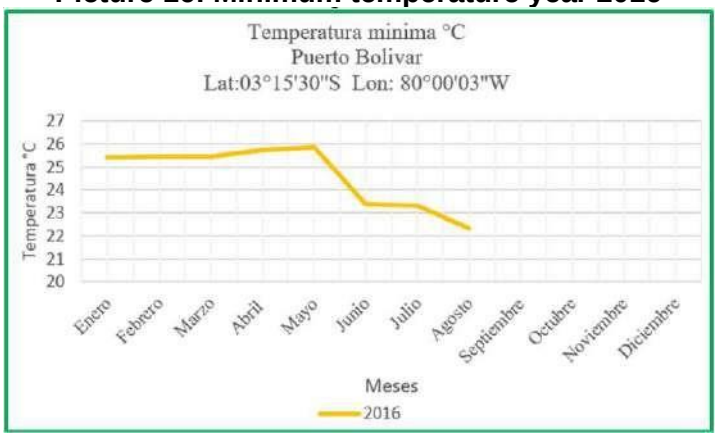
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 15: Minimum temperature years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 16: Minimum temperature year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

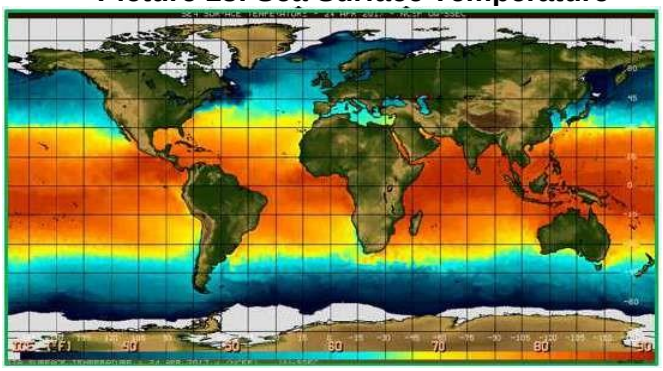
Picture 17: Isotherms Map

Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Sea Surface Temperature

INOCAR offers sea surface temperature records from previous years, which help us to obtain a seasonal trend for the year. The warmest months are February and March with averages of 27,3°C; and the months with the lowest temperature are the dry season. August is the coldest, with a temperature of 25.5°C. The warmest years correspond to the 1997 and 1998 El Niño events, in which the annual average temperature was 27.1 and 27.0 °C, respectively.

Picture 18: Sea Surface Temperature



Source: *NASA, April 24, 2017*

6.1.1.2. PRECIPITATION

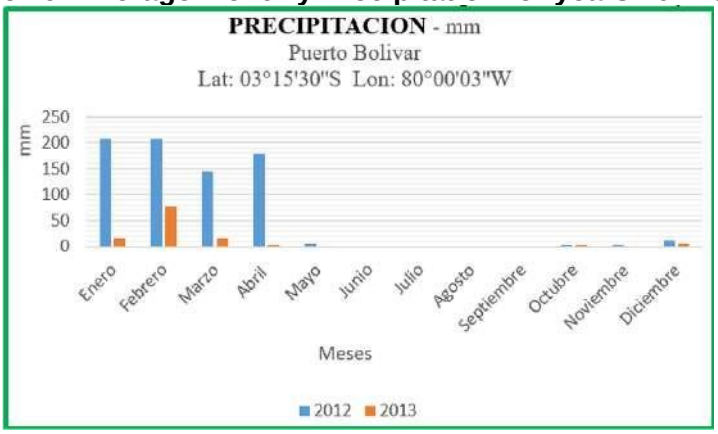
Precipitation is any form of hydrometeor that falls from the atmosphere and reaches the earth's surface. The amount of precipitation on a point on the earth's surface is called pluviometric amount.
Precipitation is generated in clouds when they reach a saturation point; at this point the water droplets increase in size until they reach a mass where they precipitate by the force of gravity.
According to statistical data provided by INOCAR from the Puerto Bolívar weather station, a normal winter period is considered to be when the accumulated rainfall during the year does not exceed 800 millimetres. The months with the highest precipitation are February and March; the driest months are August and September.
The monthly precipitation averages for the last 5 years are detailed in the following tables and pictures:

Table 8: Monthly Average Precipitation mm

MONTHS	2012	2013	2014	2015	2016
January	208	15,3	58,4	31,1	101
February	208	76,8	36,9	26,1	412,3
March	144,3	15,9	44,3	125,7	154,5
April	178,8	2,5	0	20,5	117,4
May	3,9	0,8	37,7	136,7	0
June	0	0	5,4	6,1	0
July	1	0	1,6	2	3,4
August	0	0,5	0	0,8	0
September	0	0	0	0	
October	2,9	3,4	5,3	11	
November	3,4	1	0,7	1,6	
December	11,4	5	2,2	5,4	

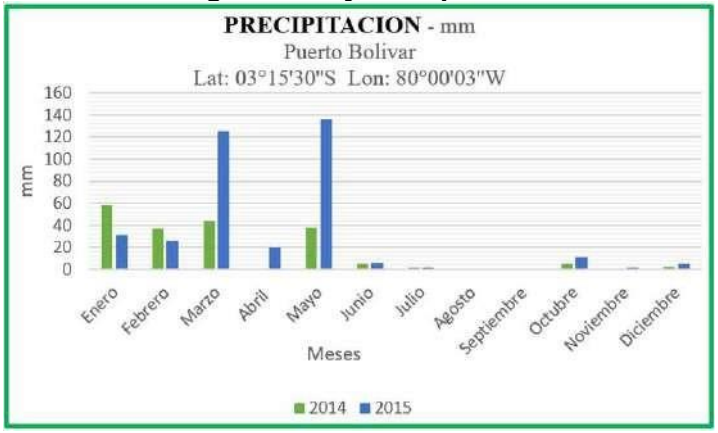
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 19: Average Monthly Precipitation for years 2012 and 2013



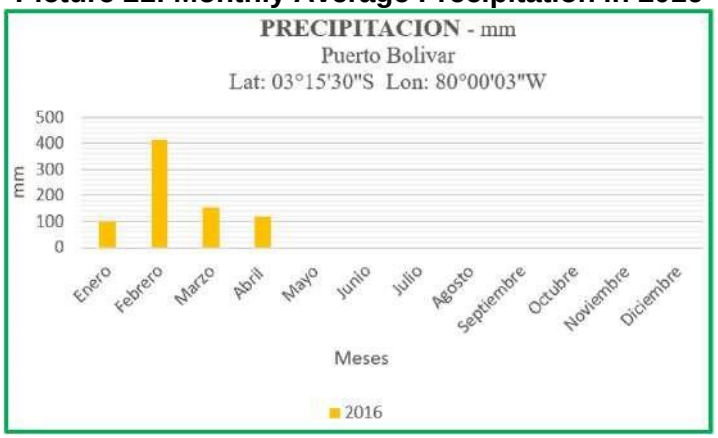
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 20: Average Monthly Precipitation 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 21: Monthly Average Precipitation in 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 22: Map of isohyets

Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.1.3. RELATIVE HUMIDITY

Humidity is due to the water vapour that is present in the atmosphere. Vapour comes from evaporation from seas and oceans, rivers, lakes, plants and other living things.

The average relative humidity in the Puerto Bolívar area is 75%; this parameter is influenced by the presence of surrounding bodies of water.

The air has a relatively constant humidity concentration during the midday hours in the months of January through March, the humidity decreases due to overheating. The monthly averages of Relative Humidity for the last 5 years are detailed in the following tables:

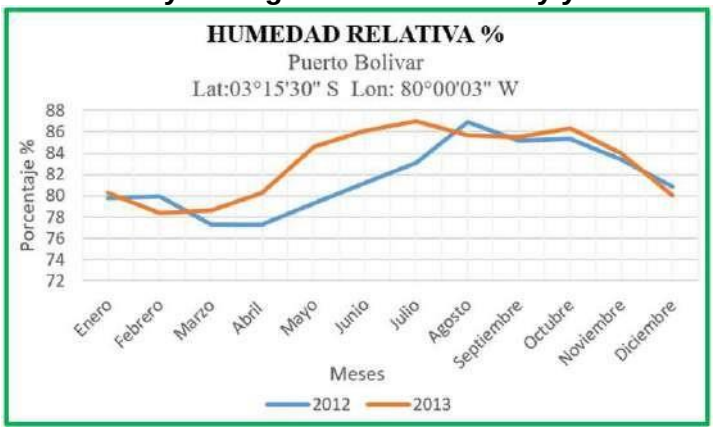
Table 9: Monthly Average Relative Humidity % (%)

MONTHS	2012	2013	2014	2015	2016
January	79,81	80,27	78,46	78,76	79,12
February	79,95	78,34	76,3	77,4	78,31
March	77,28	78,61	77,05	78,53	78,99
April	77,29	80,26	77,71	79,54	77,13
May	79,31	84,61	79,52	78,77	78,14
June	81,2	86,04	79,49	79,48	80,2
July	83,09	86,99	82,07	81,71	84,2
August	86,92	85,63	85,16	84,14	86,29

September	85,18	85,46	84,9	81,78	
October	85,29	86,36	85,01	81,95	
November	83,39	84,02	82,64	79,81	
December	80,82	80,04	79,98	77,8	

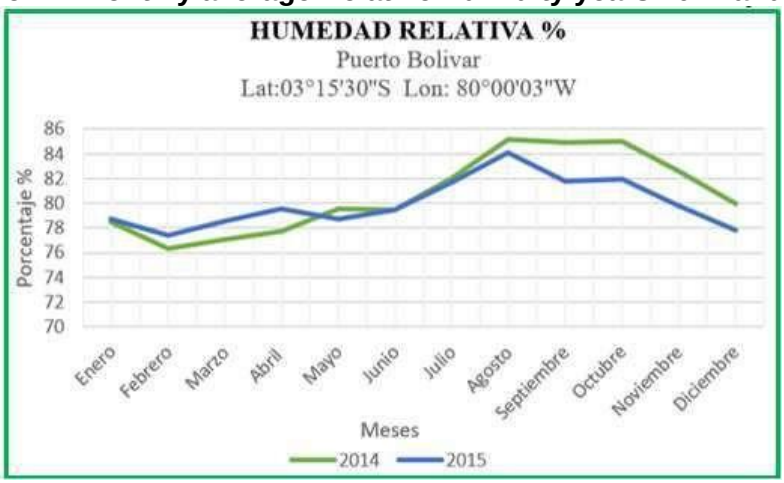
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 23: Monthly average Relative Humidity years 2012 and 2013



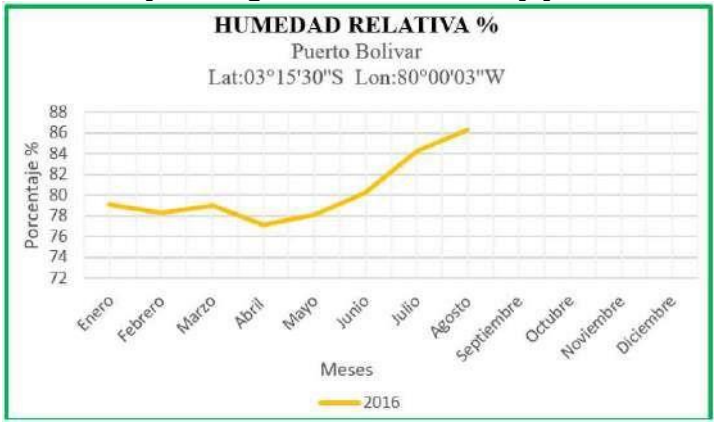
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 24: Monthly average Relative Humidity years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 25: Monthly average Relative Humidity years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.4. HELIOPHANY

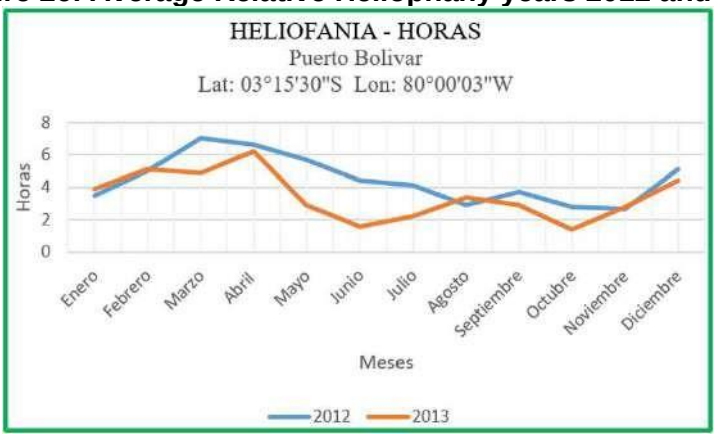
It represents the amount of sunshine. This parameter is highly variable and is directly influenced by cloudiness. The monthly average is 115 hours, having the months from December to May the highest monthly heliophoria and the months from August to November the lowest monthly heliophoria.

Table 10: Monthly average Heliophany - hours

MONTHS	2012	2013	2014	2015	2016
January	3,5	3,9	4,3	5,2	4,8
February	5	5,1	4,5	5,3	4,4
March	7	4,9	6,1	5,9	4,4
April	6,6	6,2	5,6	6,5	5,2
May	5,7	2,9	5	7	7,2
June	4,4	1,6	3,7	5,1	4,3
July	4,1	2,2	4,4	4,8	3
August	2,9	3,4	2,5	3,4	2,4
September	3,7	2,9	3	3,4	
October	2,8	1,4	2,4	2,6	
November	2,7	2,8	3,7	3,2	
December	5,1	4,4	6	5,5	

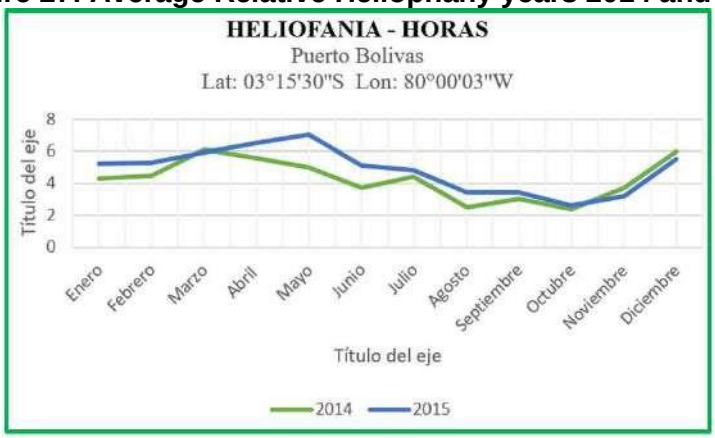
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 26: Average Relative Heliophany years 2012 and 2013



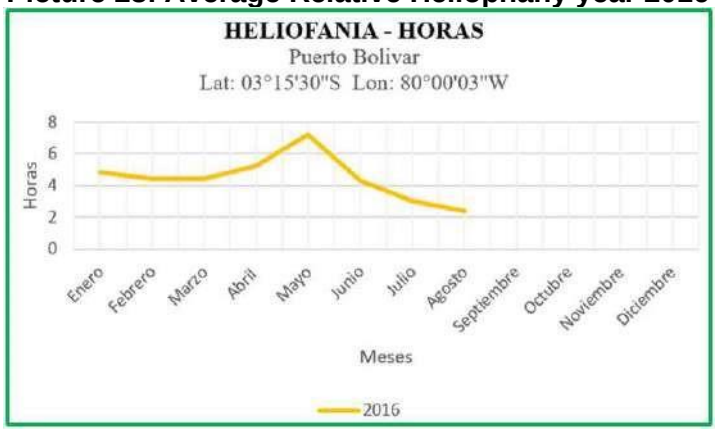
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 27: Average Relative Heliophany years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 28: Average Relative Heliophany year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.5. EVAPORATION

Evaporation is a physical process that consists of the slow and gradual passage from a liquid state to a gaseous state, after having acquired sufficient energy to overcome the surface tension.

Average monthly evaporation in Puerto Bolívar is approximately 94 mm, with maximum evaporation of 108 mm in January and minimum evaporation of 80 mm in September.

6.1.1.6. ATMOSPHERIC PRESSURE

Atmospheric pressure is the force per unit area exerted by air on the earth's surface.

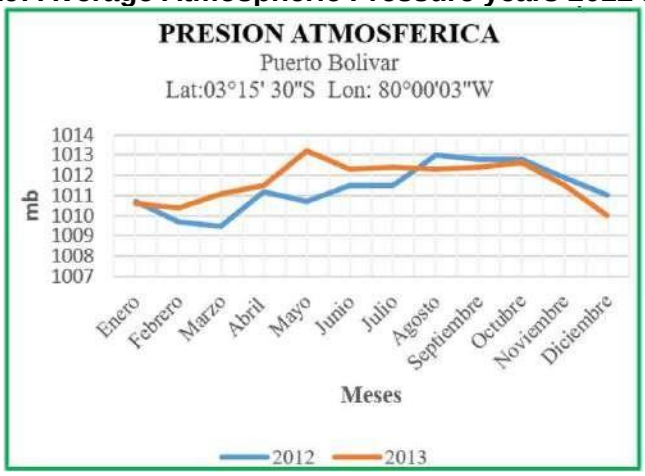
The atmospheric pressure data from the Puerto Bolívar Meteorological Station for the 5 years prior to the present study are detailed in the following tables and pictures:

Table 11: Monthly Average Atmospheric Pressures

MONTH	2012	2013	2014	2015	2016
January	1010,7	1010,6	1009,3	1009,0	1009,3
February	1009,7	1010,4	1009,3	1009,8	1008,3
March	1009,5	1011,1	1009,3	1010,1	1009,4
April	1011,2	1011,5	1008,5	1008,9	1008,7
May	1010,7	1013,2	1010,4	1008,6	1009,5
June	1011,5	1012,3	1009,4	1009,1	1011,4
July	1011,5	1012,4	1010,0	1010,1	1011,1
August	1013,0	1012,3	1011,3	1009,8	1011,3
September	1012,8	1012,4	1010,8	1009,7	
October	1012,8	1012,6	1010,9	1010,1	
November	1011,9	1011,5	1010,9	1008,9	
December	1011,0	1010,0	1009,6	1007,9	

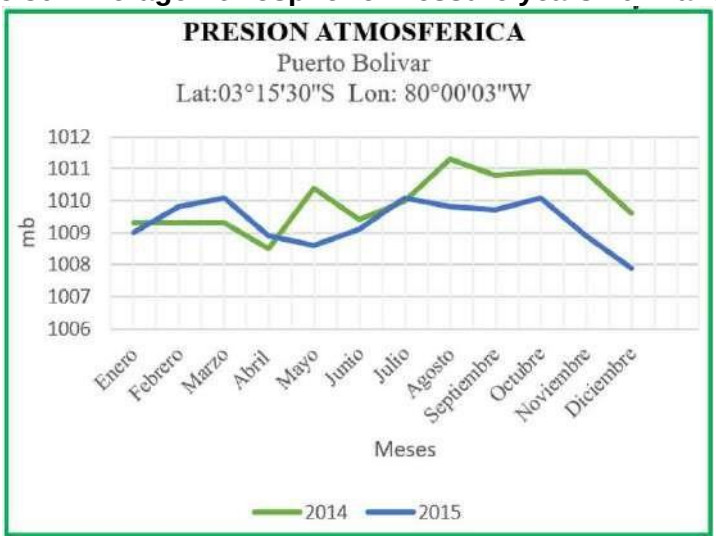
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 29: Average Atmospheric Pressure years 2012 and 2013



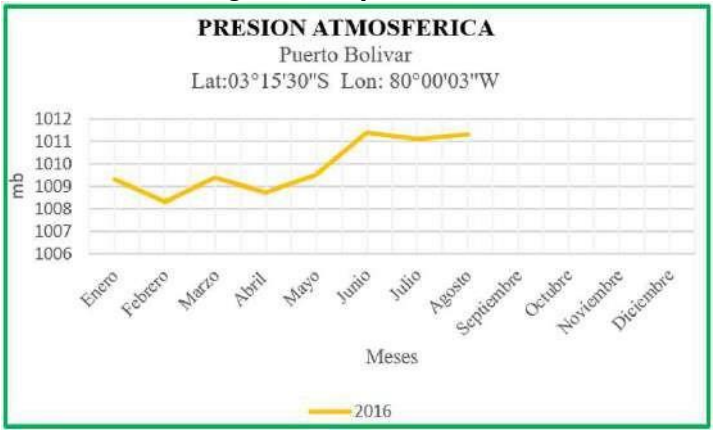
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 30: Average Atmospheric Pressure years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 31: Average Atmospheric Pressure Year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.7. VAPOR PRESSURE

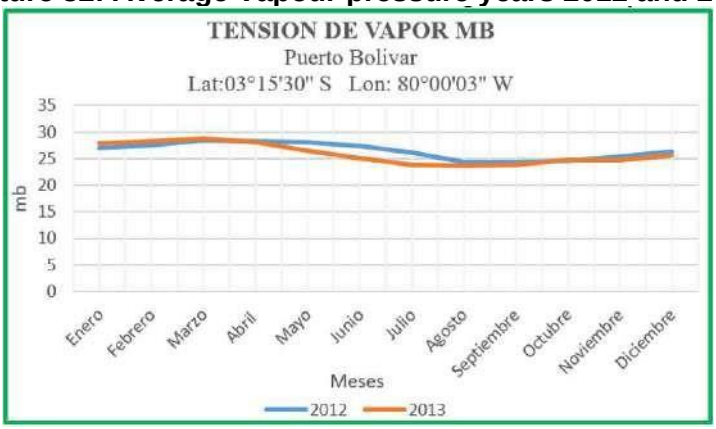
Vapour pressure is the pressure on the condensed phase at a given temperature, at the Puerto Bolívar Meteorological Station. The following data are detailed:

Table 12: Average monthly Vapour pressure

MONTHS	2012	2013	2014	2015	2016
January	27,1	27,94	27,75	28,05	29,26
February	27,54	28,21	27,52	28,45	29,55
March	28,4	28,78	27,78	28,66	29,53
April	28,28	28,04	28,53	29,81	29,54
May	28,14	26,51	28,04	29,66	29,25
June	27,38	25,04	27,08	28,58	27,03
July	26,13	23,9	26,39	27,68	26,91
August	24,36	23,62	25,11	26,15	26,02
September	24,38	23,85	25,19	26,85	
October	24,62	24,72	24,94	27,04	
November	25,35	24,73	25,65	27,7	
December	26,37	25,68	27,17	29,49	

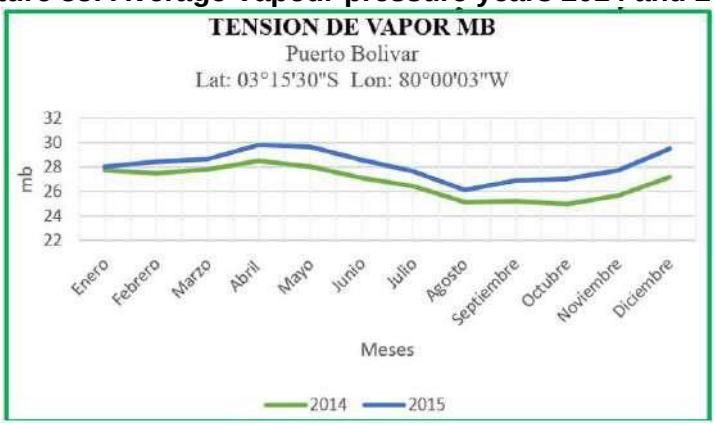
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 32: Average Vapour pressure years 2012 and 2013



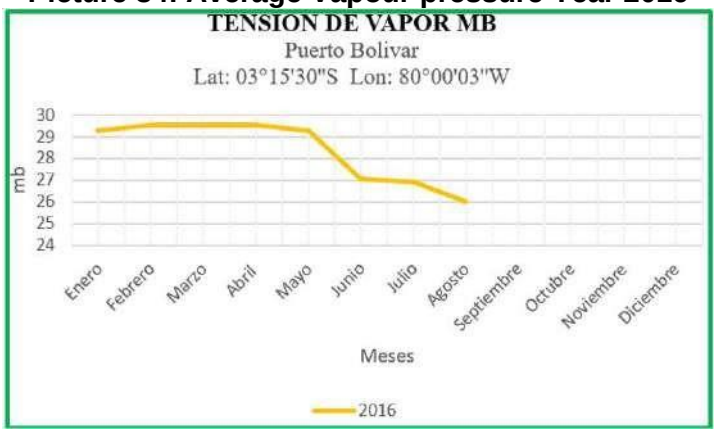
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 33: Average Vapour pressure years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 34: Average Vapour pressure Year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.8. DEW POINT

The dew point or dew temperature is the temperature at which water vapour in the air begins to condense, producing dew, mist, any type of cloud or, if the temperature is low enough, frost.

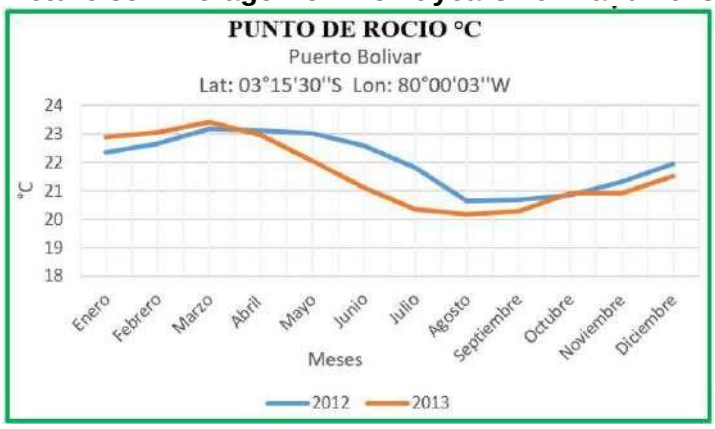
Dew point data for the last five years are as follows:

Table 13: Monthly Average Dew Point ºC

MONTH	2012	2013	2014	2015	2016
January	22,35	22,9	22,79	22,97	23,67
February	22,66	23,05	22,65	23,2	23,83
March	23,17	23,4	22,79	23,32	23,82
April	23,11	22,96	23,24	24,04	23,82
May	23,02	22,04	22,96	23,89	23,66
June	22,57	21,12	22,4	23,31	22,36
July	21,82	20,35	21,94	22,75	22,29
August	20,65	20,16	21,16	21,82	21,74
September	20,67	20,29	21,2	22,26	
October	20,84	20,9	21,05	22,37	
November	21,31	20,9	21,55	22,74	
December	21,95	21,51	22,45	23,8	

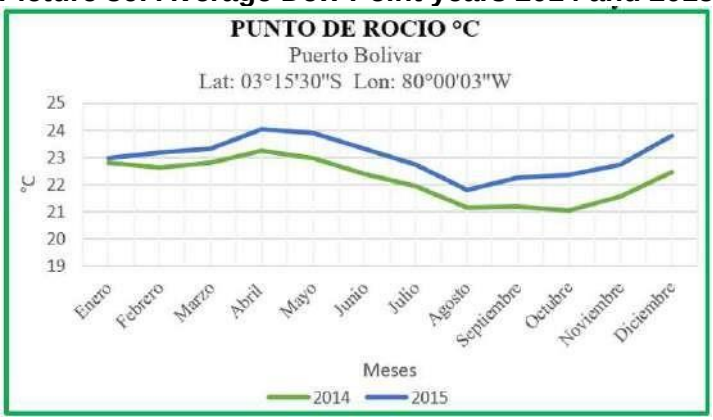
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 35: Average Dew Point years 2012 and 2013



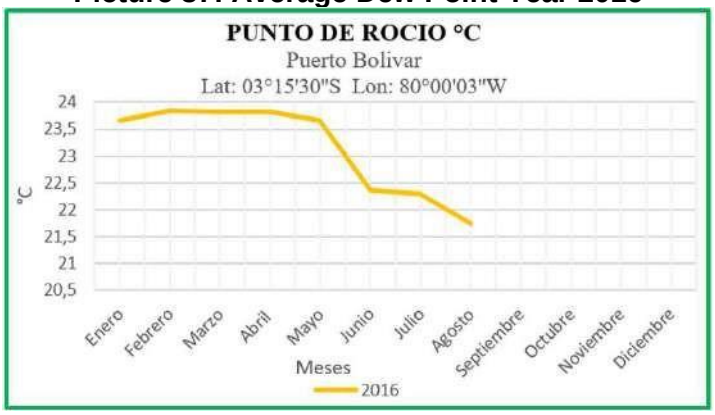
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 36: Average Dew Point years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 37: Average Dew Point Year 2016



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.9. CLOUDINESS

Cloudiness is the fraction of sky covered with clouds at a particular location. According to current meteorological standards, cloud cover is expressed in *octas*, or eighths of the sky. This is divided into 8 parts by the operator, who then evaluates the number of those parts that are covered by clouds. In this way, the observer's visibility range can be estimated.

Cloudiness is maximum in winter and minimum in summer. During the day it is usually at its maximum around 2:00 p.m., the time of maximum ascent of the air.

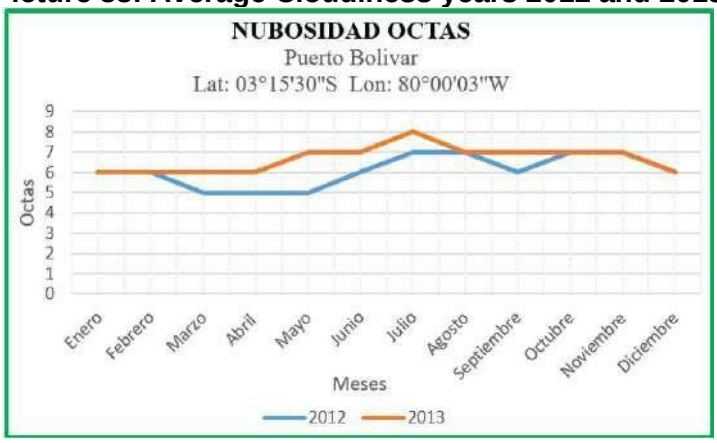
Table 14: Monthly average cloudiness octas

MONTHS	2012	2013	2014	2015	2016
January	6	6	6	6	6
February	6	6	6	6	6
March	5	6	6	6	6

April	5	6	5	5	6
May	5	7	6	5	6
June	6	7	6	6	6
July	7	8	6	6	6
August	7	7	7	7	6
September	6	7	7	6	
October	7	7	7	7	
November	7	7	6	6	
December	6	6	5	5	

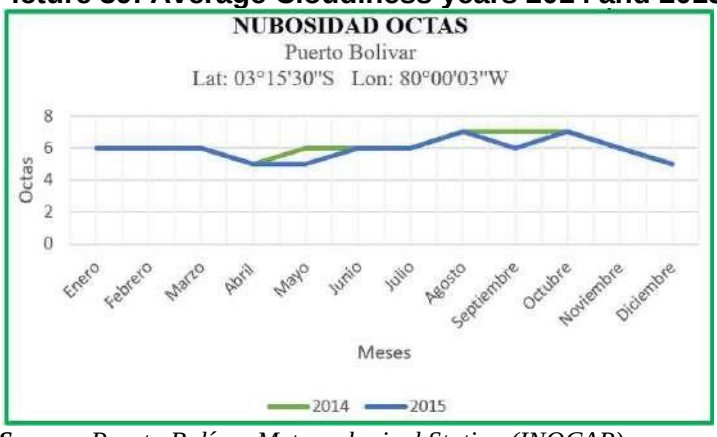
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 38: Average Cloudiness years 2012 and 2013



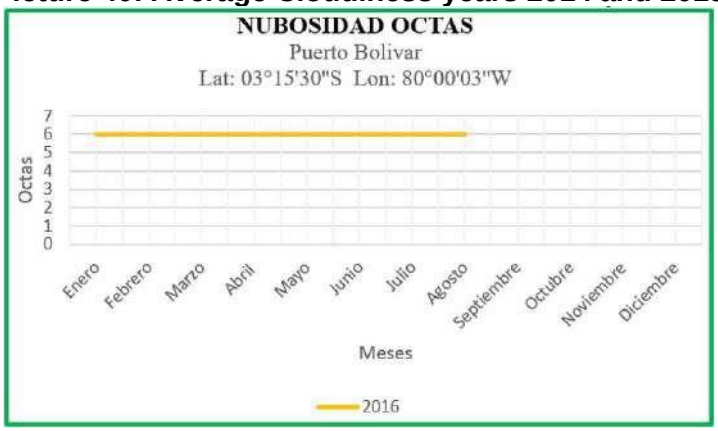
Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 39: Average Cloudiness years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 40: Average Cloudiness years 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

6.1.1.10. WINDS

Wind is the large-scale flow of gases. On Earth, wind is the mass movement of air in the atmosphere in horizontal motion. In meteorology, winds are usually named according to their strength and the direction from which they blow.

Wind speed is the speed and direction of the winds. At the Puerto Bolívar Station, the wind is generally maintained throughout the year in a W- NW direction. In the early hours of the day it is weak, with a speed of 0.5 m/s (1 knot), then increases to speeds of 1.5 m/s (3 knots) around noon; in the late afternoon and evening a light breeze is felt.
The months in which the wind is strongest are from June to September, with extraordinary forces of up to 8 m/s being recorded. The rest of the year the average wind speed remains at 1.8 m/s. Occasionally gusts of up to 15 m/s are recorded.

The station evidences a flow of W influence, and intensities around 3 m/s. That is to say, ships entering Puerto Bolívar receive a wind speed of 3 m/s from the southwest on their exposed surface.

Table 15: Monthly Wind Frequency Year 2012

MONTH	FREQUENCY	N	NE	E	SE	S	SW	W	NW	C
January	Direction	1,08	0	1,08	0	1,08	16,13	32,26	21,51	26,88
	Speed	2	0	3	0	2	2,4	2,23	1,8	0
February	Direction	1,15	1,15	1,15	0	0	18,39	32,18	14,94	31,03
	Speed	3	2	2	0	0	2,25	1,96	1,62	0
March	Direction	2,15	0	0	0	0	23,66	29,03	13,98	31,18
	Speed	2					2,09	1,59	1,62	0
April	Direction	0	1,11	0	0	1,11	21,11	31,11	20	25,56
	Speed		1			1	2,37	1,75	1,78	0
May	Direction	3,23	0	0	0	0	21,51	35,48	20,43	19,35
	Speed	2,33					2,35	2,09	2	0
June	Direction	2,22	0	0	2,22	0	21,11	38,89	25,56	10
	Speed	3,5			2,5		3	2,77	2,17	0
July	Direction	0	1,08	2,15	1,08	3,23	19,35	37,63	27,96	7,53

	Speed		2	2	4	2,67	3,33	2,57	2,19	0
August	Direction	3,23	0	1,08	0	1,08	19,35	40,86	32,26	2,15
	Speed	2,67		4		2	3,83	2,84	2,2	0
September	Direction	1,11	0	0	0	0	16,67	40	24,44	17,78
	Speed	3					3,27	2,67	2,05	0
October	Direction	0	0	0	0	0	19,35	33,33	24,73	22,58
	Speed						3,39	2,61	2,04	0
November	Direction	1,11	0	0	0	2,22	17,78	30	21,11	27,78
	Speed	2				2	2,75	2,22	2	0
December	Direction	1,08	0	0	0	0	15,05	33,33	23,66	26,88
	Speed	2					2,14	1,97	1,95	0

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Table 16: Monthly Wind Frequency Year 2013

MONTH	FREQUENCY	N	NE	E	SE	S	SW	W	NW	C
January	Direction	1,08	1,08	0	0	1,08	22,58	35,48	20,43	18,28
	Speed	2	2			1	2,1	2,12	1,95	0
February	Direction	3,61	1,2	0	0	0	14,46	36,14	20,48	24,1
	Speed	2	2				2	1,9	1,94	0
March	Direction	0	0	0	0	0	25.81	33,333	17,2	23,66
	Speed						2.13	1,94	1,94	0
April	Direction	0	1,1 1	0	1,11	0	21,11	34,44	16,67	25.56
	Speed		2		1		3	2,23	2,4	0
May	Direction	0	0	0	1,08	0	16,13	41,94	26,88	13,98
	Speed				3		3,4	2,74	2,08	0
June	Direction	0	0	0	0	0	22,22	34,44	28,889	14.44
	Speed						3,7	2,74	2,04	0
July	Direction	0	0	0	0	1,08	21,51	34,41	27,96	15,05
	Speed					0	3,7	2,66	2,15	0
August	Direction	0	0	0	0	0	22,58	34,41	25,81	17,2
	Speed						3,67	2,53	2,17	0
September	Direction	3,33	0	0	0	0	17,78	36.67	28,89	13,33
	Speed	2,67					3,25	2,94	2,23	0
October	Direction	1,08	0	1,08	0	0	12,9	32,26	38,71	13,98
	Speed	2		3			3,08	2,77	2,28	0
November	Direction	1,1 1	0	1,11	0	0	15,56	36,67	28,89	16,67
	Speed	4		4			2,93	2,7	2,08	0
December	Direction	4,3	0	0	0	1,08	13,98	32,26	22,58	25,81
	Speed	2,75				3	2,08	2,07	1,81	0

Source: *Puerto Bolívar Meteorological Station (INOCAR)*

Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Table 17: Monthly Wind Frequency Year 2014

MONTH	FREQUENCY	N	NE	E	SE	S	SW	W	NW	C
January	Direction	2,15	0	0	1,08	0	19,35	33,33	22,58	21,51
	Speed	3			3		2	1,9	1,86	0
February	Direction	5,95	0	0	1,19	1,19	11,9	30,95	21,43	27,38
	Speed	3,8			2	2	2,5	2,04	1,72	0
March	Direction	0	0	0	0	0	10,75	37,63	22,58	29,03
	Speed						2,1	2,09	1,9	0
April	Direction	2,22	0	0	0	2,22	13,33	33,33	21,11	27,78
	Speed	4				2,5	2,5	2	1,95	0
May	Direction	2,15	0	1,08	0	0	15,05	34,41	25,81	21,51
	Speed	2,5		2			2,79	2,75	2,08	0
June	Direction	0	3,33	1,11	0	0	14,44	37,78	26,67	16,67
	Speed		3,67	2			3,08	2,88	2,42	0
July	Direction	0	1,15	1,15	0	1,15	14,94	35,63	20,69	25,29
	Speed		3	3		1	3,69	3,19	2,33	0
August	Direction	2,15	6,45	3,23	0	0	18,28	37,63	20,43	11,83
	Speed	8	2,5	2,67			3,82	2,89	2,26	0
September	Direction	0	0	0	0	1,11	20	37,78	25,56	15,56
	Speed					2	3,22	2,71	2,26	0
October	Direction	0	0	0	0	0	18,28	36,56	27,96	17,2
	Speed						3	2,65	2,31	0
November	Direction	2,25	1,12	0	0	0	16,85	32,58	24,72	22,47
	Speed	3,5	4				2,47	2,62	2,36	0
December	Direction	2,15	1,08	0	0	0	18,28	31,18	20,43	26,88
	Speed	4,5	4				2,24	2,17	2,05	0

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Table 18: Monthly Wind Frequency Year 2015

MONTH	FREQUENCY	N	NE	E	SE	S	SW	W	NW	C
January	Direction	2,15	1,08	0	0	0	18,28	33,33	17,2	27,96
	Speed	5	4				2,12	2,03	2	0
February	Direction	3.57	0	0	0	0	20,24	29,76	15,48	30,95
	Speed	2,67					2,12	2	2	0
March	Direction	1,08	0	1,08	0	0	18,28	33,33	20,43	25,81
	Speed	4		3			2,41	2,32	2,11	0
April	Direction	2,22	0	0	0	0	20	32,22	20	25,56
	Speed	2,5					2,17	2,76	2,06	0
May	Direction	2,15	0	0	0	0	16,13	33,33	24,73	23,66
	Speed	2					2,27	2,1	2	0
June	Direction	0	2,25	0	0	0	13,48	40,45	25,84	17,98
	Speed		3,5				2,75	2,56	2,04	0
July	Direction	1,08	0	0	0	0	13,98	37,63	29,03	18,28
	Speed	8					3,69	2,91	2,33	0
August	Direction	1,08	0	0	0	0	23,66	38,71	30,11	6,45
	Speed	2					3,81	2,97	2,43	0
September	Direction	1,11	0	0	0	0	21,11	37,78	17,78	22,22
	Speed	2					3,37	2,79	2,5	0
October	Direction	1,08	0	0	0	0	13,98	37,63	26,88	20,43
	Speed	3					3,31	2,94	2,4	0
November	Direction	3,33	0	0	0	0	16,67	33,33	23,33	23,33
	Speed	3					2,8	2,53	2,05	0
December	Direction	2,17	1,09	0	0	0	20,65	21,74	16,3	38,04
	Speed	2,5	3				2,42	2,3	2,13	0

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Table 19: Monthly Wind Frequency Year 2016

MONTH	FREQUENCY	N	NE	E	SE	S	SW	W	NW	C
January	Direction	0	2,2	0	0	0	18,68	31,87	20,88	26,37
	Speed		4				2,82	2,59	2,32	0
February	Direction	1,15	1,15	0	0	0	21,84	29,89	20,69	25,29
	Speed	4	6				2,63	2,19	2,44	0
March	Direction	0	1,08	0	0	0	17,2	36,56	23,66	21,51
	Speed		4				2,69	2,44	2,32	1,55
April	Direction	0	3,33	0	0	1,11	20	31,11	21,11	23,33
	Speed		5,33			3	2,28	2,29	2,11	0
May	Direction	2,15	0	0	0	0	20,43	30,11	21,51	25,81
	Speed	2,5					2,63	2,32	2,3	0

June	Direction	1,18	1,18	0	1,18	0	15,29	8,24	38,82	34,12
	Speed	2	2		2		2,5	2,29	2,24	0
July	Direction	0	0	0	1,09	0	6,52	1,09	66,3	25
	Speed				2		2	2	2,34	0
August	Direction	0	0	0	0	0	0	0	66,67	33,33
	Speed								2,43	0

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

The distribution of pollutants in the atmosphere requires knowledge of the frequency and distribution of wind direction and wind speed.

The prevailing wind over a range of time can be represented by means of a wind rose, which indicates the percentage of time the wind blows from different directions. The graph consists of using bars or extensions that go from the centre of a circle to a given point that illustrates the wind direction, the length of each extension will indicate the percentage of time that the wind was directed in that direction (*Ahrens, 1998*).

These measurements can be presented in either graphical or tabular form. The data are presented in eight primary and eight secondary directions which are as follows:

Table 20: Wind rose plot data

Primary	Secondary
N (north)	NNE (north northeast)
S (south)	ENE (east northeast)
E (east)	ESE (east southeast)
W (west)	SSE (south southeast)
NE (northeast)	SSW (south southwest)
NW (northwest)	WSW (west southwest)
SE (southeast)	WNW (west northwest)
SW (southwest)	NNW (north northwest

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

On the other hand, wind speed is divided into ranges that can be given in various units, ranging from miles per hour to meters per second. Although periods with zero speed can also be recorded, which are reported as calm.

The wind direction can also be illustrated in degrees as in a circumference with its 360º. These directions are represented by numbers which vary according to the hands of the clock starting with 360º in the north, having the east with 90º, the south with 180º and the west with 270º. There are also other directions such as NE to which the 45º belong and thus obtain the degrees corresponding to the other wind directions. Calm is expressed as 0º (*Wark et al., 1998*).

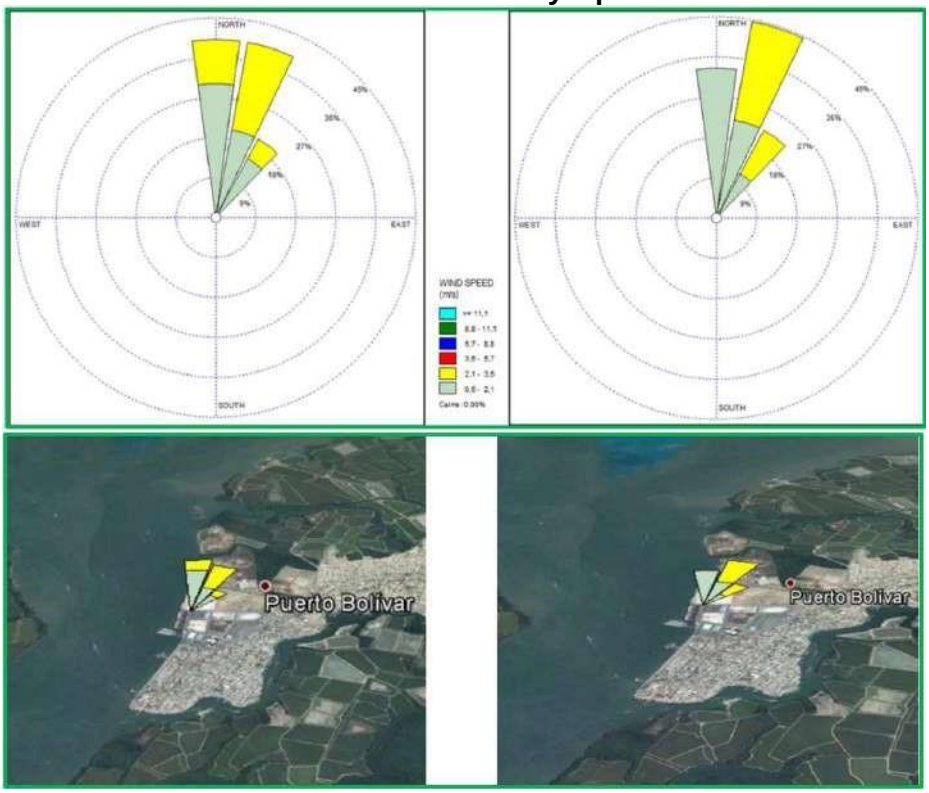
The WRPLOT Windows program was used to create the wind rose plots.

A wind rose shows the frequency of occurrence of winds in each of the wind directions provided and the wind speed classes for specific time and location.

In addition, wind direction and speed data provided by the Navy of Ecuador Oceanographic Institute - INOCAR recorded at the meteorological station of Puerto Bolívar for the years 2012, 2013, 2014 and 2015 were used.
For the purposes of this study, these tables have been plotted considering the direction in which the winds blow.

According to the data obtained in the first four-month periods January - April 2012 and 2013, the wind direction is towards the North and North Northeast (NNE) with wind speeds of less than 3.6 m/s.

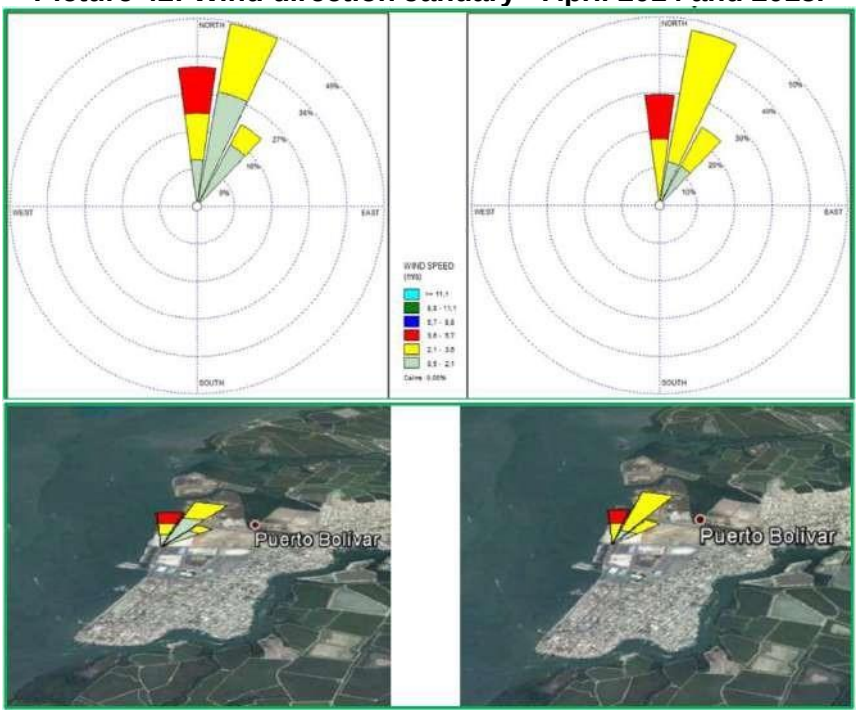
Picture 41: Wind direction January-April 2012 and 2013



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

However, for the months of January - April 2014 and 2015 the wind speed increased to the North (N) and the wind direction remained to the North and North Northeast (NNE).

Picture 42: Wind direction January - April 2014 and 2015.



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro* ***Date:*** *May 12, 2017*

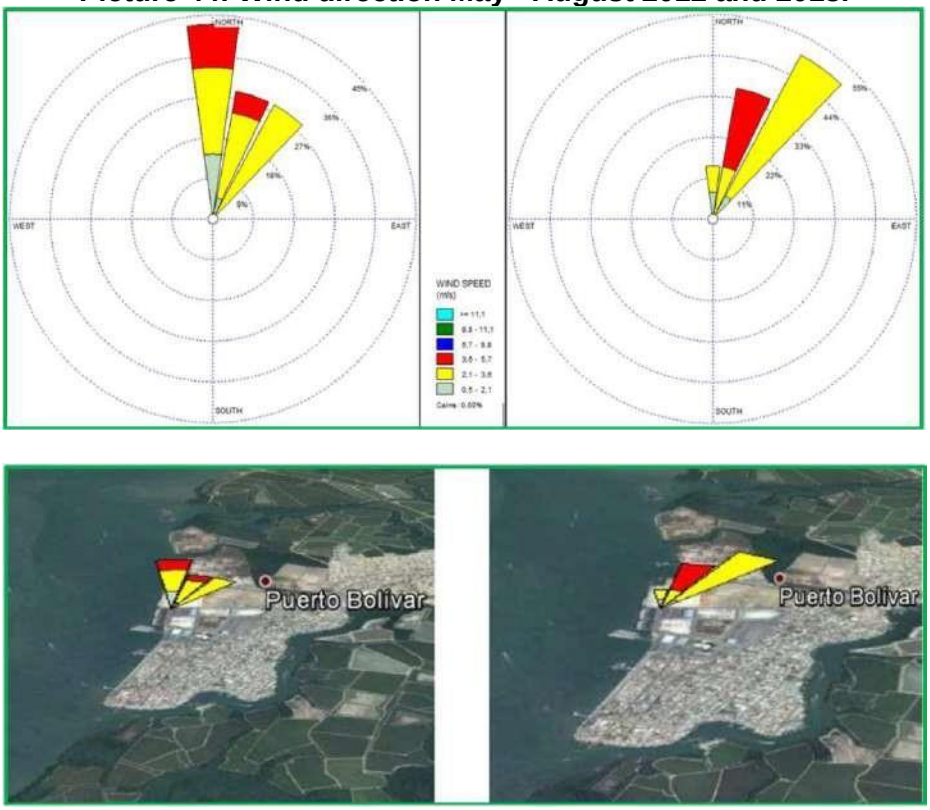
With respect to January-April 2016, the wind direction trend remained the same as in previous years, however, the wind speed increased, exceeding 5.7 m/s.

Picture 43: Wind direction January - April 2016.

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

For the second four-month period May - August 2012, wind direction is observed towards the North (N) and North Northeast (NNE) with wind speeds greater than 3.6 m/s towards the North; however, for May - August 2013, wind direction and speed is observed towards the North Northeast (NNE).

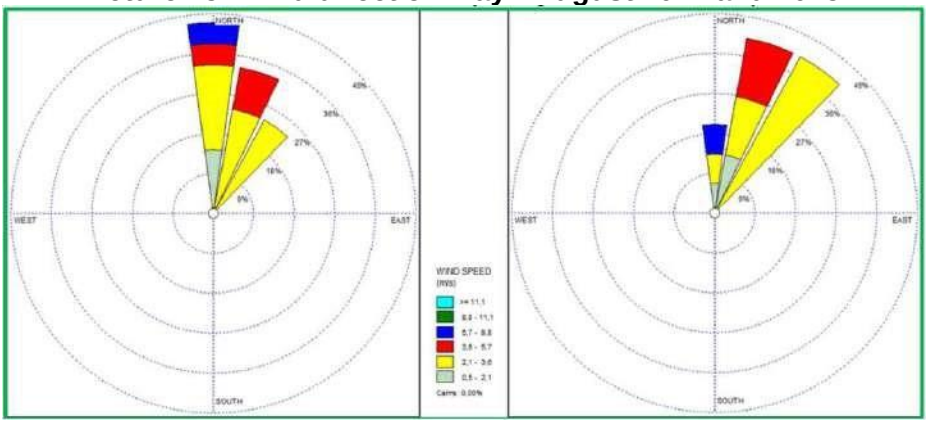
Picture 44: Wind direction May - August 2012 and 2013.



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

The months of May - August 2014 and 2015 the wind speed increased to more than 5.7 m/s to the North (N) and the wind direction remained North and North Northeast (NNE).

Picture 45: Wind direction May - August 2014 and 2015.



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro* ***Date:*** *May 12, 2017*

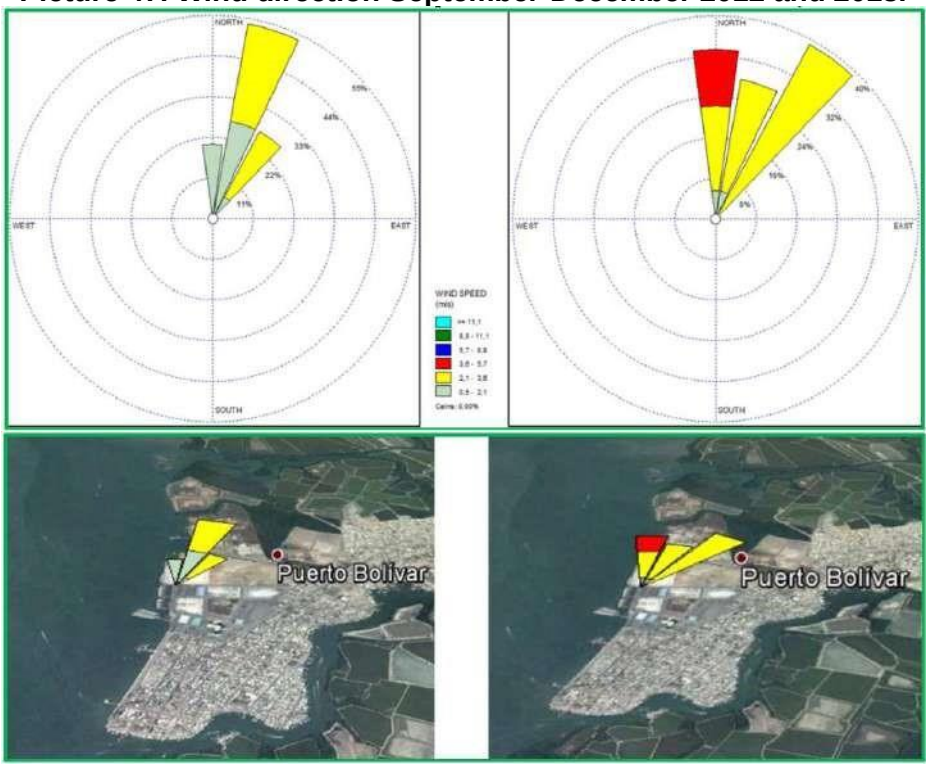
In May - August 2016 the wind speed decreased related to the previous four years and the wind direction was observed from North (N) to East Northeast (ENE).

Picture 46: Wind direction May - August 2016.

Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

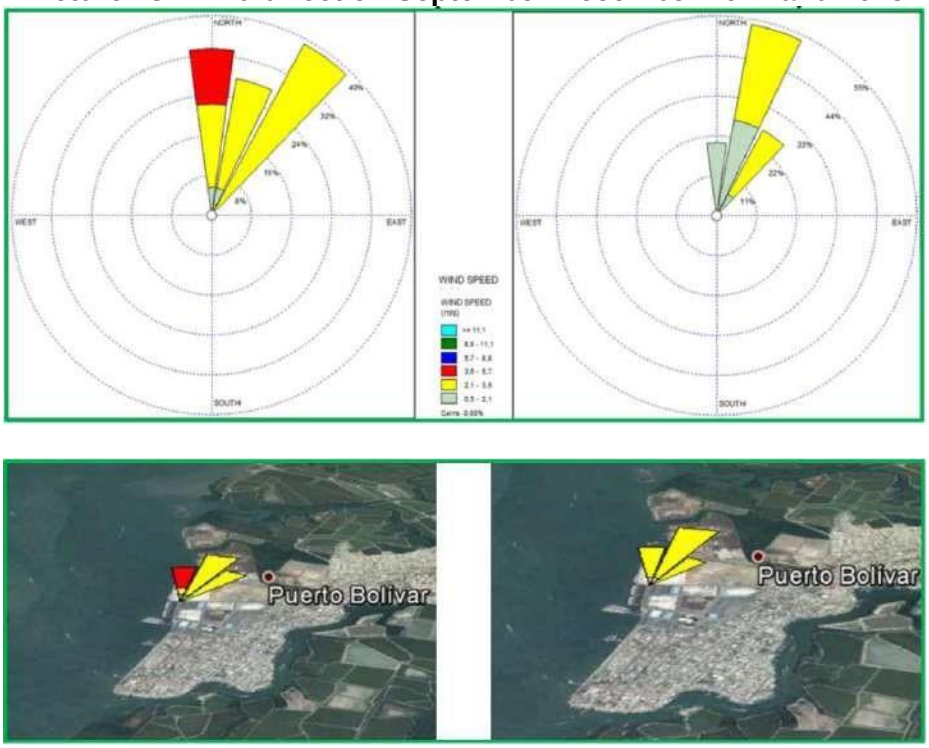
In the third four-month period September - December 2012 the wind direction was predominantly North Northeast (NNE) with wind speeds of 3.6 m/s, but for the months September - December 2013 and 2014 the wind direction was North and North Northeast and recorded an increase in wind speed to the North (N). For the last four-month period September - December 2015 the wind direction was North and North Northeast (NNE) registering wind speed up to 3.6 m/s).

Picture 47. Wind direction September-December 2012 and 2013.



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

Picture 48: Wind direction September-December 2014 and 2015



Source: *Puerto Bolívar Meteorological Station (INOCAR)*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 12, 2017*

According to the results obtained, it may be concluded that both wind direction and wind speed vary very little and show a similarity from one year to another.

The predominance of wind direction during the five years was to the north (N) and north northeast (NNE); only for the second four-month period of 2016 was the wind direction recorded to the east northeast (ENE).

During the first four-month periods (January, February, March and April) of the years 2012, 2013, 2014, 2015, the lowest wind speeds were recorded, ranging from 0.5 to 3.6 m/s. Only for the first four-month period of 2016 the wind speed increased exceeding 5.7 m/s.

For the months of May, June, July and August of the years 2012, 2013, 2014 and 2015, increases in wind speeds above 5.7 m/s were recorded, but for May - August 2016 the wind speed decreased to a 3.6 m/s related to the previous four years.

In the third quarter of each year, wind speeds decreased until they reached a range of 3.6 m/s.

It is worth mentioning that each year during the rainy season (rainy season) lower winds were recorded, compared to the dry season where wind speeds increased significantly. In relation to previous years, only in 2016 there was an increase in wind speed in the first four-month period and a decrease in wind speed in the second four-month period, in addition to registering a direction towards the East Northeast (ENE).

6.1.2. GEOLOGY

The Andes forms the main axis of Ecuador and presents the largest amount of metallic mineralization related to intrusive rocks in contact with volcanic rocks or carbonate rocks, being more accentuated in the south of the country and directly related to the limit of the Huancabamba deflection, which is considered as a mega deformation structure.

In the province of El Oro, to the north is the limit of the Huancabamba deflection, which coincides with the Jubones and Piñas-Portovelo river fault. Due to this deflection, the Andean mountain range changes direction, since in Peru the mountain system has a northwest direction and in Ecuador it changes to a preferential north - north direction. South.

The geological characteristics of the province are defined by two zones, taking the Jubones fault as a reference:

- **Northern Zone:** It is the smallest in area and with the lowest elevation. There are rocks dating from the Cretaceous, consisting of rocks of the Macuchi Formation and identified as andesitic volcanoclastics, lavas, tuffs and Quaternary sediments. Most of this area is covered by Tertiary deposits such as the Saraguro Formation, composed of andesitic and rhyolitic lavas and pyroclasts. The Tarqui Formation belongs to the Quaternary, made up of pyroclasts, rhyodacites and lavas, as well as Quaternary sedimentary deposits formed by estuarine marine clays.
- **Southern Zone:** It corresponds to the area south of the Jubones fault, which includes most of the province. The oldest rocks outcrop that correspond to a Precambrian metamorphic sequence, such as the Piedras Group, made up of green schists, amphibolite and quartzite; from the lower Paleozoic, the Tahuín Group, Capiro and San Roque Formations, made up of schists, gneisses, quartzite and amphibolite; from the Cretaceous, the Raspa Formation, made up of schists, the Celica Formation composed of andesitic and pyroclastic lavas, the Alamor Group, conglomerates, sandstones, lutites, greywackes, pyroclasts.

The Puyango Petrified Forest is one of the sites with unique geological characteristics in Ecuador, located in the provinces of El Oro and Loja. It was formed under coastal marine and terrestrial conditions in a relatively narrow sedimentation basin; limited to the east by the volcanically active Andes Mountains, and to the west by the volcanic archipelago known as the Amotepe Mountain Range. On the sediments grew a forest of large trees of the Araucaria family, which was destroyed and then regrown, from at least six eruptions millions of years ago. Water from the Pacific 65 million years ago penetrated the buried forest; it filled the wood with silica, quartz crystals formed and the trunks turned to stone.

Throughout the province there are intrusive rocks ranging in age from the Paleozoic to the Tertiary, being of the granitic or acidic intrusive type such as granite and granodiorites.

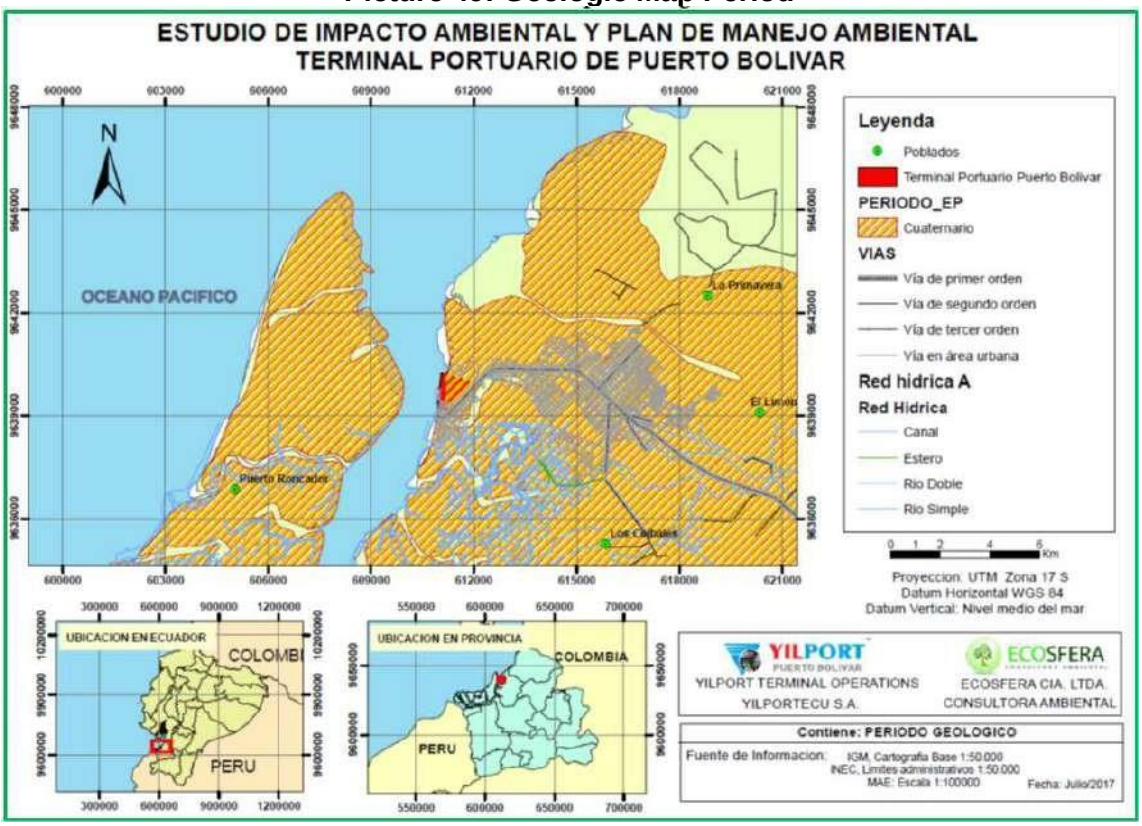
There are 2 geological faults that deserve to be pointed out for their extension and depth:

- Jubones River
- Giron River

The Jubones River fault extends with an east-west orientation, through the lower zone, up to its intersection with the Girón River fault. This fault runs more than 60 km and its dip has not been determined. The Girón river fault extends in a northeast-southwest direction, runs for 15 km and is a normal fault, produced by continuous uplift. In the coastal plain of the Jubones River it has slopes ranging from 0.1%, in the proximity of the sea, to 0.3% next to Tres Cerritos, presenting in the Lower Zone gentle meanders, which makes the energy of the main channel high. The rivers of the Low Zone form basins with mixed characteristics of the plain and mountains. The rivers located north of the Jubones have slopes on the order of 0.1% with gentle meanders.

The geological period of the study area belongs to the Quaternary Period since thousands of years ago in the Recent Quaternary geological stage. It has been subject to the inexorable cycles of variable deposition energy, as occurs in rainy periods that are sedimentation stages with strong energy, such as the El Niño Phenomenon (ENSO period, El Niño Southern Oscillation) and/or deposits of low energy in times of drought. This sedimentation process is also influenced by the ebb and flow of the tides of Santa Rosa Estuary.

Picture 49: Geologic Map Period



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

The sediments of the area are composed of a sequence of clay deposits with thin layers of fine sands and medium to coarse grained silty sands, medium dense to very dense with oxidation spots, which reach an approximate depth defined by the 48 m a.s.l. elevation. Then it continues with a deposit of silty clays with organic matter spots, of hard consistency, of medium high plasticity up to elevation -59.50 m a.s.l. Underlying this layer continues a very hard over consolidated clay.

The thickness of interbedded silty sandy sediments of dense compactness and/or clays of hard to very hard consistency, can be greater than 100 m. In the area of Puerto Bolívar and below underlies the soft rock geological formation Puna or Progreso.

Some of the most characteristic processes of estuarine zones are expressed in the formation of sedimentary terraces on which islets can originate. These processes are favoured by the action of the mangrove, which has a great capacity to trap and retain sediments. According to Wolf, large areas of the Gulf of Guayaquil, the islands of the Jambelí Archipelago (south of the Gulf) as well as several islands of Esmeraldas would have been formed with the participation of these processes.

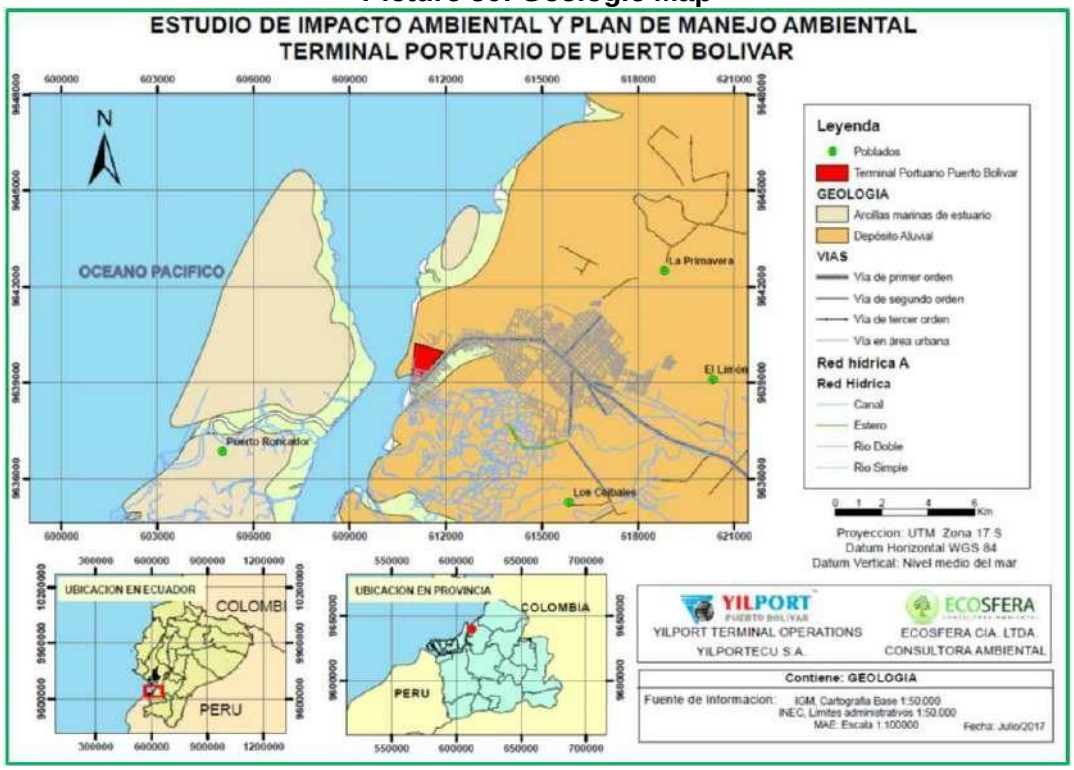
Therefore, basically lithological the study area is constituted by estuarine marine clays, as detailed in the map above.

- **Estuarine marine clays (QE):** The entire flat and lower part of the coastal plain is constituted by well stratified fine granular materials that have been deposited in a sedimentary environment of continental to marine transition or marsh zones and tidally influenced surfaces. These estuarine marine clays, as named in the

Geological Map of Ecuador (CODIGEM & BGS, 1993) are composed of strata of fine sands interbedded with clays and silts with abundant organic activity. The water table in these deposits is superficial, so they are always saturated. The clay component gives these materials a medium to high plasticity and they have a soft consistency.

The estuarine deposits are located on the banks along the Jambelí channel, Puerto Bolívar and the entire area of influence of the Huaylá up to the sector of the Nueve de Mayo stadium.

Picture 50: Geologic Map



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.3. GEOMORPHOLOGY AND RELIEF

In the province of El Oro the territory is predominantly flat, with beaches to the northwest of the province. Its high zone is formed by the foothills of Tio Loma, Mullopungo and Chilla.

In the study area there are estuaries and mangroves, and in front of them there is a set of channels that separates the Jambeli Archipelago from another subzone classified as lowlands, which runs from the Jubones River to Santa Rosa. The mangrove subzone extends from the Tumbes inlet to the Santa Rosa estuary. This subzone is a coast without a beach where exuberant vegetation predominates, consisting of several species of mangroves that are practically on brackish water where the soil texture is very fine-grained. The other zone to the east continues the coastal plain with a very low to no slope and the elevation varies from 0 to 20m.

There is also a subzone of savannahs from Santa Rosa, passing through the vicinity of Machala and reaching near the Jubones River. These are places that are flooded in the winter and are not suitable for agriculture, but they are suitable for cattle raising. When

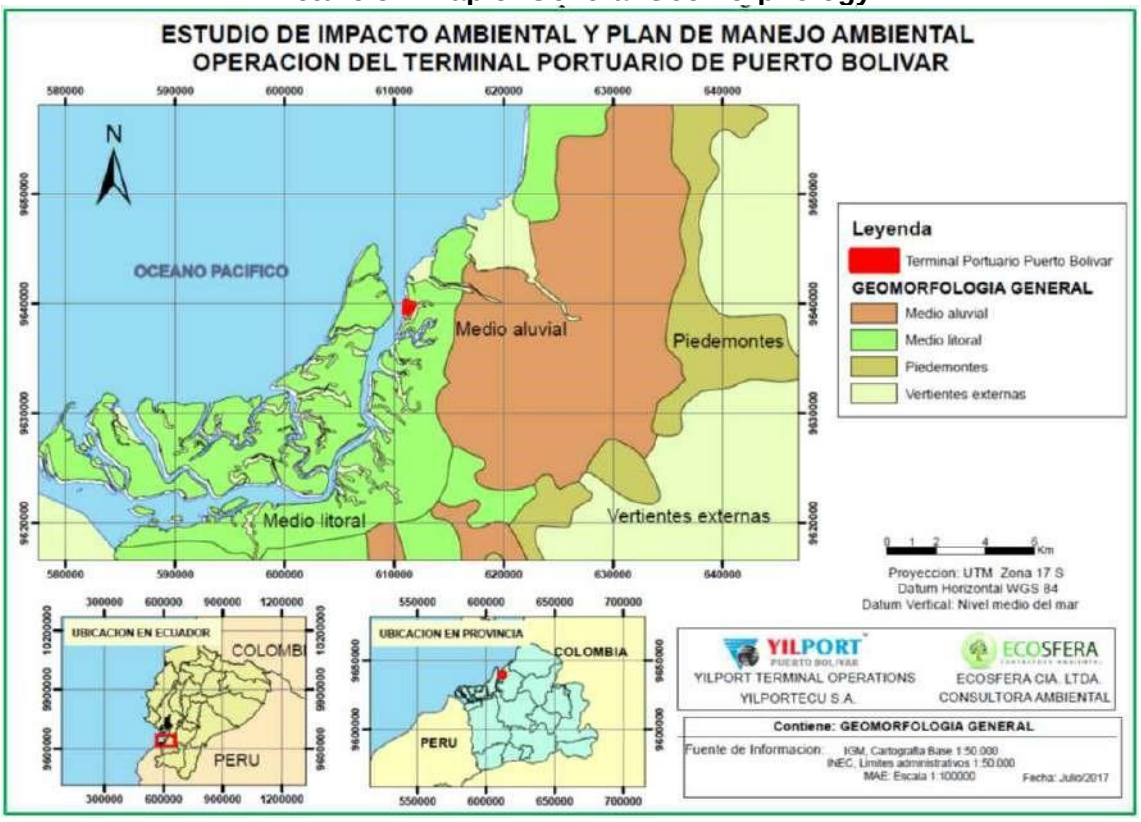
summer arrives, the savannahs dry out and present a clay soil. In the savannahs are the Tembladeras that are extensions of water that remain stagnant and are fed by different rivers.

According to the geomorphological map, the study area corresponds to the Alluvial and Littoral Medium.

- **Alluvial Environment:** Flat area where only small undulations that form natural levees and crests of semilunar bars (scrolls) stand out. In this area there is fluvial diversion and a wide development of the floodplain.

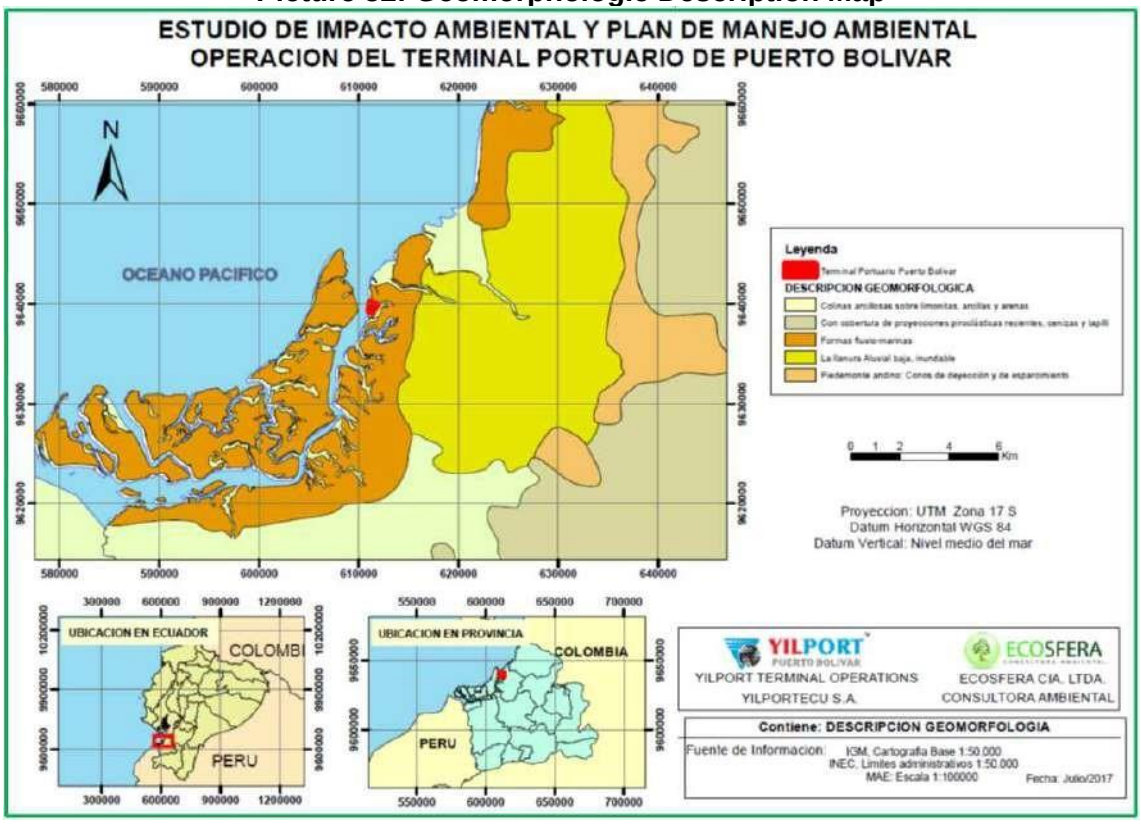
- **Coastal Environment:** Plains, more or less elevated above sea level, which owe their origin to the phenomena of aggradation of degradation by marine or lake waters.

Picture 51: Map of General Geomorphology



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Picture 52: Geomorphologic Description Map



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.4. SOILS

The province has a physiography made up of low mountains, which are the foothills of the south-western mountain range, as well as a dry plain, differentiated by oceanic winds that have caused a sub-humid-dry climatic diversity, with notable productivity indexes of its soils. It corresponds to the physiographic classification of alluvial terrace, with alluvial soils, products of the frequent floods, as well as light plains of the highlands, product of alluvial-colluvial soils.

Geologically, the soils are made up of alluvial sediments of Tertiary alluvial origin, Quaternary alluvial sediments, and Paleozoic metamorphic rocks. Some factors have contributed to the degradation of the province's soils, including agricultural activity, mining, the development of the shrimp industry, monoculture agriculture, high use of agrochemicals, total tillage and mechanical movement of the soil, which has caused the appearance of the first symptoms of desertification such as soil erosion in some cantons, which is detrimental to their economic development.

The coastal soil is made up of Quaternary alluvial detritic material that fills the coastal basins. During periods of abundant rainfall, in flat and low areas with poor drainage, flooding occurs and forms soils of the order entisols, suborder fluvents, which are made up of recent alluvial sediments on the flood plain, fans, river deltas and terraces. The main characteristic is the stratigraphic layers of variable texture and irregular organic matter content. On the coast there are areas exposed to the influence of the sea, marsh areas that are plains near the sea, in which the water is brackish, where mangrove forests develop.

Machala is located in the lower part of the Jubones River basin, which is characterized by flat to slightly undulating terrain with slopes that do not exceed 5%. The texture varies from sandy to clayey with a predominance of clay-loam soils.

The substrate consists mostly of clayey and sandy silt of fluvial origin with grayish tones, extending to several meters deep, there are also layers of coarse silt to fine sand, the origin is related to sedimentation processes of fluvial material from the Quaternary. Currently the soil (surface layer) has been filled with gravel to prevent flooding.

The low slope and textural characteristics determine that drainage is restricted to moderate.

Regarding soil fertility, we can qualify it as medium to low. With a notable lack of nitrogen. Organic matter is present in variable proportions. Some units present slightly to strongly saline and solid values, increasing as they approach the salt marsh areas.

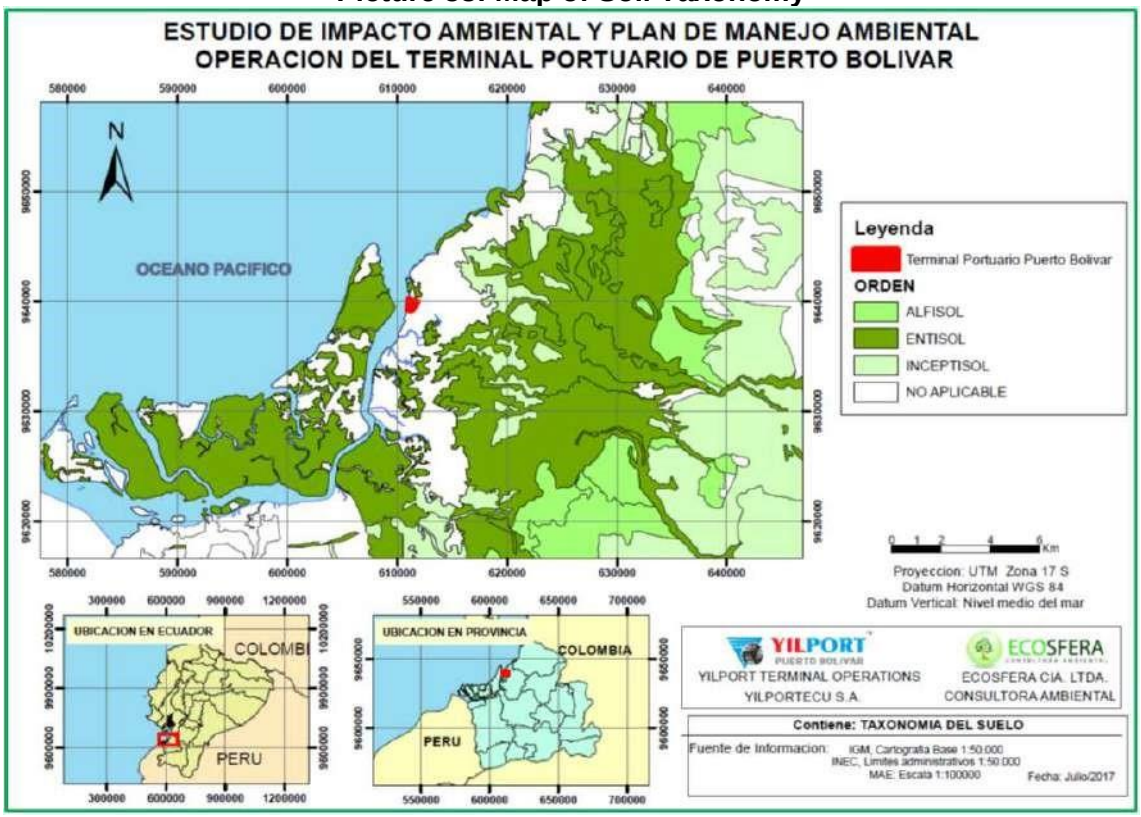
According to the Taxonomy of Soils, it was determined that there are two soil types in the study area:

- **Entisol:** It is defined as soils that do not show any defined development of profiles. They are younger soils in which the formative processes have not yet generated diverse horizons. They generally present only one horizon, the ''A'', whose composition is very similar to the rocky material that gave rise to it and on which it rests.

- **Inceptisol:** Soils with weak development of horizons, they are soils derived from both fluvionic and residual deposits, and are formed by lithic materials of volcanic and sedimentary nature. They are superficial to moderately deep and have flat to broken topography.

These soils are slightly less young than the entisols and with an incipient development of horizons. They do not show accumulation of organic matter, iron or clay.

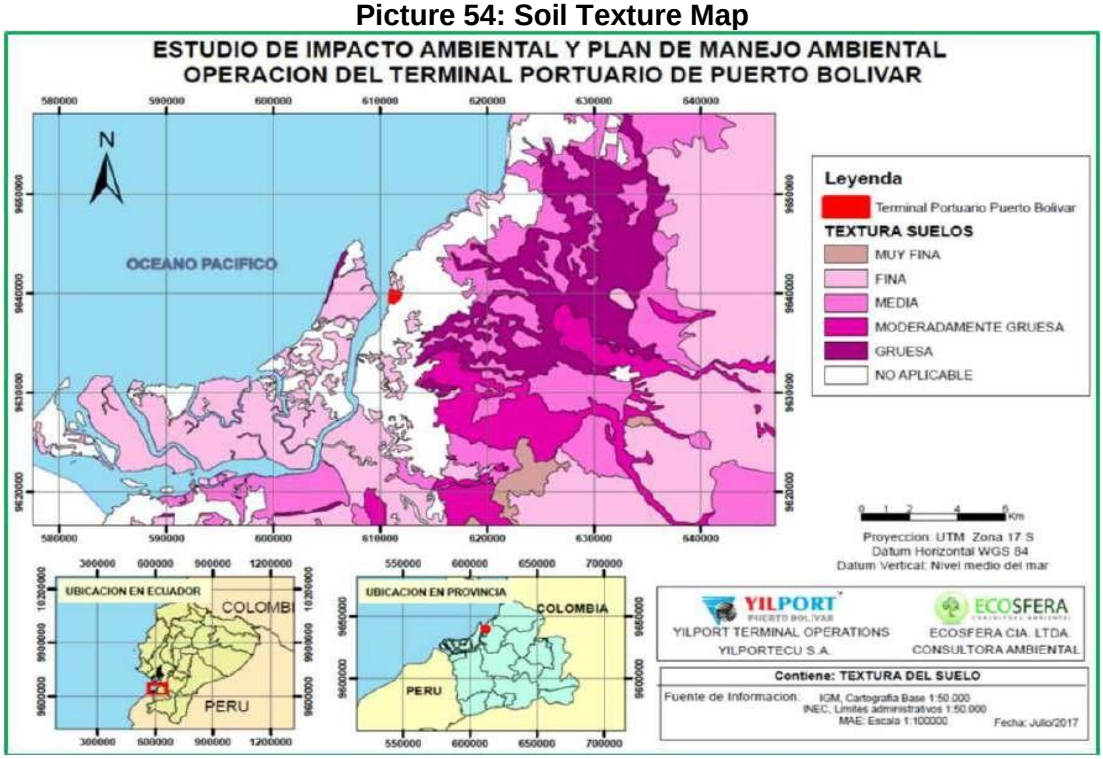
Picture 53: Map of Soil Taxonomy



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC* ***Prepared by:*** *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

In terms of soil texture, the study area has fine, medium, coarse and moderately coarse textured soils.

Picture 54: Soil Texture Map



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.4.4.1. SOIL USES

The province of El Oro allocates 420,028 hectares for agricultural, livestock and forestry purposes. Annual banana production in El Oro represents 43.3% of the national production of this crop, while annual rice production represents 0.6%. In this province, cattle leads the livestock sector, accounting for 3.6% of the national total.

Table 21: Soil Use Categories of the province

USO	AREA	PERCENTAGE (%)
Permanent Crops	94215,35	22,43
Transient Crops	8294,69	1,97
Rest	3078,06	0,73
Cultivated Pastures	218863,38	52,11
Natural Pastures	22463,93	5,35
Moors	1562,14	0,37
Forests and woodlands	60273,33	14,35
Other Uses	11277,09	2,68
TOTAL	**420028,01**	**100%**

Source: *Secretary of Planning GAD El Oro*
Prepared by: *Ecosfera Cía. Ltda, 2017.*
Date: *July 10, 2017*

The distribution of agricultural and forestry soil uses is characterized by the significant importance that the areas destined for livestock use (cultivated pastures 52.11% and natural pastures 5.35%) have over the rest.

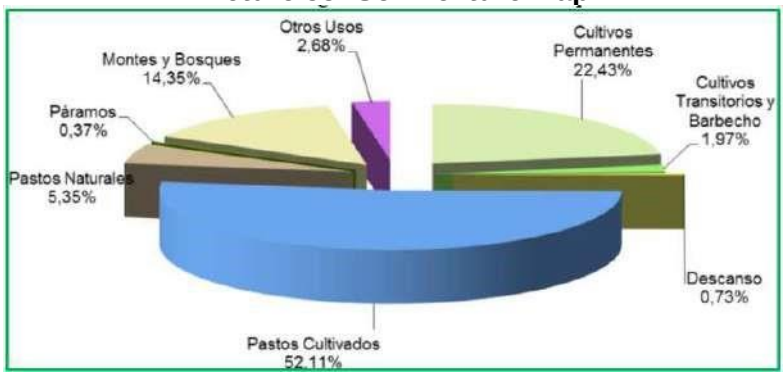
In 2013, the Province allocated 57% of the soil used for agricultural and forestry purposes to natural pastures and cultivated pastures. In turn, the arable agricultural area represents only ¼ of the total agricultural and forestry land in El Oro. Finally, the area used for forests and woodlands in the province is 14.35%.

The agricultural area is mostly made up of cultivated pastures, which represent 52.11% of the total area of soil used for agricultural and forestry purposes, permanent crops represent 22.43% of the agricultural area, while transitory crops and fallow land correspond to 1.97%, moorland 0.37%, forests and woodlands 14.35%, and other uses 2.68%.

The province of El Oro has a great diversity of uses distributed throughout its territory. These uses derived from the different anthropic activities carried out in the province have a direct impact on the natural environment.

Based on data from the Survey of Surface Area and Continuous Agricultural Production (ESPAC), for 2013 the uses are distributed as shown in the following graph:

Picture 55: Soil Texture Map



Source: *Secretary of Planning GAD El Oro*
Prepared by: *Ecosfera Cía. Ltda., 2017.*

According to the 2000 National Agricultural Census, crops are classified as transitory and permanent, and if we analyse the UPAS dedicated to this activity in relation to the 5,7,095 UPAS in the province, 26.43% are permanent crops and 10.19% of the UPAS are dedicated to transitory crops and fallow land.

In relation to the area used for production, most of it is used for cultivated pastures, permanent crops, and woodlands and forests. The area used for permanent crops is 18% and transitory crops 1%.

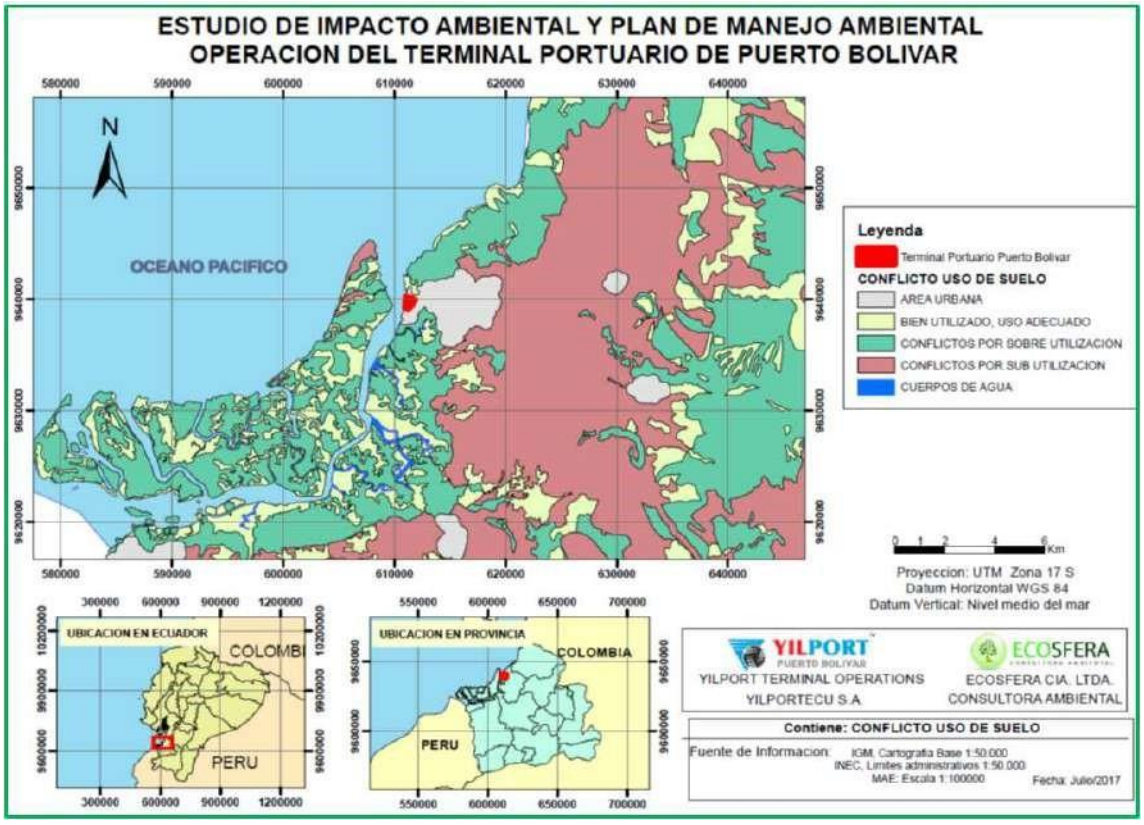
The vast majority of the province's surface area is occupied by agricultural and livestock production activities, while the forest and natural component is relegated to the steeper slopes and areas of difficult agricultural use. The flat areas of the province are where most of the intensive agricultural uses are concentrated, while the areas occupied by cultivated pastures are located in areas that on many occasions are on slopes of over 25%.

The physical, geographic and climatic diversity that characterizes the province, with three large differentiated zones - the Coast, the Highlands or Transition Zone and the Highlands - has given rise to differentiated soil use within the province, a fact that can be seen in the different distribution of uses in the different cantons of the province.

The agricultural area of the province of El Oro is mostly made up of permanent crops, if we compare permanent crops with transitory crops we have that the former represent 91.91%, compared to transitory crops with 8.09% in 2013.

The following map shows the soil use conflicts in the project area, being the study area an urban area:

Picture 56: Soil Use Conflict



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.5. HYDROGRAPHY

Due to its geographic location, the province has a dense hydrographic network whose end or mouth is the Pacific Ocean. The hydrological regime is characterized by its great variability and dependence on the rainy period from January to May.

It is necessary to emphasize that the wealth and socioeconomic development of the province is fundamentally based on water resources. A clear example of this is the Jubones River valley with its extensive banana-growing area. Other important rivers for their contribution to the wealth of the province are the Buena Vista, Santa Rosa and Arenillas. The first two through direct catchments such as the Caluguro-Bella Vista and Santa Rosa-La Tembladera canals and others, and the Arenillas that with the Tahuin

reservoir allow the agricultural development of the canton. In the future, the province of El Oro has the Puyango-Tumbes project to transfer its water to the border area and irrigate the cantons of Santa Rosa, Arenillas, Las Lajas and Huaquillas.

The province of El Oro, in general, is composed of several hydrographic areas:

- Watersheds that originate in the foothills of the western mountain range, such as the Jubones River, which is shared by the provinces of Azuay and Loja, and whose middle and lower parts belong to the province of El Oro.
- The Puyango river basin, which, like the previous one, originates in the mountain range and is shared with Peru.
- Foothill watersheds, which originate around 1500 meters above sea level and flow directly into the Pacific Ocean, such as Pagua, E Guajabal, Santa Rosa, Arenillas.
- The Zarumilla River Basin, which is not only a foothill area, but also binational, shared with Peru.

The distribution in surface area is shown in the following table, which highlights the relative importance of the hydrographic areas in the province:

Table 22: Hydrographic Basins of the Province of El Oro

NAME	AREA Ha	PORCENTAGE (%)
PUYANGO RIVER	150537.1	27.35
CHIRA RIVER	28.7	0.01
ZARUMILLA RIVER	83547.6	15.18
ARENILLAS RIVER	63525.0	11.54
SANTA ROSA RIVER	91806.8	16.68
PAGUA RIVER	54524.0	9.91
SIETE RIVER	2928.3	0.53
TENGUEL RIVER	19.5	0.004
GUAJABAL ESTUARY	12728.2	2.31
JUBONES RIVER	90767.2	16.49
TOTAL	**550412.4**	**100%**

Source: *Secretary of Planning GAD El Oro*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *July 10, 2017*

40.04% of Machala canton's surface area (13,196 ha) is located within the Guajabal Estuary Basin, corresponding to the central part of the canton, in the areas of Los Ceibales, Nuevo Pajonal, Corralitos, Cañas Viejas, Km 15, San Luis and the south of Machala and La Unión.

On the other hand, to the north of the canton where La Primavera and El Limón are located, La Iberia, El Portón and the north of Machala correspond to the sub-basin of the Jubones River, in the basin of the same name, occupying an area of 9,535 ha (28.93% of the canton's surface area).

The southern part of the canton is located in the sub-basins of the Santa Rosa, Buenavista and Motuche rivers, all included in the Santa Rosa river basin, with an area

of 10,230 ha, equivalent to 31.03% of the total area of the canton, and is located mainly in the towns of La María, La Y del Enano, San José, El Retiro, El Recreo, Motuche and Guarumal.

Table 23: Hydrographic Basins of Machala Canton

BASIN	SUBCUENCY	Area (Ha)	Percentage (%)
Rio Jubones	Minor Drainage	9.535	28,93
Estero Guajabal	Estero Guajabal	13.196	40,04
Santa Rosa River	Santa Rosa River	10.230	31,03
	Motuche River		
	Buena Vista River		

***Source**: Machala Land Use Plan 2012*
***Prepared by:** Ecosfera Cía. Ltda, 2017.*
***Date:** July 10, 2017*

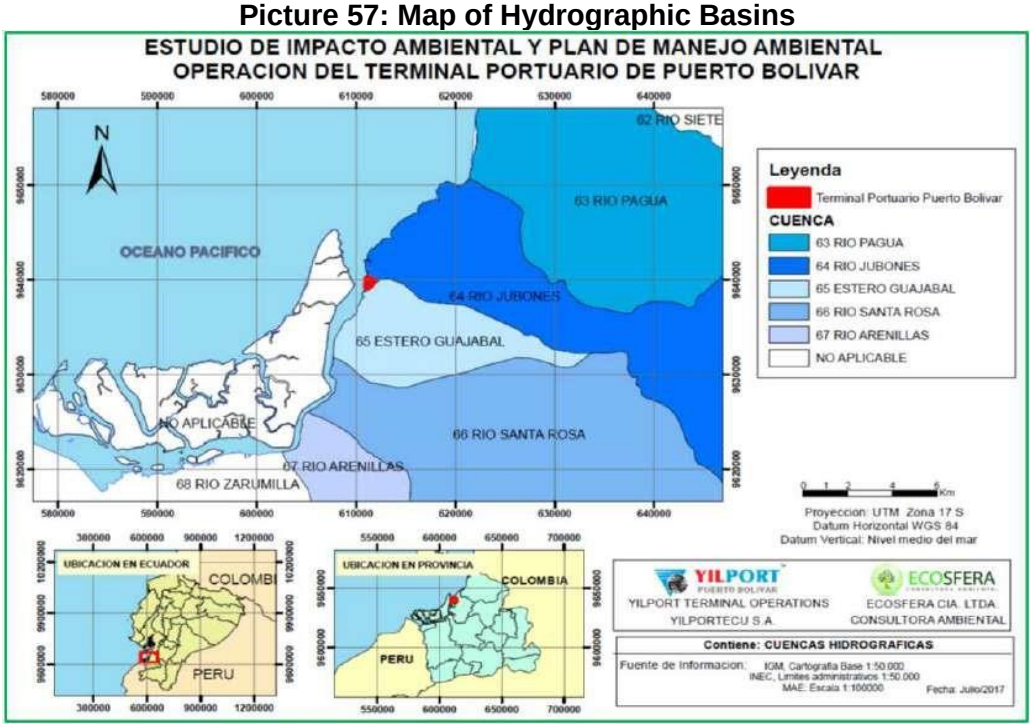
Santa Rosa River Basin

The surface waters of the Santa Rosa River basin are considered suitable for irrigation use. Carbonates, chlorides and sodium are present, which are close to the non-permissible limits.

In the samples of the Buena Vista, Raspas, Calaguro and Santa Rosa Rivers, the carbonate content is close to the non-permissible limits; in the rest of the samples the carbonate content is within the permissible limits. In all the samples the presence of chlorides is evidenced in limits close to the non-permissible limits, with the exception of one sample in the Calaguro River and one sample in the Santa Rosa River. However, this is not considered to be a serious problem for the use of the water for irrigation. It will always be appropriate to monitor the irrigation water to prevent these salts from causing adverse effects on the soil and plants.

The results of the samples show that there is a significant magnesium content in the samples analysed, but they do not impair the quality of the water for irrigation. The presence of coliforms outside the permissible limits was reported in the samples corresponding to the Calaguro and Santa Rosa Rivers.

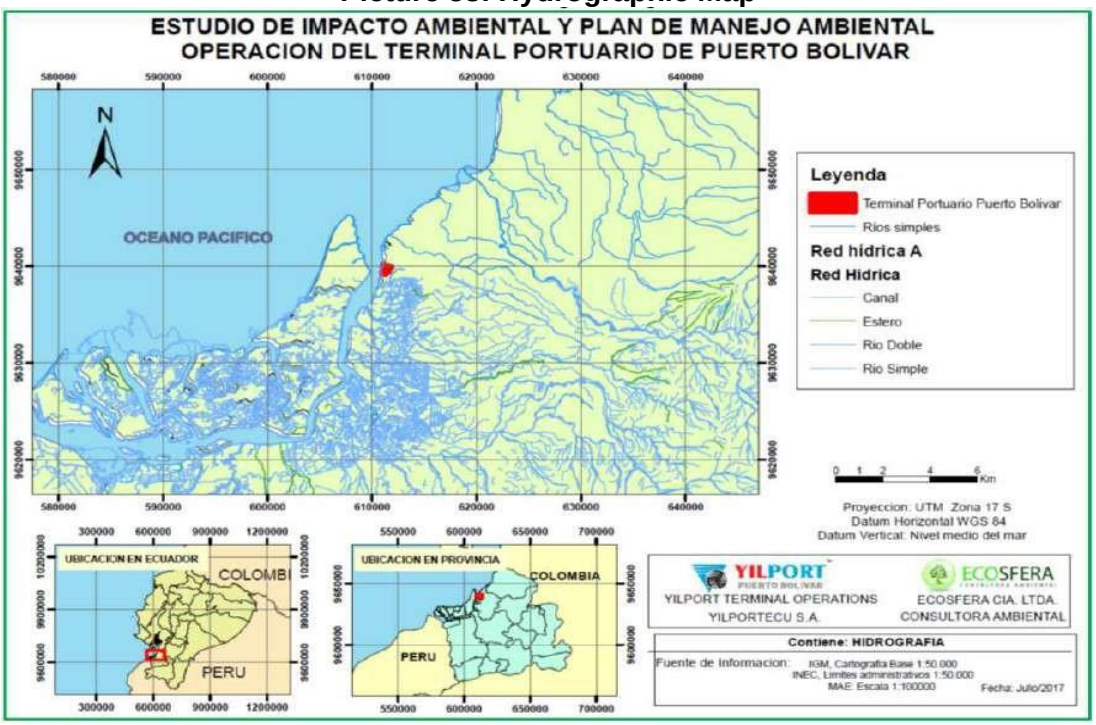
Picture 57: Map of Hydrographic Basins



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

As for the rivers of Machala, they are detailed in the following map:

Picture 58: Hydrographic Map



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.6. OCEANOGRAPHY

The INOCAR Institute carried out a survey of the oceanographic component and within this, observations of incident waves were made, with the result that when the swell approaches the coast, there comes a time when the depth is 1.3 times the height of the wave, at this point the phenomenon known as "breaker" occurs.

The coast around the Puerto Bolívar maritime terminal is low, without visible elevations, covered with mangroves on its edges (surrounded by shrimp farms), whose heights do not exceed 10 meters.

The maritime traffic in Puerto Bolívar is regular and its position offers enormous advantages. It has a natural bay that is completely calm because it is defended from the effects of the sea.

Its access channel (Santa Rosa Estuary) is deep enough for vessels with a draft of 9 m (30 ft), with sufficient width for manoeuvring vessels in its inland waters. The port is 5 miles from the open sea.

The depths are regular, the 10-meter channel is interrupted in the E. part of Punta Jambeli, however, it reaches the head of the dock without difficulty, allowing good manoeuvrability for ships, and there is also a narrowing between the Salinas estuary and the Muerto estuary, where it reaches 182 meters wide.

The Santa Rosa channel offers sufficient and regular depths so the longitudinal gradient is gentle. In the transverse direction it has a gradient of 3% on the E shore and 0.7% on the W shore, the bottom has a sandy silt consistency.

6.1.7. WATER QUALITY ANALYSIS

Based on the stipulations of Ministerial Resolution 061 of the Ministry of the Environment, a Water Quality Analysis of the area of the project ***"Construction and Operation of the Puerto Bolívar Port Terminal"*** *was* carried out for this Environmental Impact Study.

The company Consultora Ecosfera Cía. Ltda. proceeded to contract the Laboratorio Grupo Químico Marcos of the city of Guayaquil, which are accredited by the Ecuadorian Accreditation Service, planning the sampling and analysis to be carried out.

SAMPLING POINTS WATER QUALITY ANALYSIS

The water quality sampling points were as follows:

Table 24: Water Quality Sampling Points

SAMPLE No.	SAMPLING POINT	Coordinates	Sampling Time
SAMPLE 1	In front of Port Authority	X: 610680 Y: 9639902	11:35
SAMPLE 2	In front of the Liceo Naval	X: 610682 Y: 9640521	11:19

Source: *Test Report Grupo Químico Marcos*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala, Santa Rosa - El Oro*

Samples were spot and simple at 0.60 meters depth, on Friday, March 17, 2017, following the Technical Sampling Standard INEN 2169:98 - 2176:98.

Photograph 3: Water Sampling

WATER QUALITY EVALUATION PARAMETERS

The parameters determined for water quality analysis are physical and chemical. The parameters to analyse are:

Table 25: Water Quality Parameters to be Analysed

PARAMETERS
Arsenic
Cadmium
Total Chromium
Copper
Iron
Mercury
Fecal Coliforms
Surfactants - Detergents
Oils and Fats
Biochemical Oxygen Demand
Chemical Oxygen Demand
Total petroleum hydrocarbons
Dissolved oxygen in situ
Ammonia
Total Suspended Solids

Prepared by: *Ecosfera Cía. Ltda., 2017*
Source: *Test Report Grupo Químico Marcos*

WATER QUALITY ANALYSIS METHODS

The analysis of dissolved compounds in water is based on standardized methods, which include a series of procedures both in the field and in the laboratory. These procedures include a series of physical, chemical and biological measurements.

To determine the values and concentrations of the parameters determined, the methods established in the manual "Standard Methods for the Examination of Water and Wastewater", in its most recent edition, should be applied. In addition, the following standards of the Instituto Ecuatoriano de Normalización (INEN) should be considered

- Ecuadorian Technical Standard NTE INEN 2169:98. Water: Water quality, sampling, handling and conservation of samples.

- Ecuadorian Technical Standard NTE INEN 2176:98. Water: Water quality, sampling, sampling techniques.

Depending on the parameters to be analysed for each of the samples, the following methods were used for the analysis:

Table 26: Water Quality Methods of Analysis

PARAMETERS	METHOD
Arsenic	PEE - GQM - FQ - 33
Cadmium	PEE - GQM - FQ - 33
Total Chromium	PEE - GQM - FQ - 33
Copper	PEE - GQM - FQ - 33
Iron	PEE - GQM - FQ - 33
Mercury	ICP - OES
Fecal Coliforms	9222 D
Surfactants - Detergents	PEE - GQM - FQ - 21
Oils and Fats	PEE - GQM - FQ - 03
Biochemical Oxygen Demand	PEE - GQM - FQ - 05
Chemical Oxygen Demand	PEE - GQM - FQ - 04
Total petroleum hydrocarbons	PEE - GQM - FQ - 07
Dissolved oxygen in situ	PEE - GQM - FQ - 65
Ammonia	PEE - GQM - FQ - 31
Total Suspended Solids	PEE - GQM - FQ - 06

Source: *Test Report Grupo Químico Marcos*
Prepared by: *Ecosfera Cía. Ltda.*

WATER QUALITY ANALYSIS EQUIPMENT AND MATERIALS

The following is a general list of the implements required at the time of sampling:

- Geopositioning (GPS).
- Portable equipment for temperature, pH and electrical conductivity measurements.
- 10 L capacity plastic buckets
- Isopor or polyurethane cooler with enough ice packs to maintain a temperature close to 4°C.
- Absorbent paper towel.
- Ballpoint pen and indelible ink marker.
- Board
- Gloves
- Plastic and glass containers.
- Comfortable coveralls or work clothes that provide adequate protection

WATER QUALITY ANALYSIS RESULTS

The following tables and graphs detail the results obtained in the samples from the six Water Quality sampling points and their relationship with the Maximum Permissible Limit established in the current Environmental Legislation.

SAMPLE 1: IN FRONT OF PORT

Table 27: Results Sample 1 Water

PARAMETERS	UNIT	RESULT	MAXIMUM ALLOWABLE LIMIT*
Arsenic	mg/l	**<0,0031**	0,05
Cadmium	mg/l	**<0,0004**	0,005
Total Chromium	mg/l	**<0,0024**	0,05
Copper	mg/l	**<0,0037**	0,005
Iron	mg/l	**<0,0047**	0,3
Mercury	MPN/100 ml	**<0,00500**	0,0001
Fecal Coliforms	mg/l	**2**	----
Surfactants Detergents	mg/l	**0,027**	0,5
Oils and Fats	mg/l	**<0,44**	0,3
Biochemical Oxygen Demand	mgO2/l	**9,12**	---
Chemical Oxygen Demand	mgO2/l	**18**	---
Total petroleum hydrocarbons	mg/l	**<0,04**	0,5
Dissolved oxygen in situ	mgO2/l	**5,17**	>5
Ammonia	mg/l	**0,06**	0,4
Total Suspended Solids	mg/l		---

Source: *Test Report Grupo Quimico Marcos*

Prepared by: *Ecosfera Cía. Ltda.*

SAMPLE 2: IN FRONT OF LICEO NAVAL

Table 28: Results Sample 2 Water

PARAMETERS	UNIT	RESULT	MAXIMUM ALLOWABLE LIMIT*
Arsenic	mg/l	**<0,0031**	0,05
Cadmium	mg/l	**<0,0004**	0,005
Total Chromium	mg/l	**<0,0024**	0,05
Copper	mg/l	**<0,0037**	0,005
Iron	mg/l	**<0,0047**	0,3
Mercury	MPN/100 ml	**<0,00500**	0,0001

Fecal Coliforms	mg/l	**2**	----
Surfactants Detergents	mg/l	**0,045**	0,5
Oils and Fats	mg/l	**<0,44**	0,3
Biochemical Oxygen Demand	mgO2/l	**19**	---
Chemical Oxygen Demand	mgO2/l	**36**	---
Total petroleum hydrocarbons	mg/l	**<0,04**	0,5
Dissolved oxygen in situ	mgO2/l	**4,65**	>5
Ammonia	mg/l	**<0,036**	0,4
Total Suspended Solids	mg/l	**87**	---

Source: *Test Report Grupo Químico Marcos*
Prepared by: *Ecosfera Cía. Ltda.*

WATER QUALITY COMPLIANCE ANALYSIS WITH REGULATIONS

Table 29: Analysis of Compliance with Water Quality Regulations

SAMPLE No.	PARAMETERS	RESULT	MAXIMUM ALLOWABLE LIMIT*	COMPLIANCE
SAMPLE 1 IN FRONT OF PORT	Arsenic	**<0,0031**	0,05	COMPLIES
	Cadmium	**<0,0004**	0,005	COMPLIES
	Total Chromium	**<0,0024**	0,05	COMPLIES
	Copper	**<0,0037**	0,005	COMPLIES
	Iron	**<0,0047**	0,3	COMPLIES
	Mercury	**<0,00500**	0,0001	DOES NOT COMPLY
	Fecal Coliforms	**2**	—	—
	Surfactants Detergents	**0,027**	0,5	COMPLIES
	Oils and Fats	**<0,44**	0,3	COMPLIES
	Biochemical Oxygen Demand	**9,12**	—	—
	Chemical Oxygen Demand	**18**	—	—
	Total petroleum hydrocarbons	**<0,04**	0,5	COMPLIES
	Dissolved Oxygen in situ	**5,17**	>5	COMPLIES
	Ammonia	**0,06**	0,4	COMPLIES
	Total Suspended Solids	**106**	**—**	**—**
SAMPLE 2 FRONT A NAVAL HIGH SCHOOL	Arsenic	**<0,0031**	0,05	COMPLIES
	Cadmium	**<0,0004**	0,005	COMPLIES
	Total Chromium	**<0,0024**	0,05	COMPLIES
	Copper	**<0,0037**	0,005	COMPLIES

	Iron	**<0,0047**	0,3	COMPLIES
	Mercury	**<0,00500**	0,0001	DOES NOT COMPLY
	Fecal Coliforms	**2**	—	**—**
	Surfactants Detergents	**0,045**	0,5	COMPLIES
	Oils and Fats	**<0,44**	0,3	DOES NOT COMPLY
	Biochemical Oxygen Demand	**19**	**—**	—
	Chemical Oxygen Demand	**36**	**—**	—
	Total petroleum hydrocarbons	**<0,04**	**0,5**	COMPLIES
	Dissolved Oxygen in situ	**4,65**	**>5**	DOES NOT COMPLY
	Ammonia	**<0,036**	**0,4**	COMPLIES
	Total solids suspended	**87**	**—**	—
	Iron	**<0,0047**	**0,3**	COMPLIES
	Mercury	**<0,00500**	**0,0001**	DOES NOT COMPLY
	Fecal Coliforms	**8**	**—**	—
	Surfactants Detergents	**0,016**	**0,5**	COMPLIES
	Oils and fats	**<0,44**	**0,3**	DOES NOT COMPLY
	Biochemical oxygen demand	**23**	**—**	—
	Chemical oxygen demand	**44**	**—**	--
	Total petroleum hydrocarbons	**<0,04**	**0,5**	COMPLIES
	Dissolved oxygen in situ	**5,95**	**>5**	COMPLIES
	Ammonia	**<0,036**	**0,4**	COMPLIES
	Total suspended solids	**177**	**—**	—

Source: *Test Report Grupo Químico Marcos*
Prepared by: *Ecosfera Cía. Ltda.*

PHYTOPLANKTON AND ZOOPLANKTON ANALYSIS

- **METHODOLOGY**

As part of the water quality sampling in the Santa Rosa Estuary, an analysis of phytoplankton and zooplankton was carried out by performing surface trawls to obtain a zooplankton sample and a phytoplankton sample at a speed of 2 knots/hour in a time of 2 minutes.

Sampling determined that the zooplankton net had a mouth opening of 0.30 m in diameter and a mesh length of one meter with a net pore size of 300 µ. Samples were poured into 500 ml plastic bottles and preserved in 70% alcohol. For phytoplankton capture, a 0.30 m diameter and 1.00 m long net with a 60 µ mesh eye opening was used, the samples were emptied into 500 ml plastic bottles and preserved with lugol.

Samples were subjected to refrigeration before analysis, and microscopy was used for observation. For quantitative analysis bibliography from Tapia 2002, Actas Oceanográficas 2002, Cajas 1998, Jiménez 1983, Luzuriaga 1998 and Zambrano 1983 was consulted.

Photograph 4: Phytoplankton and Zooplankton sampling.

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*

RESULTS

- **Phytoplankton analysis (60µ net)**

  The species with the highest abundance found in the sample were in order:

  - *Skeletonema costatum* with 10.5x105 cells/m3
  - *Biddulphia sinensis* with 4.7x104 cells/m3
  - *Coscinodiscus concinnus* with 4.3x104 cells/m3
  - *Biddulphia mobiliensis* with 2.19 x104 cells/m3
  - *Chaeroceros debilis* with 1.8x104 cells/m3
  - *Coscinodiscus radiatus* with 1.6X104 cells/m3
  - *Navicula sp.* with 1.46x104 cell/m3
  - *Chaetoceros sp.* with 8463 cell/ m3

- *Ditylum brighwellii* with 457 cell/ m3
- *Chaeroceros affinis* with 343 cells/ m3
- *Dinophuysis caudatas and Paralia sulcata* with 229 cell/ m3

- **Zooplankton analysis (60µ net)**
  In this sample the species with the highest abundance were the copepods in *Copepodito* state with 24.4x104 org/10m2, followed by the copepods in *Nauplio* state with 21.9x104 org/10m2, *Tintinnopsis dadayi* with 7.3x104 org/10m2; and lastly, with the lowest abundance was the tintinnid *Tintinnopsis campanula* with 4575x104 org/10m2, and *Tintinnopsis campanula* with 4575x104 org/10m2.

- **Zooplankton analysis (300µ net)**
  In this sample only the species *Acartia tansa* was found, which presented a low abundance of 343 org/10m2 cell/m3.

CONCLUSIONS

- The analysis found 16 phytoplanktonic species grouped into two divisions: *Bacillariophyta (*15 species) and the *Dinophyta* division (1 species).
- The total phytoplankton captured was 16.6x105 cells/m3; the most abundant species was *Skeletonema costatum*, which comprised 83% of the total phytoplankton collected.
- In the microzooplanktonic analysis (60µ) the following groups were found: *Copepoda* and *Ciliophora.*
- The total microzooplankton collected was 54.2x104 org/10m2; where copepods in the copepod stage reached the highest abundance, with 45% of the total microzooplankton collected.
- In the zooplanktonic analysis (300µ) only one species was found, which was the copepod *Acartia tonsa*, with an abundance of 343 org/10m2.

Picture 59: Phytoplankton and Zooplankton Species of Santa Rosa Estuary

Source: *Water Quality Report 6755-4 (Grupo Quimico Marcos)*
Prepared by: *Ecosfera Cía. Ltda.*

WATER QUALITY ANALYSIS CONCLUSIONS

The samples taken were simple and punctual, covering the area of the project where Dock #6 will be built. For this purpose, Grupo Químico Marcos, a laboratory in the city of Guayaquil that is accredited by the Ecuadorian Accreditation Service, was hired.

Water quality samples taken at different points in the Santa Rosa Estuary show that the Arsenic, Cadmium, Total Chromium, Copper, Iron, Surfactants, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Petroleum Hydrocarbons, Dissolved Oxygen, Ammonia and Fecal Coliforms parameters comply with the Water Quality Criteria for the preservation of aquatic life in sea waters (Ministerial Resolution 097 A, Annex 1, Table 2). However, the Mercury and Oils and Fats parameters do not meet this criterion.

The results of the water quality samples that show values such as metals like Arsenic with a value of <0.0031 in all samples, is due to the fact that the value found is below the quantification limit of Laboratorio Grupo Quimico Marcos, so the qualification limit is reported as the lowest value that can be analytically detected with a statistical certainty of at least 95.45 % with 2 effective degrees of freedom.

The Santa Rosa Estuary is a semi-enclosed marginal seawater body where salinity is significantly diluted by freshwater discharges.

It is important to note that about 70%-75% of global marine pollution is a product of human activities that take place on the land surface. Some 90% of pollutants are transported by rivers to the sea.

The contamination level of the Santa Rosa Estuary is mainly due to daily wastewater discharges from domestic sources, fuel residues, and due to ocean currents and high and low tide mechanisms that allow metal-enriched sediments to enter the estuary.

Another factor contaminating the waters of the Santa Rosa Estuary is the presence of chemical products from the shrimp farms in the area.

An important parameter of sea water quality in terms of aquatic life is dissolved oxygen, which indicates the ecosystems health. In the samples obtained, the results indicate ranges between 5.2 - 6 mgO2/l, values that comply with the regulations in force.

The presence of fecal coliforms in the water samples is due to contamination from excreta, specifically from domestic sewage that is discharged into the Santa Rosa Estuary through the Huayla Estuary and other water vectors in the area.

6.1.8. AMBIENT AIR QUALITY ANALYSIS

All industrialized countries, and a growing number of developing countries, have created standards that control and limit the amount of emissions from their industries. Due to industry's increasing commitment to the environment and the legislation in force, monitoring their emissions and verifying that they comply with national standards is of crucial importance.

Air pollution is the term used to describe the presence of one or more pollutants in the atmosphere, the amounts and characteristics of which may be harmful or interfere with health, welfare or other natural environmental processes.

Various human activities pollute the air. Pollutants originating from human activity can come from stationary sources (factories, thermoelectric plants, homes, etc.) or mobile sources (vehicles, airplanes, trains, ships, etc.). There are also natural sources, such as pollen emitted by flowers, dust from wind erosion and volcanic eruptions.

When air contains contaminants in the form of particles, gases or biological agents, there is a potential for adverse health effects.

Air monitoring is the result of air pollutant sampling and analysis procedures. Important air pollutants commonly monitored are: SO_2, CO, PST, PM10, ozone and nitrogen oxides (NOx). These pollutants are known as criteria pollutants, for which air quality standards exist.

6.1.8.1. AIR QUALITY LEGAL FRAMEWORK

MINISTERIAL RESOLUTION 061: RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF THE ENVIRONMENT

SECTION III: QUALITY OF ABIOTIC CONSTITUENTS
PARAGRAPH IV: AIR AND ATMOSPHERIC EMISSIONS QUALITY

- **Art. 219 Air quality –** It corresponds to the characteristics of the ambient air such as the type of substances that compose it, their concentration and the period in which they occur in a given place and time; these characteristics must guarantee the ecological balance, health and welfare of the population.
- **Art. 220 Ambient Air Quality -** The National Environmental Authority shall issue the technical norm for the control of ambient air quality or immission level, by means of the corresponding legal figure, which shall be of mandatory compliance. If necessary, the National Environmental Authority may provide for the evaluation and control of ambient air quality by means of biological indicators, for which purpose it shall establish the respective technical standards and guidelines.

MINISTERIAL RESOLUTION 097 A
ANNEX 4: AMBIENT AIR QUALITY OR IMMISSION LEVEL STANDARD

This technical standard is issued under the Environmental Management Act and the Regulations to the Environmental Management Act for the Prevention and Control of Environmental Contamination and is subject to the provisions of these, is mandatory and applies throughout the national territory.

This standard establishes:

- Ambient air quality objectives
- Permissible limits for criteria pollutants and non-conventional ambient air pollutants
- Methods and procedures for the determination of contaminants in ambient air.

- **OBJECT**

  The main purpose of this standard is to preserve the health of people, the quality of ambient air, the well-being of ecosystems and the environment in general. To meet this objective, this standard establishes the maximum permissible limits of contaminants in ambient air at ground level. The standard also provides methods and procedures for the determination of ambient air pollutant concentrations.

- **CLASSIFICATION**

  This standard establishes the maximum permissible limits for concentrations of criteria pollutants and non-conventional pollutants at ground level in ambient air. The standard establishes the present classification:

  - Ambient air quality standard:
    a) Ambient air pollutants
    b) General standards for concentrations of criteria pollutants in ambient air
    c) Air quality alert, warning and emergency plans
    d) Methods for measuring ambient air criteria pollutant concentrations
    e) General standards for concentrations of non-conventional pollutants in ambient air
    f) Methods for measuring concentrations of non-conventional ambient air pollutants
    g) Nuisance or hazardous from other air pollutants

- **REQUIREMENTS**
  - **Ambient Air Quality Standard - Ambient Air Pollutants**

    For the purposes of this standard, the following are established as criteria pollutants of ambient air:
    - Sedimentable particles
    - Particulate Matter of aerodynamic diameter less than 10 (ten microns) PM10

- Particulate matter of aerodynamic diameter less than 2.5 (two whole five tenths microns) PM2.5
- Nitrogen Dioxide NO2
- Sulphur Dioxide SO2
- Carbon monoxide CO
- Ozone O3

- The National Environmental Authority may request, if necessary, that projects, works or activities that emit or are likely to emit pollutants into the ambient air, to carry out ambient air quality monitoring, as indicated in this regulation, with the objective of preventing future deterioration of air quality.
- **General standards for concentrations of criteria pollutants in ambient air**
- The following maximum allowable concentrations are established for criteria air pollutants:

Table 30: Maximum allowable concentrations for air quality

POLLUTANT	TIME	MAXIMUM CONCENTRATION
Sulphur Dioxide (SO2)	24 h 10 min	µg/m3 µg/m3
Carbon Monoxide (CO)	8 h 1 h	10,000 µg/m3 30,000 µg/m3
Ozone	8h	µg/m3
Nitrogen Dioxide (NO2)	1h	µg/m3

Source: *Ministerial resolution 097 A, Annex 4: Ambient Air Quality*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *July 10, 2017*

- The concentration values for criteria air pollutants established in this standard, as well as those determined in public measurement programs, are subject to the reference conditions of 25°C and 760 mmHg.

6.1.8.2. AIR QUALITY ANALYSIS METHODOLOGY

For air quality monitoring at the Puerto Bolívar Port Terminal project, the services of the Elicrom laboratory in the city of Guayaquil, which is accredited by the Ecuadorian Accreditation Body (OAE), were hired.

The monitoring was conducted on Thursday, April 20, 2017. The procedures used for the measurement are based on the Ecuadorian Air Quality Legislation, Annex 4 - Ministerial Resolution 097 A.

6.1.8.3. EQUIPMENT USED FOR AIR QUALITY ANALYSIS

- GPS
- SUPELCO PUMP
  - Internal code: EL.EA.071
  - Brand: Micro Air Sampler
  - Model: Not Specified
  - Serial Number: Not specified
  - Calibrated: May 9, 2016
- THERMO-HYGROMETER

- Internal code: EL.PT.211
- Brand: ATM
- Model: HT9214
- Serial Number: Not specified
- Calibrated: January 7, 2017

- ANEMOMETER
  - Internal code: EL.PT.567
  - Brand: Control Company
  - Model: 3655
  - Calibrated: March 4, 2016
- BAROMETER
  - Internal code: EL.PT.547
  - Brand: Control Company
  - Model: 1081
  - Calibrated: March 1, 2016

6.1.8.4. AIR QUALITY ANALYSIS MONITORING POINTS

Table 31: Air Quality Monitoring Points

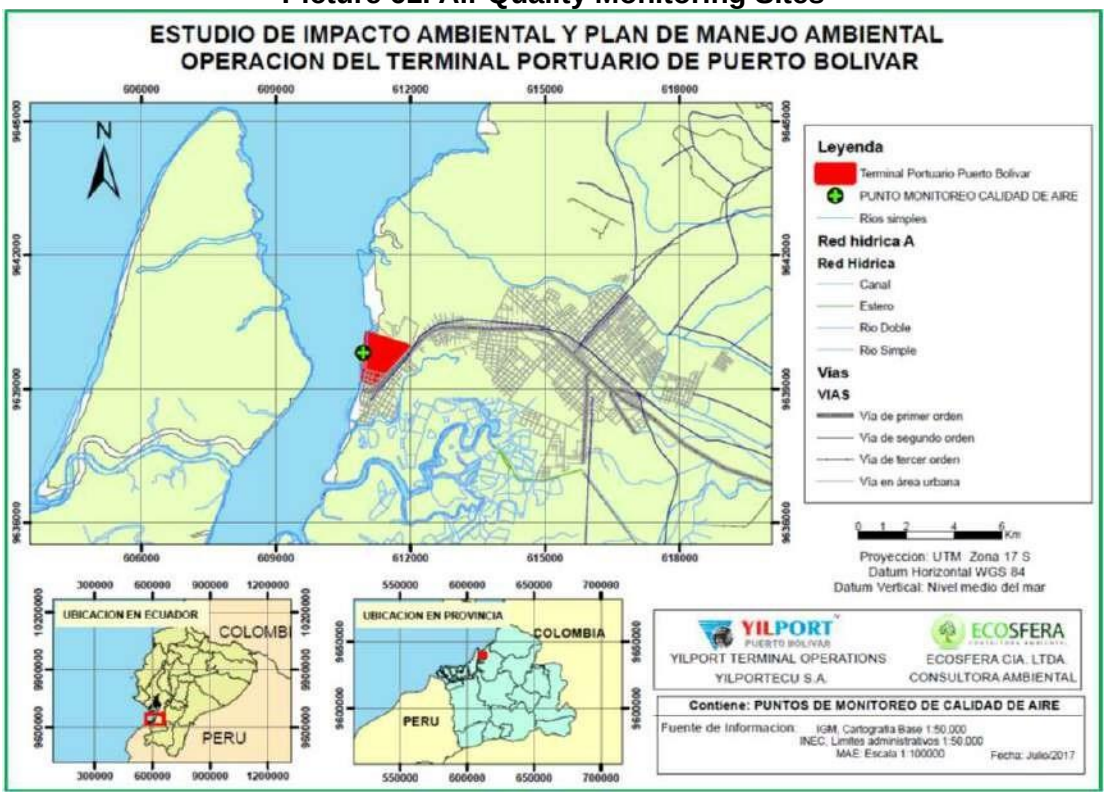
MONITORING POINT	LOCATION	COORDINATES
POINT 1	Dock 5	X: 610951 Y: 9639819

Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Picture 60: Air Quality Monitoring Point

Source: *www.googleearth.com*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Picture 61. Air Quality Monitoring Sites



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

Photograph 5: Air Quality Monitoring

AIR QUALITY MONITORING
DOCK 5

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *April 24, 2017*

6.1.8.5. AIR QUALITY ENVIRONMENTAL CONDITIONS ANALYSIS

Ambient conditions on the monitoring day (April 20, 2017) were:

- Average temperature = 31.6°C
- Relative Humidity = 69.3% RH
- Wind speed = 1.5 m/s
- Atmospheric Pressure = 753,6 mmHg

6.1.8.6. MONITORING RESULTS AIR QUALITY ANALYSIS

Table 32. Air Quality Monitoring Results

POLLUTANT EMITTED	CORRECTED CONCENTRATION µg/m3	MAXIMUM PERMITTED *
Carbon Monoxide CO	**2086,62**	10.000

Nitrogen Dioxide NO2	**11,29**	200
Sulphur Dioxide SO2	**8,90**	125
Ozone	**23,56**	100

* Air Quality or Immission Level Standard, Annex 4, Ministerial Resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

ANALYSIS OF AIR QUALITY RESULTS

CARBON MONOXIDE CONCENTRATION

Table 33: Air Quality Monitoring Results - Carbon Monoxide

POLLUTANT EMITTED	CONCENTRATION	MAXIMUM ALLOWABLE CONCENTRATION*
CARBON MONOXIDE (CO)	**2086,62**	10.000

* Air Quality Immission Level Standard, Annex 4, Ministerial Resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*

Picture 62: Air Quality Monitoring Results - Carbon Monoxide

Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

The result of the Air Quality Monitoring for Carbon Monoxide Pollutant obtained a value of 2086.62 µg/m3, which complies with the permitted Concentration that establishes a value of 10,000 µg/m3.

NITROGEN DIOXIDE CONCENTRATION

Table 34: Air Quality Monitoring Results - Nitrogen Dioxide

POLLUTANT EMITTED	CONCENTRATION	MAXIMUM ALLOWABLE CONCENTRATION*
NITROGEN DIOXIDE (NO2)	11,29	200

* Air Quality or Immission Level Standard, Annex 4, Ministerial resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Picture 63: Air Quality Monitoring Results - Nitrogen Dioxide

Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Regarding the concentration of the pollutant Nitrogen Dioxide, the monitoring value was 11.29 µg/m3, which indicates compliance with environmental regulations.

SULFUR DIOXIDE CONCENTRATION

Table 35: Results of Air Quality Monitoring - Sulphur Dioxide

POLLUTANT EMITTED	CONCENTRATION	MAXIMUM ALLOWABLE CONCENTRATION*
SULFUR DIOXIDE NO2	8,90	125

* Air Quality or Immission Level Standard, Annex 4, Ministerial resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Picture 64: Air Quality Monitoring Results - Sulphur Dioxide

Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

The sulphur dioxide pollutant in the monitoring obtained a value of 8.9 µg/m3; this value complies with the permitted concentration of 125 µg/m3.

OZONE CONCENTRATION

Table 36: Air Quality Monitoring Results -Ozone

POLLUTANT EMITTED	CONCENTRATION	MAXIMUM ALLOWABLE CONCENTRATION*
OZONE	23,56	100

* Air Quality or Immission Level Standard, Annex 4, Ministerial resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Picture 65: Air Quality Monitoring Results -Ozone

Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

The concentration of the pollutant Ozone complies with the permitted concentration, having obtained in the Air Quality Monitoring a result of 23.56 µg/m3.

6.1.8.7. ANALYSIS OF COMPLIANCE OF AIR QUALITY MONITORING WITH REGULATIONS

Table 37: Analysis of Compliance with Air Quality Monitoring Regulations

DOCK 5			
POLLUTANT EMITTED	**CONCENTRATION CORRECTED µg/m3**	**MAXIMUM ALLOWABLE***	**EVALUATION**
Carbon monoxide CO	**2086,62**	10.000	COMPLIES
Nitrogen Dioxide NO2	**11,29**	200	COMPLIES
Sulphur Dioxide SO2	**8,90**	125	COMPLIES
Ozone	**23,56**	100	COMPLIES

* Air Quality or Immission Level Standard, Annex 4, Ministerial Resolution 097 A
Source: *Elicrom Air Quality Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *May 10, 2017*

6.1.8.8. AIR QUALITY MONITORING CONCLUSIONS

Air quality monitoring was performed by the Elicrom Laboratory, which, as mentioned above, is accredited by the Ecuadorian Accreditation Organization (OAE).

A single monitoring point was identified at Dock 5 of the Puerto Bolívar Port Terminal, a site within the project's area of influence.

Monitoring was conducted on Thursday, April 20, 2017 in accordance with the Regulations described in Ministerial resolution 097 A, Annex 4: Ambient Air Quality Standard or Immission Level.

The results of the Air Quality Monitoring show compliance with the Maximum Allowable Concentrations for the pollutants: Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide and Ozone.

6.1.9. NOISE MONITORING

As part of the environmental baseline survey for the present project, the following Environmental Impact Study, a Noise Monitoring was conducted at several points of the Area of influence of the Project

6.1.9.1. LEGAL FRAMEWORK NOISE MONITORING

MINISTERIAL RESOLUTION 061: RESTATEMENT TO BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF THE ENVIRONMENT

SECTION III: QUALITY OF ABIOTIC COMPONENTS

PARAGRAPH V: OF THE PHYSICAL NOISE PHENOMENA

- **Article 224 - Evaluation, Control and Follow-up.** The Competent Authority, at any time, may evaluate or order the Control Subject to evaluate the environmental quality by means of sampling of ambient noise and/or noise emission sources established in the environmental evaluation and control mechanisms.
  For the determination of noise in fixed or mobile sources by means of programmed monitoring, the Control Subject must indicate the sources used daily and the power at which they operate in order for the sampling or monitoring to be valid; the omission of such information or its partial or altered delivery will be punished with the corresponding sanctions.
- **Art. 225 Technical norms:** The National Environmental Authority shall be the one to issue the technical norms for the control of environmental noise pollution, stipulated in Annex V or in the corresponding technical norms. These norms shall establish maximum permissible noise levels according to soil use and source, and shall also indicate the methods and procedures for the determination of noise levels in the environment, as well as provisions for noise prevention and control. The norms on the generation of industrial noise are complementary, which will be dealt with by the competent authority in Health and Labour matters.
- **Art. 226 Noise emission:** The Controlled Subjects that generate noise shall contemplate all methodological and technological alternatives in order to prevent, minimize and mitigate the generation of noise.

MINISTERIAL RESOLUTION 097 A

ANNEX 5: MAXIMUM NOISE EMISSION LEVELS AND MEASUREMENT METHODOLOGY FOR STATIONARY AND MOBILE SOURCES

This technical standard is issued under the Environmental Management Act and the Regulations to the Environmental Management Act for the Prevention and Control of Environmental Contamination and is subject to the provisions of these, is mandatory and applies throughout the national territory.

This technical standard determines or establishes:

- Maximum emission levels of noise emitted to the environment by fixed noise sources (FFR)
- Maximum noise emission levels emitted into the environment by mobile sources of noise
- Methods and procedures for determining compliance with maximum noise emission levels for FFR and FMR.

- **PURPOSE**

The purpose of this standard is to preserve the health and welfare of people and the environment in general, through the establishment of maximum noise emission levels for FFR and FMR.

Subject to the provisions of this standard are all FFRs and FMRs, public or private, with the following exclusions:

- Exposure to noise pollution produced in work environments shall be subject to the Labour Code and the corresponding regulations.
- Aircraft shall be governed by the standards established by the Directorate General of Civil Aviation and ratified international conventions and treaties.
- Others determined by the National Environmental Authority.

- **GENERAL CONSIDERATIONS**

- The competent environmental authority may carry out the visits, inspections, measurements and verifications that are necessary to verify adequate compliance with the provisions contained in this standard. The cost of inspections, visits or measurements shall be borne by those responsible for the activities that generate the emissions.
- The Community Relations Plan of the Environmental Management Plan should consider noise perception and disturbance surveys.
- It is a fundamental duty of the regulated party to report to the competent environmental entity the results of the monitoring of its noise emissions as established in its approved Environmental Management Plan at least once a year.
- For the approval of environmental studies of those activities involving RES, the environmental noise assessment and the noise control measures proposed to mitigate their impact will be taken into account.
- The regulated party shall demonstrate documented and technically the effectiveness of the proposed noise control measures when required.
- Municipal governments must control the use of alarms in vehicles and buildings, as well as the use of horns, bells, sound application systems, sirens or similar devices.
- The Municipal GADs may authorize, for reasons of general interest or of special significance for citizens or for the organization of events with special official, cultural, religious or similar nature projection, the temporary modification or suspension of the levels established in Table 1.
- Laboratories that perform noise evaluations must be accredited by the Official Accreditation Body and carry out these activities with competent personnel.

- **MAXIMUM EMISSION LEVELS FOR FFR AND FMR NOISE**

Maximum Noise Emission Levels for FFRs

The corrected equivalent continuous sound pressure level, LKeq in decibels, obtained from the evaluation of noise emitted by an FFR, shall not exceed the levels set forth in Table 1 according to the soil use in which it is located.

Table 38: Maximum Noise Levels (LKed) for Fixed Noise Sources

MAXIMUM NOISE EMISSION LEVELS FOR FFR		
SOIL USE	LKeq (dB)	
	Day Period 07:01 until 21:00 hr	**Night Period 21:01 to 07:00 hr**
Residential (R1)	55	45

Social Services Equipment (EQ1)	55	45
Equipment of Utilities (EQ2)	60	50
Commercial (CM)	60	50
Residential Agricultural (AR)	65	45
Industrial (ID1/ID2)	65	55
Industrial (ID3/ID4)	70	65
Multiple use	When there are multiple or combined land uses, the lowest LKeq of any of the uses that make up the combination will be used. Example: Land Use: Residential + ID2 LKeq for this case = Daytime 55 dB and Night-time 45 dB	
Agricultural Protection (PE) Natural Resources (NR)	The determination of the LKeq for these cases shall be carried out according to the procedure described in Annex 4.	

Source: *Ministerial Resolution 097 A, Annex 5: Maximum Noise Emission Levels*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *May 10, 2017*

- The FFR must comply with the maximum noise emission levels at the measurement points determined for the evaluation, for which it must obtain from the corresponding municipal administration the certificate indicating the specific soil use in which it is located.

- In those situations, where conflicts or non-existence of the definition of soil use are verified, the competent Environmental Authority will determine the maximum emission level of the FFR to be evaluated based on the PCAs. If the competent Environmental Authority is still unable to determine the maximum emission level, the objective of this standard, which is to preserve the health and welfare of people and the environment, shall be applied as a criterion.

- **DETERMINATION OF THE NOISE EMISSION LEVELS PRODUCED BY A FFR**

  Environmental Noise Baseline Assessment

  - The purpose of the baseline environmental noise assessment is to identify noise emitting sources, the highest sound pressure levels at the perimeter of the FFR and the PCAs that could be affected by the FFR.
  - This assessment shall determine any activity, operation or process that involves noise emission and that constitutes a noise emitting source (ERF), as well as its contribution in time and level of noise emitted by the ERF.
  - Locations on the perimeter of the FFR, where the highest noise levels are emitted, as well as nearby PCAs, should be identified.
  - At a minimum, the following information must be collected and reported:
    - NPS and where these are highest on the perimeter
    - The soil use where it is located

        - Identification of noise sources contributing to residual noise
    - For each of the FFR's RES:
        - Description of the process and its simultaneity with other processes.
        - Equipment and machinery involved
        - Temporary periods of operation
        - Corresponding points of potential impact
        - Emission of impulsive noises or with important low frequency content.
        - Others that are relevant
    - Others
        - FFR map with location of observed FER
        - Map showing the location of potential sites and other FFRs in the vicinity.
    - The critical points will be defined by the subject of control within its environmental studies (EIA, Environmental File, EMP, etc.).

- **METHODOLOGY FOR THE MEASUREMENT, QUANTIFICATION AND DETERMINATION OF THE NOISE LEVEL FOR FFR.**

  Measurement points:

  For the purposes of this standard, the specific noise measurement of an FFR shall be made:
    - At critical measurement points (PCA) determined in the baseline environmental noise assessment and environmental studies, or those determined by the competent environmental authority.
    - At locations and times where the FFR emits the highest NPS at the outer perimeter.

  Minimum Number of Measurement Points

  There is no minimum number of measurement points, however, it is recommended that the minimum number of measurement points be determined by the following criteria
    - Taking into account the PCA close to the FFR
    - Taking into account the highest NPS issued by the FFR in its outer perimeter

  Determination of the Sites where the Measurement should be carried out

  Nearby PCA sites

  These sites will be determined through the baseline environmental noise assessment carried out by the control subjects within the baseline or environmental diagnosis.

  In the absence of a baseline environmental assessment, a specific noise level survey should be conducted at the outer perimeter of the FFR and measurement points should be defined based on the Measurement Point criteria.

  Sites where the FFR noise emission is poorly high.

  These sites will be determined through the baseline environmental noise assessment carried out by the control subjects within the baseline or environmental diagnosis of the activity or project to be executed.

  In the absence of a baseline environmental assessment, a specific noise level survey should be conducted at the outer perimeter of the FFR and measurement points should be defined based on the Measurement Point criteria.

Criteria About the Measurement Point

The measurement point shall be determined by considering the site/point where the specific noise is very high, outside the perimeter, physical limits, boundaries or factory lines of the FFR. The topography of the environment and the location of the PCA shall be taken into consideration.

The measurement should be made at the determined point and the evaluator should minimize the effect of sound reflecting surfaces.

Times at which the measurement should be carried out

The evaluation personnel are responsible for performing the measurement at the time(s) at which the FFR emits the highest NPS for each evaluation point, under normal operating conditions.

Measurement Equipment Requirements

Evaluations should be performed using class 1 or class 2 integrating sound level meters in accordance with the International Electro Technical Commission Standard IEC 61672-1: 2002, or any superseding standard.

To verify the correct operation of the sound level meter during the measurements, an acoustic calibrator that is appropriate for the sound level meter shall be used. The SPL of the calibrator shall be measured with the sound level meter before and after the measurement, these SPLs shall be recorded in the measurement report. The sound level meter can be used for the measurement only if the average SPL with the calibrator has a maximum deviation according to the criteria of the Ecuadorian Accreditation Body.

Noise measuring equipment and its components must be in good working condition and have the proper calibration certificates issued by a competent laboratory. It is recommended that calibration certificates for acoustic calibrators be renewed every calendar year and for sound level meters every two years. Measurements will not be allowed with instruments whose calibration certificates have expired.

Environmental Conditions during Measurement

Measurements should not be carried out in adverse conditions that may affect the measurement process, for example: presence of rain, thunder, etc.

The microphone should be protected with a wind shield during measurements. Measurements should be carried out only when the wind speed is equal to or less than 5 m/s.

Sound Level Meter Location

The sound level meter shall be placed on a tripod and located at a height equal to or higher than 1.5 meters from the ground, directing the microphone towards the source with an inclination of 45 to 90 degrees, on its horizontal plane. During the measurement, the operator should be at least 1 meter away from the equipment.

Residual Noise at the Time of Measurement

During the measurement the residual noise should be such that it has a minimal influence on the total noise, i.e. the contribution of the specific noise of the FFR to the total noise is maximized.

- **METHODOLOGY FOR DETERMINING THE SPECIFIC NOISE LEVELS AND THE Lkeq**

- **Methods for noise sampling and determination and Lkeq**
  For the measurement of total and residual noise, this standard contemplates the use of two methods that can be used as the case may require.
- **15-second method (Leq 15s)**
  In this method, a minimum of 5 15-second samples will be taken and reported.
- **5-second method (Leq 5s)**
  In this method, a minimum of 10 5-second samples will be taken and reported.
- **Sampling considerations**
  The same method (Leq 15s or Leq 5s) will be used to measure total and residual noise.
  The series of samples reported will be considered valid when the difference between the external values obtained in it, is less than or equal to 4dB.
  In order to validate the noise levels during the measurements and to facilitate the analysis and comparison of the samples, the minimum SPL (LAmin) and maximum SPL (LAmax) measured for each sample will be reported.

OCCUPATIONAL HEALTH AND SAFETY AND WORKSITE ENVIRONMENT IMPROVEMENT REGULATIONS

- **Art. 55. NOISE AND VIBRATIONS**
  1. The prevention of noise and vibration risks shall be carried out by applying the methodology expressed in paragraph 4 of Article 53.
  2. The anchoring of machines and equipment that produce noise or vibrations shall be carried out with techniques that allow achieving their optimum static and dynamic balance, isolation of the structure or use of anti-vibration supports.
  3. Machines that produce noise or vibrations shall be located in isolated enclosures if the manufacturing process permits, and shall be subject to an adequate maintenance program that minimizes the emission of such physical contaminants as much as possible.
  4. (Amended Art. 31 of D.E. 4217, R.O. 997, 10-VIII-88) It is prohibited to install machines or devices that produce noise or vibrations, attached to walls or columns, excluding alarm devices or acoustic signals.
  5. (Amended Art. 32 of D.E. 4217, R.O. 997, 10-VIII-88) Ducts with forced circulation of gases, liquids or solids in suspension, especially when directly connected to machines with moving parts and when they contribute notably to the increase of noise and vibrations, shall be provided with devices that prevent the transmission of vibrations generated by them by means of absorbent materials in their anchorages and in the parts of their route that cross walls or partitions.
  6. (Amended by Art. 33 of D.E. 4217, R.O. 997, 10-VIII-88) The maximum sound pressure limit is set at 85 decibels scale A of the sound level meter, measured in the place where the employee habitually keeps his head, for the case of continuous noise with 8 hours of work. However, jobs that require mainly intellectual activity, or regulatory or surveillance tasks, concentration or calculation, shall not exceed 70 decibels of noise.
  7. (Amended by Art. 34 of D.E. 4217, R.O. 997, 10-VIII-88) In the case of continuous noise, the sound levels measured in decibels with filter "A" in slow position, which will be allowed, will be related to the exposure time according to the following table:

Table 39: Noise level by exposure time per day

NOISE LEVEL /dB (A-SLOW)	EXPOSURE TIME PER DAY/HOUR
85	8
90	4
95	2
100	1
110	0.25
115	0.125

Source: *Occupational Health and Safety and Environmental Improvement Regulations*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *May 10, 2017*

The different sound levels and their corresponding permissible exposure times correspond to equivalent continuous exposures in which the daily noise dose (D) is equal to 1.
In no case shall the level of 115 dB (A) be exceeded, regardless of the type of work.
Employees subjected to such conditions must be subject to annual audiometric studies and controls.

6.1.9.2. PERSONNEL WHO CARRY OUT NOISE MONITORING

The noise measurement was carried out by ELICROM personnel.
The laboratory is accredited by the Ecuadorian Accreditation Service (SAE), under the supervision of Engineer José Marcial, Technical Coordinator, and with technicians who have been trained in the respective subjects.

6.1.9.3. NOISE MONITORING SOURCE EVALUATION

Table 40: Source Identification Noise Monitoring

PROJECT NAME	PUERTO BOLÍVAR PORT TERMINAL
ACTIVITY	STORAGE, LOADING AND UNLOADING OF CONTAINERS
CRITICAL POINTS OF AFFECTATION	**RECEIVERS:** - Nearby housing - Administrative Staff - Port Staff
SURROUNDING SURFACES SOUND REFLECTORS	**Emitter:** No physical boundaries **Receiver:** Concrete Walls
OPERATING MODE	**Shifts:** 3 (or hours each shift) **Days per month:** 30 days **Hours per month:** 720 hours
DESCRIPTION OF RESIDUAL NOISE	- P1: Passage of vehicles to the warehouse - P2: Behind administrative areas - P3: Vacant lot near the Manoeuvring Area, Dock 5 - P4: Near the Parish Council **Contributing sources:** There were no sources of noise pollution.
DESCRIPTION OF THE SPECIFIC NOISE	- **P1:** Taken at the passage of vehicles for loading and unloading of goods

	- **P2:** Taken together with administrative areas - **P3:** It was taken in a manoeuvring area or vehicle passage. - **P4:** It was taken at the passage of vehicles.

Source: *Elicrom Noise Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *May 10, 2017*

6.1.9.4. NOISE MONITORING POINTS

Table 41: Noise Monitoring Measurement Points

POINT	MEASUREMENT SITE	COORDINATES	
		X	Y
1	Dock 1	610941	9639369
2	Administrative Areas	611136	9639401
3	Dock 5	611014	9640135
4	Cabotage Dock	610892	9639050

POINT	MEASUREMENT SITE	Qualification	Start time	End Time	Time of Measurement	Total samples
1	Dock 1	A	15:15:26	15:17:26	00:02:00	5
		C	15:21:19	15:23:19	00:02:00	5
2	Administrative Areas	A	15:31:40	15:33:40	00:02:00	5
		C	15:34:00	15:36:00	00:02:00	5
3	Dock 5	A	15:57:31	15:59:31	00:02:00	5
		C	16:00:00	15:02:00	00:02:00	5
4	Cabotage Dock	A	16:39:39	16:41:39	00:02:00	5
		C	16:42:10	16:44:10	00:02:00	5

Source: *Elicrom Noise Monitoring Report* ***Prepared by:*** *Ecosfera Cía. Ltda.*
Location: *Areas of Influence of the Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

6.1.9.5. JUSTIFICATION OF THE USED METHOD

The type of measurement performed in the external Ambient Noise Monitoring of the project was as follows:

- The sound level meter was placed on a tripod and located at a height equal to or higher than 1.5 meters from the ground, directing the microphone towards the source with an inclination of 45 to 90 degrees, on its horizontal plane. The operator during the measurement should be at least 1 meter away from the equipment.
- The measurement was carried out for a 2-minute measurement time at each selected point, taking 5 samples at each one.
- The measurement of noise in the outdoor environment will be made by means of a standardized decibel meter (sound level meter), previously calibrated, with its selectors in the A-weighting filter and in slow response (slow).

Photograph 6: Point 1 Noise Monitoring

POINT 1: DOCK 1




Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Photograph 7: Point 2 Noise Monitoring

POINT 2: ADMINISTRATIVE AREAS




Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Photograph 8: Point 3 Noise Monitoring

POINT 3: DOCK 5	
	
	

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

Photograph 9: Point 4 Noise Monitoring

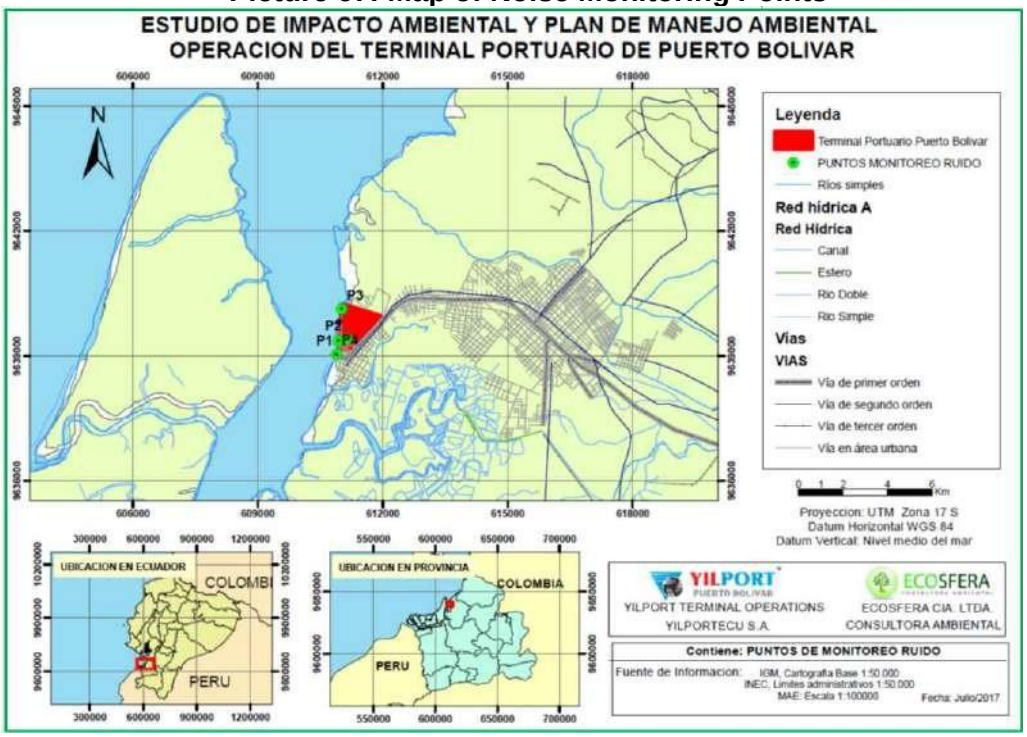
POINT 4: CABOTAGE DOCK	
	
	

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location*: Area of Influence of the Puerto Bolívar Port Terminal - Machala, El Oro.*
Date: *May 10, 2017*

Picture 66: Noise Monitoring Points

Source: *www.googleearth.com*
Location: *Area of Influence of the Puerto Bolívar Port Terminal - Machala, El Oro.*
Date: *May 10, 2017*

Picture 67: Map of Noise Monitoring Points



Source: *www.geoportaligm.gob.ec, Military Geography Institute INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.1.9.6. INSTRUMENTS FOR MEASURING NOISE LEVELS

Table 42: Noise Measurement Instrument Description

SOUND LEVEL METER	
CODE	EL.EM.022
BRAND	CENTER
MODEL	0390
SERIAL NUMBER	150207044
CALIBRATION	May 12, 2016
CALIBRATOR	
CODE	EL.EM.003
BRAND	SPER SCIENTIFIC
MODEL	850016
SERIAL NUMBER	081202542
CALIBRATION	January 7, 2016
THERMO-HYGROMETER	
CODE	EL.PT.211
BRAND	ATM
MODEL	HT9214
CALIBRATION	January 7, 2017
ANEMOMETER	
CODE	EL.PT.567
BRAND	CONTROL COMPANY
MODEL	3655
SERIAL NUMBER	160252813
CALIBRATION	March 4, 2016
BAROMETER	
CODE	EL.PT.547
BRAND	CONTROL COMPANY
MODEL	1081
SERIAL NUMBER	160253706
CALIBRATION	March 1, 2016

Source: *Elicrom Noise Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

6.1.9.7. NOISE MONITORING METEOROLOGICAL CONDITIONS

The environmental conditions on the day of the measurement are described in the following table:

Table 43: Noise Monitoring Environmental Conditions

ENVIRONMENTAL CONDITIONS		
MEASUREMENT SITE	**FACTOR**	**REGISTERED VALUE**
DOCK 1	Temperature	31,6 °C
	Relative humidity	69,3%
	Wind speed	1,5
	Pressure	753.6 mmHg
ADMINISTRATIVE AREA	Temperature	31,9 °C
	Relative humidity	67,9%
	Wind speed	1,3
	Pressure	753.6 mmHg
DOCK 5	Temperature	32,1 °C
	Relative humidity	66,5%
	Wind speed	1,1
	Pressure	753.6 mmHg
CABOTAGE DOCK	Temperature	32,3 °C
	Relative humidity	66,5%
	Wind speed	0,9
	Pressure	753.6 mmHg

Source: *Elicrom Noise Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

6.1.9.8. NOISE MONITORING RESULTS

Table 44: External Ambient Noise Measurement Results

N°	POINTS	Qualification	Total Noise Leq. t	Max. L (dB)	Min. L (dB)	Residual Noise Leq. R	Specific Noise Lkeq=le (dB)	Specific Noise Lkeq (dB)
1	Dock 1	**A**	65,2	69,8	62,7	50,9	65,0	**68,0**
		C	77,6	79,3	77,3	58,5	77,5	
2	Administrative Areas	**A**	65,1	71,4	59,1	62,3	61,9	**64,9**
		C	78,5	81,9	77,0	75,0	76,0	
3	Dock 5	**A**	63,7	66,1	62,4	61,3	59,9	**65,9**
		C	81,8	87,1	79,6	78,5	79,1	
4	Cabotage Dock	**A**	58,0	63,1	55,0	51,3	57,0	**60,0**
		C	72,1	77,2	70,4	60,9	71,7	

Source: *Elicrom Noise Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

6.1.9.9. NOISE MONITORING COMPLIANCE EVALUATION

Table 45: Noise Monitoring Evaluation Results

POINT	MEASUREMENT AREA	SPECIFIC NOISE LKEQ=LEDB (A)	LIMIT ALLOWABLE VALUE	
			Fixed Noise Sources (*)	Noise level per time of exposure per day (**)
1	Dock 1	**68,0**	70 COMPLIES	85 COMPLIES
2	Administrative Areas	**64,9**	60 COMPLIES	85 COMPLIES
3	Dock 5	**65,9**	70 COMPLIES	85 COMPLIES
4	Cabotage Dock	**60,0**	60 COMPLIES	85 COMPLIES

(*) Maximum Allowable Limit for Ambient Noise, Ministerial Resolution N0097A, Annex 5, Table 1, Commercial and Industrial Zone ID3, Commercial Zone (CM)
(**) Maximum Allowable Limit for occupational noise of the Occupational Health and Safety and Worksite Environment Improvement Regulations Art. 55.
Source: *Elicrom Noise Monitoring Report*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *May 10, 2017*

- **CONCLUSIONS NOISE MONITORING**

Noise Monitoring carried out in the area of influence of the project: ***"Puerto Bolívar Port Terminal"***; it is generally determined that it complies with the 70 dB established in the environmental regulations for this type of area (industrial and commercial area) and complies with the provisions of other laws such as the Occupational Health and Safety Regulations that establish a level of 85 dB for a working day of 8 hours, which correspond to the number of hours the staff of the Puerto Bolívar Port Terminal works.

The only point that does not comply with the regulations is Point 2 corresponding to the Administrative Areas, which is 4.9 points above the level established in the rule for a commercial area (60 dB). In this sense, it is necessary to clarify that the measurements were taken in an outdoor environment and the receivers are the administrative personnel inside the offices, so the noise reception decreases considerably.

In comparison with the regulations established in Ministerial resolution 097, Annex 5, the corresponding measurement complies with 75% of the permissible limits.

The results compared to the Occupational Health and Safety Regulation established at 85 dB are 100% compliant in the project's area of influence.

6.2. BIOTIC ENVIRONMENT

Biotic components are understood as the flora, fauna and other living organisms in their different levels of organization.

According to the area and characteristics of the project, environmental quality will be additionally evaluated and controlled by means of biotic studies using the tools established in the existing environmental regulation and control mechanisms.

The characterization of the biotic component aims to establish preventive measures to guarantee the conservation of biodiversity, the maintenance and regeneration of life cycles, structure, functions and evolutionary processes of nature.

The purpose of the control and monitoring of biotic components is to verify environmental quality by means of indicators, identify possible alterations in diversity, and determine and apply corrective measures if necessary.

In general terms, the study of this component will evaluate the current status and determine the relationship between this component and the socioeconomic variables.

The results of field campaigns conducted in the area and in zones with physical and biotic characteristics similar to those of the area of interest will be used as a basis for comparison. This information will allow us to better establish the sites to be sampled and the expected results of the field campaigns developed specifically in the area of direct influence of the project.

The characterization of the biotic resources of the area will be based on the processing and systematization of the information generated in field campaigns to be carried out. The characterization will be complemented with information available from public and private entities (for the planning of the field trip); this will allow a more objective evaluation of the current situation of the flora and fauna in the area of direct influence of the exploitation project.

The unit of representation of this classification system is the ecosystem, conceptualized as a group of vegetation communities at a local scale that tend to coexist within landscapes with similar biophysical variables, environmental gradients, and dynamic processes *(Comer et al. 2003).*

6.2.1. METHODOLOGY

For the characterization of the flora and fauna, information was collected through a rapid ecological assessment with reconnaissance, observation and data collection, and photographs for identification, taking into account the 1 kilometre to the area of influence where the current land use is mostly residential, aquaculture and tourism.

In addition, due to the characteristics of the area of direct influence, transect or quadrat methods were not applied, considering that there are no forests, shrubs or other types of wild vegetation.

In order to identify the plant diversity present in the direct and indirect zone, a walking tour was made through the places where there are certain remnants of vegetation, making direct observation of trees that have been planted on the site.

Here all species were recorded and a complete photographic record was made. For species that could not be identified in the field, a fertile botanical sample was taken (if possible) for later recognition in the laboratory phase.

Woody species with a diameter at breast height (DBH) greater than or equal to 10 cm were recorded, as specified in Ministerial Resolution No. 134 dated December 25, 2012 and published in Official Register No. 812 dated October 18, 2012. Thus, their DBH and height were recorded as part of the inventory.

Once the species present in the study area were known, they were compared with the national and international conservation lists to determine if they were catalogued in any conservation category or if they were endemic to the country or the area.

Two phases were applied:

1. The field phase to fulfil the objectives set out, is developed with the use of a series of tools, utensils and for specific cases of monitoring equipment; Materials such as: GPS-navigator (GARMIN-Etrex), digital camera, video camera, binoculars, boards, field notebook, field guide for the identification of species of flora and fauna among others, reference book, sheets (A4) to collect data in the field.
2. In order to carry out the cabinet work, they had desks, computer equipment, multifunctional equipment (scanner, copier, printer), calculator, office materials and accessories, etc.

The objective is to inventory, determine and evaluate the conservation status, diversity and number of species of Flora and Fauna in the area of direct and indirect influence of the Project.

The specific objective is to classify, quantify and interpret the specimens of the taxonomic groups of flora and fauna, identifying dominant, rare, threatened and endemic species present in the study area.

6.2.2. ECOSYSTEM

We define an ecosystem classification system as a set of methodologies that allow grouping and delimiting biotic communities and their interactions with the elements of their environment, in a logical and orderly manner, and thus arranging them in categories with a hierarchical and inclusive order. Since vegetation is the most visible element of an ecosystem, it is used to differentiate and specialize them geographically.

The representation unit of this classification system is the ecosystem, conceptualized as a group of vegetation communities at a local scale that tend to coexist within landscapes with similar biophysical variables, environmental gradients, and dynamic processes *(Comer et al. 2003).*

Due to the characteristics of the area of direct influence of the project, transept or quadrat methods were applied, considering that there are forests, bushes or other types of wild vegetation.

In order to identify the plant diversity present in the direct and indirect zone, a walking tour was carried out following trails accompanied by a guide of the study zone, who helped empirically in the identification of the plant species of the zone (citing the common names).

Here all species were recorded and a complete photographic record was made. For species that could not be identified in the field, a fertile botanical sample was taken (if possible) for later recognition in the laboratory phase.

Woody species with a diameter at breast height (DBH) greater than or equal to 10 cm were recorded, as specified in Ministerial Resolution No. 134 dated December 25, 2012 and published in Official Register No. 812 of October 18, 2012. Thus, their DBH and height were recorded as part of the inventory.

Once the species present in the study area were known, they were compared with the national and international conservation lists to determine if they were catalogued in any conservation category or if they were endemic to the country or the area.

Using information published by Sierra (1999), it was determined that the project is located within a single Life Zone. Additionally, the Ministry of Environment of Ecuador, in

its 2012 publication, Ecosystem Classification Systems of Continental Ecuador describes the study area as an intervened area and does not describe any natural ecosystems.

6.2.2.1. ECOSYSTEM CLASSIFICATION OF THE STUDY AREA

Once the monitoring and field visits were conducted in the **study area,** located in the Puerto Bolívar parish of the Machala canton, the environmental parameters considered included vegetation type, ecological dynamics, altitude, and location, and it was determined that it has the following ecological classification:

Table 46: Ecosystem definition of the project area

BsTc05 Jama-Zapotillo Mangrove	
Classification:	Plant Formation Classification / Ecosystem
Cerón et al. 1999	Mangrove, central and southern subregion, lowlands sector
Josse et al. 2003:	CES402.599 Estuary and Pacific coast mangroves.
Diagnostic factors	
Physiognomy: forest	
Bioclimate: xeric, Ombrotype (Io): dry	
Biogeography: Region: Littoral, Province: Equatorial Pacific, Sector: Jama-Zapotillo	
Phenology: evergreen	
Bioclimatic zone: Lowlands (0-10 m above sea level), Thermotype (It): infratropical.	
Geoform: General Relief: Coast, Macrorelief: Plain, Mesorelief: Tidal plain.	
General flooding: Flood regime: floodable, type of water: brackish.	

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Province of El Oro*
Date: *April 25, 2017*

Mangrove forests often less developed in relation to the forests of this type located towards the northwest of the country in the biogeographic province of Chocó (this corridor crosses the equator and passes through Esmeraldas, hence the comparison with the mangroves of southern Ecuador according to the classification system of the ecosystems of continental Ecuador of the MAE). They develop at the interface of land to the open sea and have a closed canopy ranging between 10 to 12 meters, typical vegetation with the presence of stilt roots, also within this matrix are several species of grasses, ferns and occasionally some epiphytes, especially of the Bromeliaceae family.

As in most mangroves, the plant communities are distributed according to their specificity; towards the outside is *Rhizophora* spp. (red mangrove), followed by *Avicennia germinans* (black mangrove), then *Laguncularia racemosa* (white mangrove) and finally *Conocarpus erectus* (button mangrove).

This order depends on the degree of tolerance to salinity of each species. This type of vegetation is characteristic of the estuary of the Jubones-Santa Rosa-Arenillas river and with a large representation in the estuary of the Guayas river and the Gulf of Guayaquil.

The soils of this ecosystem are generally swampy (poorly consolidated), saturated with moisture, poor in oxygen, slightly acidic, composed of silt, clay, sand and decomposing organic matter.

These soils contain a high water and salt content as a result of tidal intrusions and washed by the runoff generated. (Sierra, 1999)

6.2.3. LIFE ZONES

The Machala Canton has two different life zones or biomes, as described in the table below.

The meters above sea level of each biome are also included. It is important to consider that the life zones described in this section refer to the group of plant associations that can develop according to a natural division of climate, edaphic conditions and succession stages. The description of the different Life Zones is shown below:

Table 47: Life zones or vegetation formations

Biome Description (masl)	Ecological System	Zoogeographic Floor	Biome Remnant Area	Percentage at El Oro %
|Dry forest of Lowlands (0 - 300 masl)	Lowland deciduous forest and shrubland of the Jama-Zapotillo lowlands	Tropical Southwest	468	2,34
	Jama-Zapotillo lowland deciduous forest			4,72
	Jama-Zapotillo lowland semi-deciduous forest			
	Jama-Zapotillo seasonal lowland evergreen forest			1,15
Mangrove and Coastal Marine Zone	Jama-Zapotillo Mangrove	Tropical Southwest	239	4,02

Source: *MECN-INB-GADPEO.2015. Birds, Amphibians and Reptiles of El Oro Province.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *July 5, 2017*

6.2.3.1. LOWLAND DRY FOREST

Dry forests are vegetation formations where annual precipitation is less than 1600 mm, with a dry season of five to six months; consequently, ecological processes are markedly seasonal and net primary productivity is lower than in humid forests, because it only occurs during the rainy season (Barquero et al. 2004, Aguirre et al.2006).

On the coast of Ecuador and northern Peru, this type of forest forms a coastal strip 100 to 150 km wide (Vanegas 2005). The Tumbesian dry forests are divided into two floristic

areas separated by the Gulf of Guayaquil. To the north of the Gulf there are approximately 22,771 km2 within the Ecuadorian provinces of Guayas, Manabí and Esmeraldas and to the southwest there are more than 64,588 km2 in the Ecuadorian provinces of El Oro and Loja, as well as in the Peruvian departments of Tumbes, Piura, Lambayeque and La Libertad (Aguirre et al.2006). In Ecuador, the dry forests of the coast are continuous, while in the dry valleys of the inter-Andean alley they are isolated (MAE 2013).

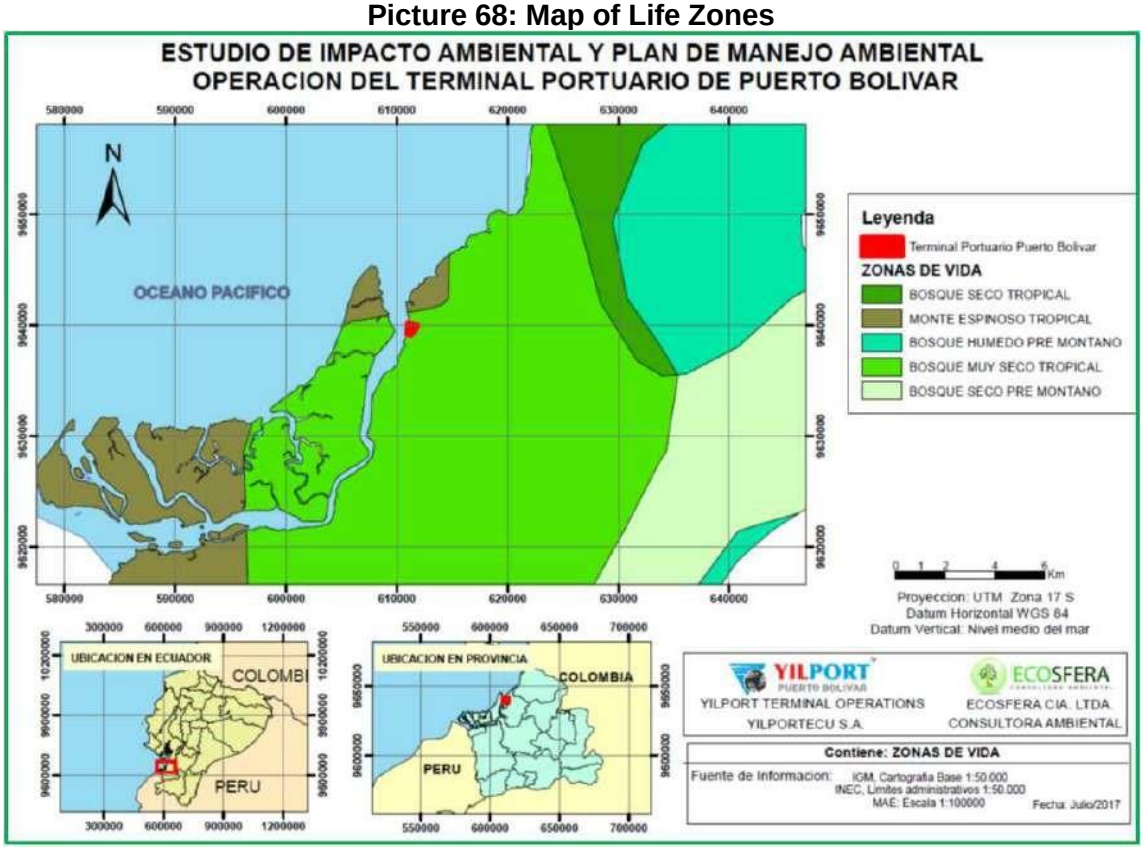
6.2.3.2.2. MANGROVES AND COASTAL MARINE AREA

Mangroves are forested ecosystems that surround tropical coasts, lagoons and marine islands. They extend throughout the tropical zone from South Florida in the United States southward along the Atlantic and Pacific coasts (Kricher 2006). These biomes are characterized by the arboreal vegetation found in the zone of direct tidal influence.

It is an ecosystem of transition between the marine zone and the mainland, characterized by innumerable estuaries, channels, lagoons and muddy soils. The high tide floods and when it recedes, it exposes long, humid sand and silt beaches, 2 to 7 km long. These sites are used by various vertebrates, mainly birds, as resting and foraging sites (Kricher 2006).

Mangroves tend to form monospecific or low species rich forests. The most obvious elements are the mangroves, which can be present in up to six species, and often reproduce by creating new plants (viviparism) rather than by seed. These trees can exceed 30 meters in height, and their stilt and aerial roots are strongly adapted to tolerate high levels of saltwater immersion (Cerón et al. 1999), and are associated with species of the families Bromeliaceae, Orchidaceae, and Polypodiopsida (ferns).

Picture 68: Map of Life Zones



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.2.4. PROTECTED AREAS AND PROTECTIVE FORESTS

The declaration of Protected Areas within the province of El Oro are an essential and irreplaceable way to protect ecosystems, biodiversity and environmental services; the objectives of protected areas in the international context respond to different purposes, activities or forms of human use and with this a wide range of biological and social realities.

In the province there are two areas within the SNAP (National System of Protected Areas) which are:

- Santa Clara Island Wildlife Refuge, which is one of the most important refuges on the Ecuadorian coast because it is home to large concentrations of seabirds (frigate birds, pelicans and blue-footed boobies),
- Arenillas Ecological Reserve, an important site for the endemic avifauna of the Tumbes region.

There is also the Petrified Forest Protected Area of Puyango of 2659 hectares, which is a rich fauna, flora and palaeontology, which shelters more than 130 species of birds, and more than 1150 species of flora and fauna, these are important for their level of endemism.

On the other hand, there are four areas in the province declared as Protective Forests:

- BP016: Casacay Protective Forest
- BP054: Arenillas River - Tahuin Dam Protective Forest
- BP116: Moro-Moro River Basin
- BP181: Puyango Petrified Forest

- BP 225: Uzchurrumi, La Cadena, Peña Dorada, Brazil

Taking into account the total protected surface area of the province, this represents 81,491.2 protected hectares, or 14% of the total provincial surface area.

Table 48: Protected Areas and Forests in the Province of El Oro

PROTECTED AREAS	AREA KM2
Casacay	125,77
Arenillas River Tahuin Dam	472,10
Moro - Moro River Basin	31,38
Petrified Forest of Puyango	15,54
Uzchurrumi, La Cadena, Peña Dorada, Brazil	250,86
Tahuin Dam	13,3
Arenillas Ecological Reserve	131,57
Santa Clara Island	74,5
TOTAL	**1101,78**

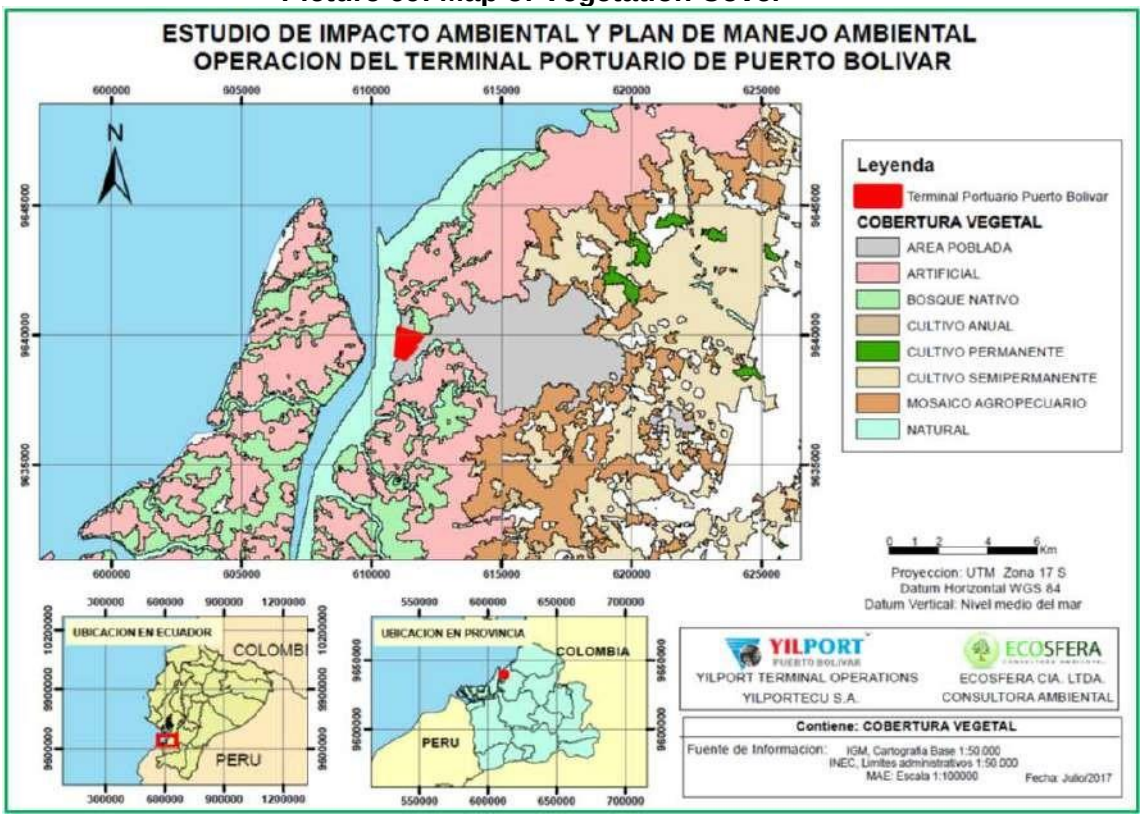
Source: *Ministry of Environment*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 25, 2017.*

6.2.5. VEGETATION COVER - FLORA

The area was evaluated, including general aspects of the vegetation, such as structure, physiognomy, indicator species and soil geomorphology, and has been classified into the following vegetation types: Mangrove forest and lowland dry forest.

Mangroves are associated with amphibious associations of woody arboreal or shrubby, evergreen plants of various families (Dinerstein et al.1995; Pinto 1993), with a high tolerance to salinity (Huber and Alarcón 1988). They occur in flat areas of estuaries and other areas of interaction between tides and fresh water in rivers and estuaries. They form a dense forest; whose trees have fulcre (stilt) roots with pneumatophores.

Picture 69: Map of Vegetation Cover



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.2.5.1. METHODOLOGY

The study was divided into two phases to obtain the results that will be presented below, the first phase is the field phase that was carried out on Wednesday, July 05, 2017, while the laboratory phase was carried out in the following days, the botanical specimens of difficult identification were photographed and others collected to then be identified based on the comparison with specimens from the botanical collection of the Herbarium, together with specialized bibliography.

6.2.5.1.1.1. FIELD PHASE

Qualitative Inventories

The qualitative sampling consisted of characterizing the different types of vegetation existing in the areas of the Puerto Bolívar Port Terminal, for which direct observation tours were conducted, obtaining as a result data on the species that serve to characterize the different common and dominant floristic groups present in the vegetation cover located within the study area. For the observation tours, the quantitative and qualitative sampling points considered in the characterization of flora in the Baseline were used. The observation tours were conducted on July 5, 2017.

It consisted of characterizing the vegetation types of the area described above in the shortest time possible, for which direct observations were made, with a range of 20m around. Sampling at these sites involved the identification of common and dominant floristic groups in the different strata of each vegetation type. Table 2 presents a summary of the sampling areas, including: site, date, coordinates, habitat and description.

Quantitative Inventories

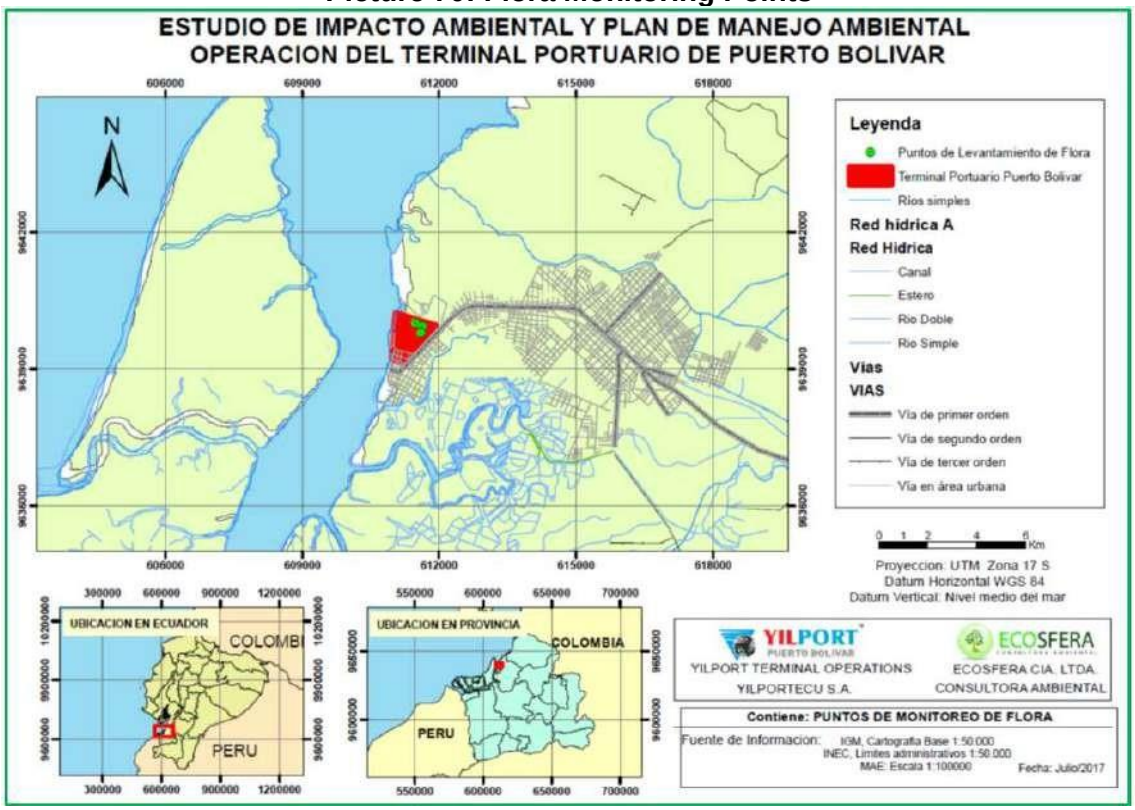
No transects or quadrats were carried out because the vegetation is sporadic and there is no forest remnant but some shrubby vegetation, in which all individuals are not equal to or larger than 10 cm. There are a few trees but they are scattered throughout the Port Terminal facilities.

Table 49: Location of Quantitative and Qualitative Flora Sampling Points

SITE	DATE	COORDINATES		HABITAT	DESCRIPTION
		EAST	NORTH		
POF-1	05/07/2017	PI 615329	9638796	Remaining shrub vegetation	Inventory Qualitative. Direct observations, with a range of 20m around, walking distance
		PF 611485	9640004		
POF-2		PI 611630	9639937		
		PF 611604	9639788		
SYMBOLOGY: POF Flora Observation Point PI: Start Point PF: End Point.					

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team, 2017.*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

Picture 70: Flora Monitoring Points



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.2.5.1.2. LABORATORY PHASE

Botanical specimens that were difficult to identify were photographed and others were collected and then identified by comparison with specimens from the botanical collection of the National Herbarium of Ecuador.

Common and scientific names recorded in the field were verified with the Catalogue of Vascular Plants of Ecuador (Jorgensen & León, 1999), collections from the QCNE National Herbarium and in the Missouri Botanical Garden (MO) Tropics database (Tropics, 2012).

Information Analysis

For the analysis of the quantitative inventory, the formulas proposed by Campbell et al. 1986 were used.

Basal Area (ab) in m2

The basal area of a tree is defined as the area of the Diameter at Breast Height (DBH) in cross section of the stem or trunk of the individual.

The basal area of a given species in the plot is the sum of the basal areas of all individuals with DBH equal to or greater than 10 cm.

$$AB = \left(\frac{\pi D^2}{4}\right)$$

Where:
D = Diameter at breast height
π **=** Constant 3.1416

Relative Density (dr)
The Relative Density of a given species is proportional to the number of individuals of that species with respect to the total number of individuals in the plot.

$$DR = \frac{\text{Number of individuals of a specie}}{\text{Total number of individual in the plot}} \times 100$$

Relative dominance (dmr)
The relative dominance of a given species is the proportion of the basal area of that species with respect to the basal area of all individuals in the transects.

$$DMR = \frac{\text{Basal area of the specie}}{\text{Basal area of all species}} \times 100$$

Importance Value Index (IVI)
Two parameters (Relative Density and Relative Dominance) are added together to obtain the Importance Value.

The sum of the Importance Value for all species in the plot is always equal to 200. Species that reach an importance value of more than 20 in the plot (10% of the total value) can therefore be considered "important" and common components of the sampled forest.

$$IVI = DR + DMR$$

Species Richness and Abundance
The term "richness" refers to the abundance of species per individual, i.e., the number of species divided by the number of individuals sampled. This data allows a direct comparison of the species diversity (richness) of botanical individuals, even when the number of individuals varies between samples. The figure is always a value between 0 and 1; if all the individuals sampled were of different species, it would have a value of 1, and a value of 0.5 means high species diversity.

Simpson's Diversity Index
This index measures the probability that two individuals randomly selected from a population of N individuals come from the same species. If a given species i (i=1, 2,..., S) is represented in the community by Pi (Proportion of individuals), the probability of randomly extracting two individuals belonging to the same species is the joint probability [(Pi) (Pi), or Pi^2].

$$\lambda = \sum pi^2$$

Where:
Σ = pi summation = is the number of individuals of species i, divided by the total number of individuals in the sample.

It is strongly influenced by the importance of the most dominant species (Magurran, 1988). Since Simpson's index (λ) reflects the degree of dominance in a community, community diversity can be calculated as:

$$D = \frac{1}{\lambda}$$

Species Abundance Curves

They include representative graphs of the most frequent species within the plot, allowing rapid identification of dominant groups and rare species.

6.2.5.2.2. RESULTS

6.2.5.2.2.1. QUANTITATIVE CHARACTERIZATION POF-1

This quantitative sampling point is located in an area where there is a remnant of shrub vegetation, where there are few woody species and where a large number of birds arrive due to its proximity to the mangrove forest.

Table 50: Flora species identified in the study area

Order	Family	Scientific name	Local Name	No. Individuals
Arecales	Arecaceae	*Cocos nucfera*	Coconut palm	5
Arecales	Arecaceae	*Adonidia merrillii*	Christmas palm	7
Fabales	Fabaceae	*Acacia sensu lato*	Acacia	7
Fabales	Mimosaceae	*Prosopis juliflora*	Algarrobo	7
Gentianales	Apocynaceae	*Thevetia peruviana*	Amancay	2
Pinales	Pinaceae	*Cedrus sp.*	Cedar	4
Zingiberales	Strelitziaceae	*Ravenala madagascariensis*	Traveler's Palm	7

* Only 2 individuals were observed in all the surveys
Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team, 2017.*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *April 25, 2017*

A total of 2 orders, 2 species belonging to 2 families were identified in the study zone.

Photograph 10: Flora species

PLANT SPECIES

Acacia sensu lato (Acacia)

Thevetia peruviana (Amancay)

Cedrus sp (cedar)

Cocos nucífera (coconut palm)

Ravenala madagascariensis (traveler's palm)

Adonidia merrillii (Christmas palm)

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

Table 51: Results using Campbell's formulas.

FAMILY	SCIENTIFIC NAME	Fr	∑AB	DnR	DmR	IVI
Arecaceae	*Cocos nucfera*	5	0,045	12,82	4,36	17,18
Arecaceae	*Adonidia merrillii*	7	0,070	17,95	6,77	24,72
Strelitziaceae	*Ravenala madagascariensis*	7	0,100	17,95	9,69	27,64
Apocynaceae	*Thevetia peruviana*	2	0,078	5,13	7,54	12,66
Pinaceae	*Cedrus sp.*	4	0,272	10,26	26,22	36,48
Fabaceae	*Acacia sensu lato*	7	0,226	17,95	21,78	39,73
Mimosaceae	*Prosopis juliflora*	7	0,245	17,95	23,64	41,58
	TOTALS:	39	1,037	100	100	200

Total: 39 individuals > 10cm DBH, 7 species of plant individuals
Total Basal Area: 1,037 m2

Symbology:
Fr: Frequency
AB: Basal Area
DnR: Relative Density
DmR: Relative Dominance
IVI: Importance Value Index

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team, 2017.*
Location: *Area of Influence of the Puerto Bolívar Port Terminal*
Date: *April 25, 2017*

6.2.5.2.2.2. IMPORTANCE VALUE INDEX (IVI)

There are three species considered to have a high Importance Value Index, *Prosopis juliflora* (Mimosaceae) with a value of 41.58, Acacia sensu lato (Fabaceae) with 39.73 and Cedrus sp (Pinaceae) with 36.48 and in smaller proportion are: *Thevetia peruviana (*Apocynaceae) with 12.66.

6.2.5.2.2.3. SPECIES RICHNESS AND ABUNDANCE

In the quantitative sampling carried out in the logged forest, a total of 39 individuals distributed in 7 species were recorded, with 0.28 representing an average richness of plant species equal to or greater than 10 cm DBH. With respect to the total basal area, it can be suggested that the sampled forest is little intervened, in addition there is the presence of abundant individuals of large shafts and few individuals of small shafts. According to the abundance of individuals, the predominant species are: *Adonidia merrillii, Ravenala madagascariensis, Acacia sensu lato and Prosopis juliflora* with 7 individuals each.

6.2.5.2.2.4. SIMPSON'S DIVERSITY INDEX

The value of Simpson's diversity index in the remnants of shrub and herbaceous vegetation with few woody species represents a low diversity index, since sampling points FL001 and FL002 have values of 0.16 and 0.27, respectively.

6.2.5.2.2.5. SHANNON-WIENER DIVERSITY INDEX

The value of the Shannon-Wiener diversity index in the logged forest at point FL001 represents an index of 1.89 and at point FL002 an index of 1.34, which, based on the 7 species recorded in the study area, indicates that the diversity for the area sampled is low.

6.2.5.2.2.6. SPECIES ABUNDANCE CURVE

The following picture shows the species abundance curve in the grounds of the Puerto Bolívar Port Terminal (FL001):

Picture 71: Abundance of species

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team, 2017.*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *April 25, 2017*

The above picture indicates the dominance of the species, with one group with four dominant species and a second group with two species considered rare and one species considered rare.

6.2.5.2.2.7. STATE OF CONSERVATION OF FLORA

In Situ, the area where the Port Terminal facilities such as offices, sheds, green areas, and parking lots are located shows a high level of anthropic intervention, generating a slight deterioration of the area, mainly made up of patches of shrub vegetation, trees that have been planted as part of the green areas, and herbaceous vegetation in part of the facilities.

6.2.5.2.2.8. ENDEMIC SPECIES

After analysing the data and reviewing the Red Book of Endemic Plants of Ecuador (Valencia et al, 2000), no endemic species were recorded.

6.2.5.2.2.9. FLORA STUDY CONCLUSIONS

- The Project area has a dominant ecosystem of shrub species and few woody species that serve more as ornamentals, with few woody species that have endured over time.
- According to the revision of the Red Book of Endemic Plants of Ecuador (Valencia et al, 2000), no endemic species were recorded.
- There is one group with four dominant species and a second group with two species considered rare and one species considered rare.

Deposit of flora species

The National Herbarium (QCNE) reserves the right to process only fertile samples, endemic, or in some category of threats UICN and CITES, species new to science, of ancestral, economic, medicinal importance or that come from unexplored places. For this reason, there is no record of receipt of the samples collected by the consulting team.

6.2.6. FAUNA

The study area is an ecosystem that was intervened years ago by the settlement of the facilities of the Puerto Bolívar Port Terminal, and that was mangrove which was replaced by the infrastructure that exists today, this generates that the area of incidence presents little space for an adequate habitat that houses representative species, the most distinctive group are birds.

6.2.6.1. GENERAL FAUNA ASPECTS

The southern region of Ecuador is well known for its diversity of species.
In the forest remnants of the area there are some species of birds and certain reptiles that have managed to adapt to the degradation of the environment.
Species of avifauna that have adapted to the presence of man and the change that this has caused, in the sector mainly we can find among the most common: herons, pelicans, frigates, gulls, patillos among others. In relation to the existing reptiles in the sector we find iguana, lizard.

6.2.6.2. METHODOLOGY

For this study, we proceeded to locate the study area directly affected by the project in a cartographic manner in the topographic charts of IGM scale 1:50000 and base map at a smaller scale 1:1000.
The field work was mainly carried out to identify and verify the most representative areas, applying the Rapid or Direct Ecological Assessment Methodology, and then the information was validated with the support of existing bibliography.
The starting points and network for tracking faunal species**.** Due to the characteristics required by the study, the current situation of the fauna in the area will be assessed, sampling in strategic sites taking into account the impact that the development of the project will cause.

BIBLIOGRAPHIC SUPPORT

For the taxonomic classification of birds and their nomenclature in Spanish, the systematic references of Ridgely el al., (1998), Ridgely & Greenfield (2001) and MECN - GADPEO, (2015) were used. For mammals we used the bibliographic reference from the text, Mammals of Ecuador (Tirira, 1999) and the field guide to the Mammals of Ecuador (Tirira, 2007). The scientific names of amphibian and reptile species were updated by reviewing Amphibians, Reptiles and Birds of El Oro Province: A Guide to Andean-Costero Ecosystems. 2015. Museo Ecuatoriano de Ciencias Naturales del Instituto Nacional de Biodiversidad MECN-INB; Gobierno Autónomo Descentralizado de la Provincia de El Oro GADPEO.

For the location of endangered or endemic species, the criteria are those set forth in the publication of the Red Book of the Birds of Ecuador (Granizo, et al., 2002) and an annotated list of the birds of continental Ecuador (Ridgely el al., 1998).

For mammals, the criteria were taken from the publication of the Red Book of the Mammals of Ecuador (Tirira, 2001), Diversity and Conservation of Neotropical Mammals (Albuja 2002 and 1999) and the field guide to the Mammals of Ecuador (Tirira, 2007).

Description

- The zoogeographic floor corresponding to the area of influence of the project will be identified and described, in order to know the distribution of existing species.
- A diagnosis of the vertebrate fauna found in the area will be prepared, indicating the abundance, diversity and sensitive areas that could be identified (salt flats, moreto palm forests, bodies of water, feeders, swamps, relicts of primary vegetation in intervened areas, etc.).

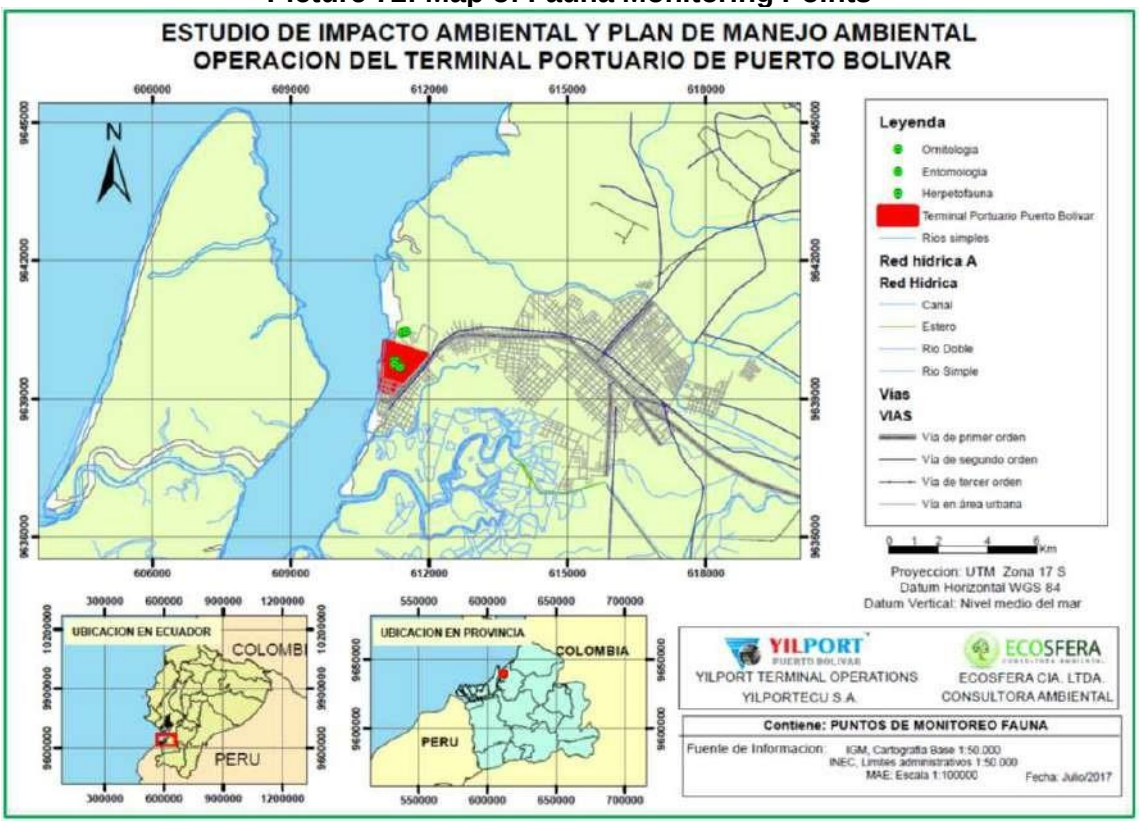
- Lists of existing species will be prepared with the appropriate taxonomic classification: group, family, genus and species, common name (with emphasis on local nomenclature), use (scientific, commercial, aesthetic, cultural and self-consumption value).
- The conservation status and categories will be determined according to the IUCN Red Book and CITES. Endemic and indicator species and the uses of the resource will also be included. Location maps of the study sites will be presented.
- A diagnosis of terrestrial invertebrates found in the area will be elaborated.

TERRESTRIAL FAUNA METHODOLOGY

For the evaluation of terrestrial fauna, the techniques established in the Rapid Ecological Evaluations [EER] of Sobrevilla and Bath [1992] will be applied. The methodologies will consist of walks with visual and auditory records of the faunal groups in the area; in addition, interviews with the inhabitants of the sector on the presence of native fauna.

The fauna group includes the following groups: birds, mammals, reptiles, fish and insects. This diagnosis also includes a qualitative assessment of the fauna, impacts, and prevention and mitigation measures.

Picture 72: Map of Fauna Monitoring Points



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.2.6.3. AVIFAUNA

Within the fauna, this group is the most frequent in the study area, due to the great capacity of birds to adapt to the presence of humans and the great ability they have to move and cover large areas of occupation, in the area it was possible to identify many birds typical of disturbed areas and estuarine mangroves.

6.2.6.3.1. METHODOLOGICAL CRITERIA

Field information was collected on July 05, 2017 in the area of influence where the project is located, walking tours were conducted throughout the Port Terminal facilities between 08H00 am and 12H00 pm; during that time and with the help of binoculars, GPS and camera, the sighting of wildlife in the sector was recorded.

The field study was complemented with the analysis of bibliographic research that helped to interpret the identification of some species not recorded during the field work.

The information obtained in the field phase was used for the analysis, identification and taxonomic classification of the different species, with the help of the systematic references of Ridgley et al. 1998 and Ridgley and Greenfield 2001.

The following scale was used to determine the relative abundance of the species recorded: rare (one individual), uncommon (2-4 individuals), common (5-9 individuals) and abundant (10 or more individuals).

Photograph 11: Avifauna Species

AVIFAUNA SPECIES

Ardea cinerea (Grey heron)

Mimus saturninus (common lark)

Pitangus sulphuratus (great kiskadee)

AVIFAUNA SPECIES

Forpus coelestis (Parrotlet)

Quiscalus mexicanus (Mexican grackle)

Columba livia (Rock dove)

Athene cunicularia (Ground Owl)

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

Table 52: List of bird species

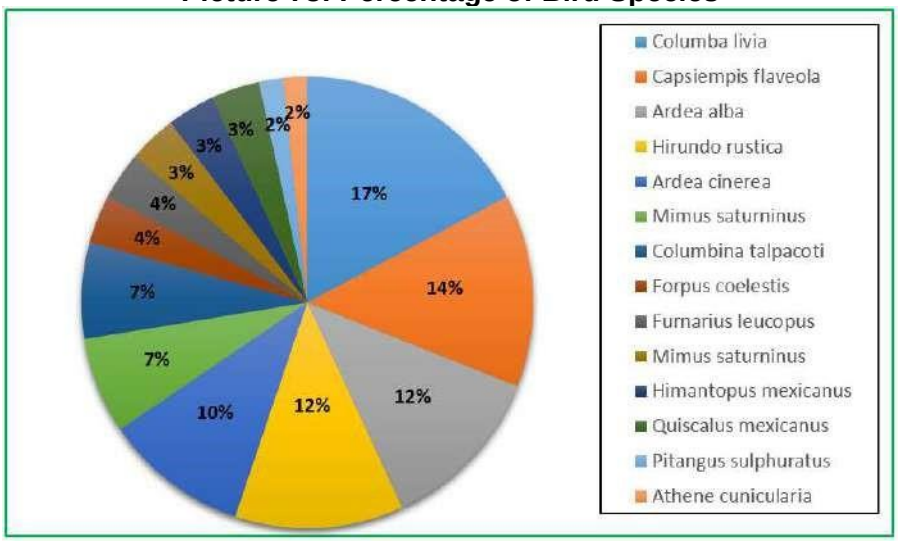
ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Pelecaniformes	Ardeidae	*Ardea cinerea*	Grey heron	C
Pelecaniformes	Ardeidae	*Ardea alba*	Great egret	C
Passeriformes	Hirundinidae	*Hirundo rustica*	Swallow	C
Passeriformes	Tyrannidae	*Capsiempis flaveola*	Yellow tyrannulet	C
Columbiformes	Columbidae	*Columba livia*	Rock dove	Ab
Psittaciformes	Psittacidae	*Forpus coelestis*	Parrotlet	Pc
Passeriformes	Furnariidae	*Furnarius leucopus*	Pale-legged hornero	Pc
Passeriformes	Mimidae	*Mimus saturninus*	Chalk-browed mockingbird	Pc
Passeriformes	Tyrannidae	*Pitangus sulphuratus*	Great kiskadee	R
Columbiformes	Columbidae	*Columbina talpacoti*	Ground Dove	Pc
Passeriformes	Mimidae	*Mimus saturninus*	Chalk-browed mockingbird	Pc
Charadriiformes	Recurvirostridae	*Himantopus mexicanus*	Black-necked stilt	Pc
Passeriformes	Icteridae	*Quiscalus mexicanus*	Mexican grackle	Pc
Strigiformes	Strigidae	*Athene cunicularia*	Ground Owl	R

*Resident	**Relative species abundance category**
Boreal Migratory * Austral Migratory	C: common; Pc: uncommon; R: rare; Ab: abundant;
E Endemic	**IUCN Categories (2014)** (EN): Endangered; (VU): Vulnerable; (NT): Near Threatened; (DD): Data Deficient; (NE): Not Evaluated; (LC): Minor concern

Category of relative abundance of species recorded	**Range**
A: Rare	0-1
Pc: Uncommon	2-4
C: Common	5-9
Ab: Abundant	10 or more

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

Picture 73: Percentage of Bird Species



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

The study area acts as a feeding, resting or migratory stopover area for species easily adaptable to areas of commercial activity. The area has a patch of vegetation cover that gives the avifauna options to increase and the families with the highest percentage of diversity are the closest or most adaptable in relation to the land use found through this diagnosis.

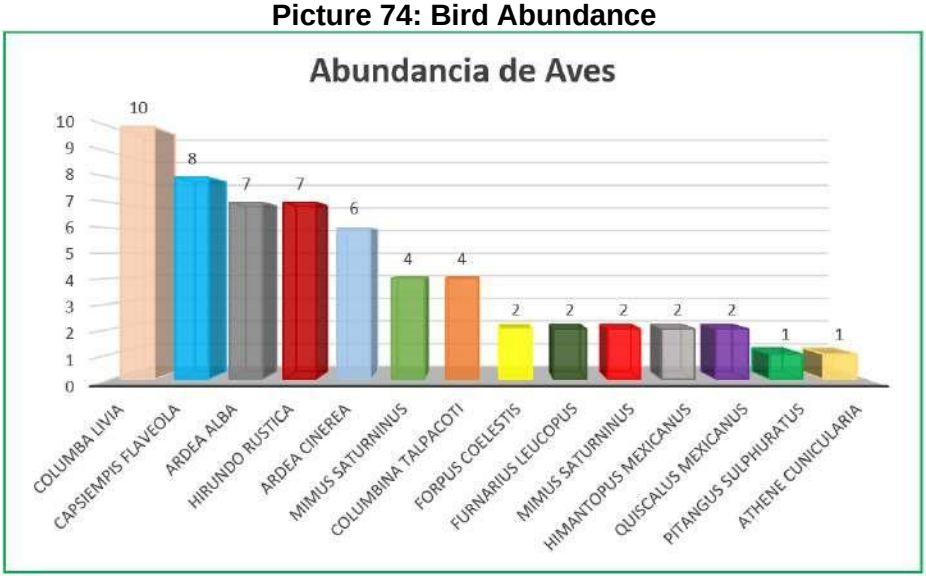
The families with the highest abundance are the Columbidae with 24%, Ardeidae with 22% and Tyrannidae with 16%. It is an area that hosts concentrations of resident waders (herons) and migratory birds (parrotlets).

6.2.6.3.2.2. RELATIVE ABUNDANCE

The relative abundance of species recorded was determined through direct observation monitoring, using digital photography for identification, and comparing it with the following scale: rare (one individual), uncommon (2-4 individuals), common (5-9 individuals) and abundant (10 or more individuals).

Where 31% of the birds observed are Uncommon, 48% considered common, 17% are considered Abundant and 4% as rare species.

Picture 74: Bird Abundance



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

6.2.6.3.3.3. DIVERSITY

The study area is located in the lowland dry forest ecosystem of the Jama-Zapotillo, due to its land use, it harbours little diversity of species, usually birds, taking into account the ecological contribution it makes to the ecosystem. The formula to be applied is:

$$H= - \sum pi \, LN \, pi.$$

The Shannon index indicates that values lower than 0 - 1 are considered and related to areas of low diversity (generally the result of anthropogenic effects) and values higher than 2.5 are considered as indicators of high biodiversity.

As a result of the formula development, the following was determined

$$H= - \sum pi \, LN \, pi.$$

Where:

S= 58
ni= 14
N= 107
Pi= 0.16

H = - S (pi x log2 pi)

H = - 58(0.16 x 0047)
H = - 25(5.17 x 10-3)
H = 2,00

According to Shannon's index, the results of the monitoring indicate that the study area would be classified as a zone of very medium

The following scale was used for the diversity index evaluation criteria:

Table 53: Shannon index value

SHANNON	
Diversity	**Condition**
0 -1	Very Low
> 1 – 1,8	Low
> 1,8 – 2,1	Medium
> 2,1 – 2,3	High
> 2,3	Very High

Source: *Guide of Methods to Measure Biodiversity, 2016*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team.*
Date: *July 5, 2017*

Based on the data obtained, the Diversity Index (Shannon-Wiener, Simpson, Jaccard and Sorensen) of the ornithofauna was determined.

Shannon-Wiener Index
When calculating the diversity data, the Shannon-Wienner Index at Point Nº1 showed a value of 2.18 and at Point Nº2 a value of 2.00. These data are very similar; therefore, it is considered as an index of average biodiversity.

Simpson's Index
When analysing the diversity data, Simpson's Index showed 0.12 for point 1 and for point 2 it gave an index of 0.14, which in relation to the total number of species, which is 15, is interpreted as average diversity.

Jaccard and Sorensen index
The Jaccard and Sorensen indices measure the similarity between the two sampled points. Calculating these indices gave us a value of 0.44 or 22% similarity between the two points. This data indicates that there is an average similarity.

National and International Conservation Status
An analysis of the conservation status of the species recorded according to the Red Book of Birds of Ecuador (Granizo et al. 2002), the 2012 Red List of the International Union for Conservation of Nature (IUCN), the species recorded are of Least Concern and/or Low Risk.

Considering the 2012 Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), there are no endangered and/or protected species in the project area.

Endemic Species
The endemism present in the sector demonstrates the interactivity of the species and that the presence of anthropic activities does not bother them or alter their habitat, because despite their conservation status, they have adapted to the impact produced by fishing and commercial activities, since the area has developed other activities (tourism) in addition to productive activities and the birds have remained in the area.

Indicator species
An important ecological aspect to consider in the studies is the sensitivity of bird species to changes in habitat quality. According to Stotz et al. (1996), birds have different degrees of sensitivity to alterations in their environment; species of high sensitivity (H), those that prefer habitats in a good state of conservation, whether natural or secondary forests of old regeneration and depending on their ranges of action, can also adapt to remnants of natural forest little intervened.

Species of medium sensitivity (M), those that can withstand slight environmental changes and can be found in areas of forest in good conservation status and/or in forest edges or areas with slight alteration and finally species of low sensitivity (L), those capable of adapting and colonizing altered areas.

According to the information obtained from the sampling of the project area, all species recorded are classified as low sensitivity; no species classified as medium sensitivity or high sensitivity were recorded. The dominance of low sensitivity species is an indicator of alterations in the sampling areas.

6.2.6.3.4. CONCLUSIONS AVIFAUNA

- The original vegetation cover has been replaced by remnants of vegetation in certain sectors of the area of influence of the project and by buildings and new infrastructure, however this alteration of the habitat of birds tend to adapt to environmental changes and modify this adaptation to survive the new conditions of survival.
- No species were recorded with any degree or criteria of threat.
- All bird species recorded in the project show low sensitivity, demonstrating that the study area is affected by various anthropogenic activities.
- The species that inhabit the project area are not used for commercial or food activities.
- The species have been able to adapt to the alteration of their habitat years ago and develop their activities in the ecosystem present in the project area.

6.2.6.4. MASTOFAUNA

No mastofauna species were recorded in the study area, as it is heavily disturbed by anthropogenic and commercial activities. In conversations with employees at the Port Terminal, we were told that there are rodent mammals such as rats, mice and domestic mammals such as cats and dogs. For this reason, no qualitative or quantitative calculations were made for this study.

6.2.6.5. HERPETOFAUNA

For the identification, direct observations were made by conducting free walks in particular habitats of this faunal group and conversations with the inhabitants of the sector. The materials to be used will be binoculars and a species registration table.
The species identified in the study area belong to individuals with generalist characteristics, which demonstrates the high degree of adaptability. Species such as lizards, iguanas and toads were identified, which are adapted to living next to disturbed areas in the shelter of dwellings or weeds and feed on a wide variety of insects, fruits and leaves.

6.2.6.5.5.1. METHODOLOGY

The methodologies used for the study of herpetofauna correspond to sampling techniques detailed by Heyer et al., (1994), and standardized in the Manual for Coordinating Efforts for Amphibian Monitoring in Latin America (Lips, K, Rehacer, J, Young, E., 1999-.2001).

- **Field phase**
  Free Roaming: This methodology consisted of observation walks in the different habitats of the project area, within a radius of 100 m, where substrates such as logs, stones, leaf litter, among others, which are micro-habitats where amphibians and reptiles hide, were collected.

- **Data processing phase**
  Since the project area is close to the intertidal fringe and subject to anthropogenic activities, few herpetofauna specimens were found during the surveys. For this reason, we also resorted to secondary information that helped us to identify the species that exist in the area mainly during the winter season.

6.2.6.5.2. RESULT ANALYSIS

The procedure was carried out through the analysis and comparison of the richness and abundance of the data obtained based on the methodology established for the evaluation of the different species of amphibians and reptiles at the sampling point.

Photograph 12: Herpetofauna Species

HERPETOFAUNA SPECIES

Iguana (Iguana or Pacaso)
HERPETOFAUNA SPECIES

Aspidoscelis opatae (striped lizard)

Barycholos pulcher (frog)

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal*
Date: *July 5, 2017*

Table 54: List of Herpetofauna species

Order	Family	Name scientist	Common Name	No. of Species
Anura	Craugastoridae	*Barycholos pulcher*	Rana	1
Squamata	Teiidae	*Aspidoscelis opatae*	Striped lizard	2
Squamata	Gekkonidae	*Tarentola mauritanica*	Common wall gecko	2
Squamata	Iguanidae	*Iguana*	Pacaso	3

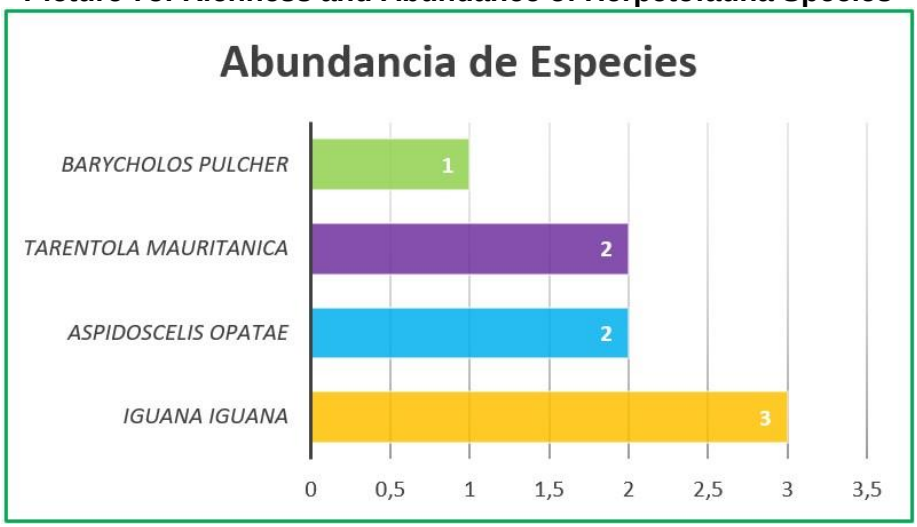
Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

According to the analysis of the data in the previous table, it may be observed that the reptile class is the most representative in the project area, in relation to the amphibian class.

The project area is generally disturbed, which made it difficult to use quantitative sampling techniques, so the Shannon-Wiener and Simpson's diversity index was calculated.

In the sampling conducted in the project area, 4 species were recorded within the Classes: Amphibia (1 sp) and Reptilia (3 sp), the most abundant species was the pacaso or Iguana (*Iguana iguana*) (3 individuals) followed by *Aspidoscelis opatae and Tarentola mauritanica* with two individuals each.

Picture 75: Richness and Abundance of Herpetofauna Species



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

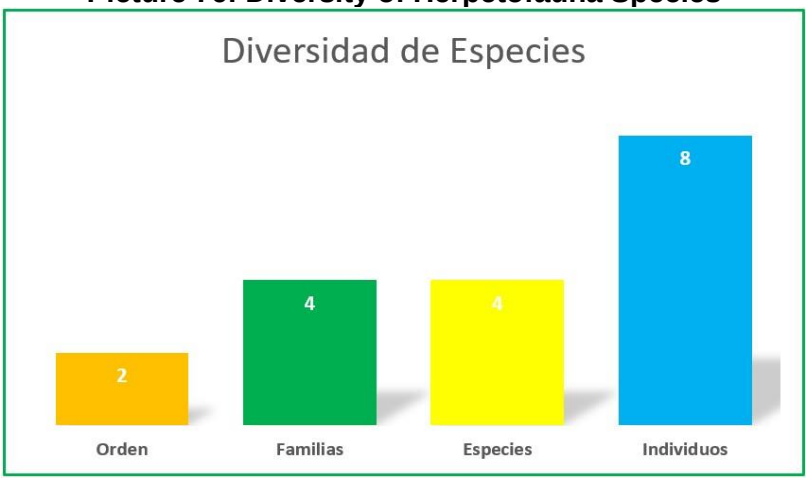
SHANNON-WIENER INDEX

When analysing the diversity data, the Shannon-Wiener Index showed a diversity value of 1.32. It is therefore considered as an index of medium equity.

SIMPSON INDEX

When analysing the diversity data, Simpson's Index showed a diversity value of 0.72. In relation to the total number of species which is 4, it is interpreted as average diversity.

Picture 76: Diversity of Herpetofauna Species



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

6.2.6.5.3. RELEVANT ECOLOGICAL ASPECTS

- **Trophic niche**

  One of the particular characteristics of amphibians is that they are important links in the energy flow within the food chain in both aquatic and terrestrial ecosystems (Stebbins and Chen, 1995). This same characteristic in lizards makes it possible to determine the use that species make of habitat and microhabitat, their activity and foraging behaviour (Vitt et al., 1996). Understanding food web interactions allows us to evaluate the close relationship between the conservation status of habitats and the stability of amphibian and reptile communities.

- **Sensitivity of herpetofauna**

  Amphibians and reptiles are unusually sensitive to environmental conditions and are generally closely tied to a particular habitat, making them more vulnerable than other vertebrate groups to habitat change. Increasing threats to biodiversity caused by humans in general have a marked negative impact on reptiles and especially amphibians (Houlahan et al. 2000), which are considered valuable indicators of environmental quality and play multiple functional roles within aquatic and terrestrial ecosystems (Blaustein and Wake 1990, Stebbins and Cohen 1995).

  According to the information from the 2017 sampling, it indicates that the low sensitivity group, which represents 100% of the herpetofauna recorded, is the most representative; this proportion indicates that the area is highly fragmented, leading to the development of generalist colonizing species, which support changes in their environment and have adapted to anthropogenic activities.

- **Conservation status**

  One way of knowing the ecological quality of an area is to evaluate the type of species present and their conservation status at the national and regional levels; in

this way, two important elements can be defined: the sensitivity of the site and the degree of sensitivity of the species.

According to the Red List Conservation Status of Amphibians of Ecuador (Ron, S. R., Guayasamin, J. M, Menéndez-Guerrero, P., 2011; Coloma and Quiguango, 2008; Frost, 2005), the 2 amphibian species are in the category of Least Concern (Low Risk).

According to the Red List of Reptiles of Ecuador (Carrillo et al., 2005), the 4 species recorded are in the category of species of Least Concern. According to CITES, none of the species recorded are in conservation concern.

6.2.6.5.4. HERPETOFAUNA CONCLUSIONS

- In the project area at the Port Terminal facilities, the reptile class is the most representative in relation to the amphibian class.
- In the project area, the most abundant species was the *Iguana* (iguana or pacaso) with 3 individuals, followed by *Aspidoscelis opatae (striped lizard) and Tarentola mauritanica (common wall gecko).*
- According to the sampling information, we can indicate that all species have low sensitivity.
- The herpetofauna species recorded are not under any category of threat, which shows that despite the fact that the area is moderately disturbed, the few existing species have adapted to these fragile biomes.
- None of the species recorded in the project area are used for commercial or food activities.

6.2.6.6.6. ENTOMOFAUNA

Of all the biological diversity of the planet, insects are considered to be the group with the greatest number of species, and with a minimal proportion formally described. Although some authors consider an order of 30 million, this number is subject to debate, and it seems that a reasonable estimate would be in the range of 5 to 10 million species according to the evaluation made by Ødegaard in 2000.

It is evident that insects are important because they provide environmental services such as soil fertilization, effects on soil physical and chemical properties, change in vegetation composition, among others. The position in key trophic levels makes insects important regulators of the flow of matter and energy, as well as important landscape designers. This highlights the fact that insects are capable of modulating the functioning of ecosystems (Guzmán 2010).

Another of the importance of their study and conservation lies in the use of insect populations in the applicability of the ecological models that are known, even more so because of the influence of man on ecosystems and the end of the same have become an essential tool for the evaluation of habitats used as ecological bioindicators (Bustamante-Sánchez et al 2004).

Within the study area, some insects were identified, especially of the following orders: Diptera (flies and mosquitoes), Hymenoptera (wasps), Lepidoptera (butterflies) and Odonata (dragonflies). Most of these insects have an omnivorous diet consisting mainly of insects, nectar, leaves, among others.

Photograph 13: Entomofauna Species

ENTOMOFAUNA SPECIES

Vespula sp (Wasp)

ENTOMOFAUNA SPECIES

Enallagma cyathigerum (common blue damselfly)

Danaus plexippus (Monarch Butterfly)

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

6.2.6.6.6.1. METHODOLOGY

- **Field phase**
  To quantify the entomofauna, a 150 m long observation transect was carried out, located in habitats within the Project area, where the technique of manual collection was used, review of logs, direct collection of entomofauna associated with fallen logs in a state of decomposition, manual capture of entomofauna on floral and herbaceous substrates, under stones, photographic record of the specimens observed and subsequent release of the same.

- **Data recording:** Specialized literature referring to this faunal group was used for the identification of the entomofauna (Celi and Davalos, 2001; Medina and Lopera, 2001). In most cases, the results of the present work are presented on the basis of taxonomic identifications at the family level.

6.2.6.6.6.2. DATA ANALYSIS

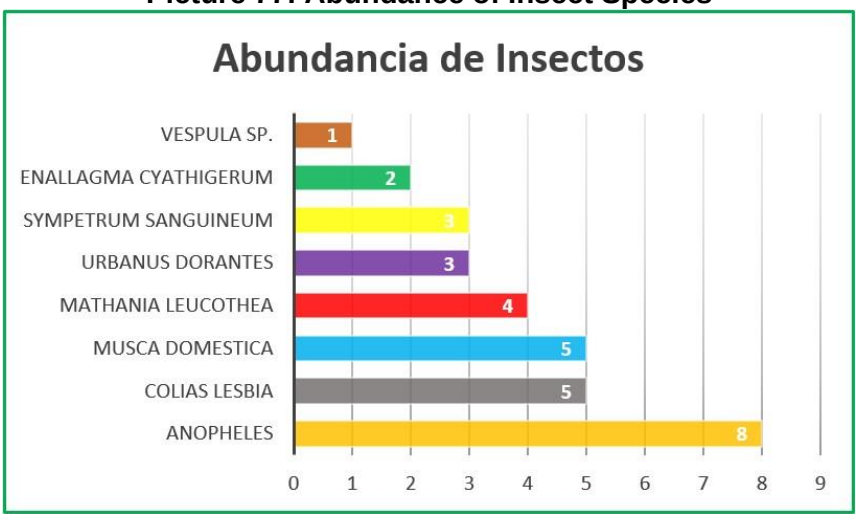
The terrestrial insect community was evaluated under the following parameters:

- **Species richness (S)**
  Total number of species in each sampling area (Magurran, 1989).

- **Abundance of individuals (N)**
  Corresponds to the total number of individuals recorded in each sampling zone (Yánez, 2005).

- **Relative abundance (%)**
  Number of individuals of each species multiplied by one hundred and divided by the total abundance recorded in each sampling area. It corresponds to the proportion of each species in the sample (Yánez, 2005).

Picture 77: Abundance of Insect Species



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

Table 55: List of Entomofauna species

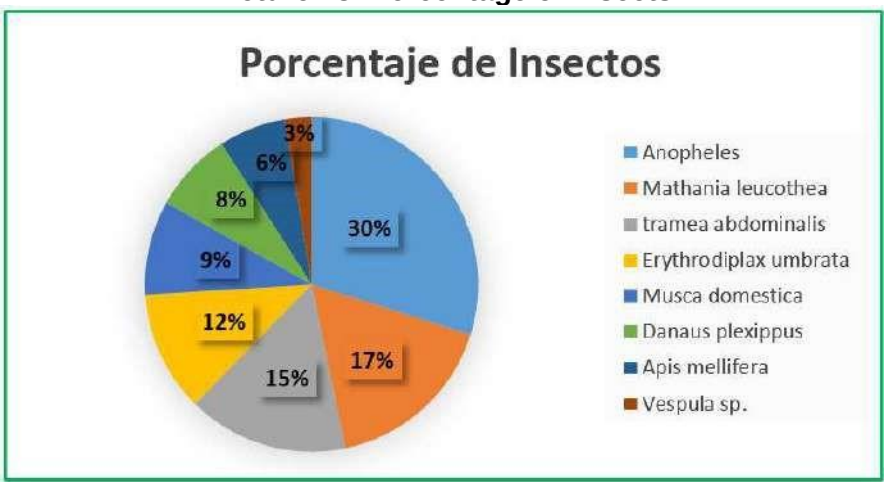
Order	Family	Scientific name	Common name	Ind. Species
Diptera	Muscidae	*Musca domestica*	Fly	5
Diptera	Culicidae	*Anopheles*	Mosquito	8
Hymenoptera	Vespidae	*Vespula sp.*	Wasp	1
Lepidoptera	Hesperiidae	*Urbanus dorantes*	Long-tail butterfly	3
Lepidoptera	Pieridae	*Colias lesbia*	Yellow butterfly	5
Lepidoptera	Pieridae	*Mathania leucothea*	White butterfly	4
Odonata	Libellulidae	*Sympetrum sanguineum*	Red dragonfly	3
Odonata	Coenagrionidae	*Enallagma cyathigerum*	Common blue damselfly	2

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

A quantitative point was established in the study area, in which a total of 31 individuals were recorded, 7 families distributed within 4 orders. The most representative family was Culicidae with a total of 8 individuals, followed by Pieridae and Muscidae with 5 individuals.

The following figure shows the percentages of terrestrial insects recorded in the area of influence of the Port's facilities.

Picture 78: Percentage of Insects



Source: *Own elaboration*
Location: *Area of Influence of the Port Terminal of Puerto Bolívar*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Date: *July 5, 2017*

Based on the data obtained, the Diversity Index (Shannon-Wiener and Simpson) of the entomofauna was determined.

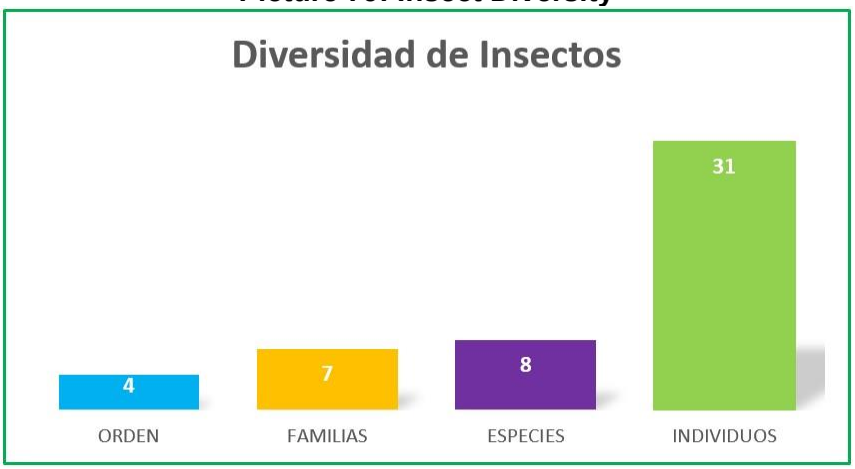
SHANNON-WIENER INDEX

When calculating the diversity data, the Shannon-Wiener Index showed a value of 1.94. It is therefore considered to be a low equity index. This index usually presents values between 1.5 and 3.5 and only rarely exceeds 4.5 (Margalef 1972, cited in Magurran 1987).

SIMPSON INDEX

When analysing the diversity data, Simpson's Index showed a value of 0.16. In relation to the total number of species, which is 8, it is interpreted as low diversity.

Picture 79: Insect Diversity



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

6.2.6.6.6.3. NICHE AND TROPHIC GUILD

The Entomofauna recorded in the project area, presents the following benefits within the study habitats:

- They recycle nutrients: leaf litter, wood degradation.
- They disperse fungi, decompose carrion, excrement and aerate the soil.
- They propagate plants: pollination and seed dispersal.
- They maintain the composition and structure of plant communities via phytophagy.
- They maintain the structure of the animal community via: transmission of diseases to animals, predation and parasitism to animals. Food for insectivorous invertebrates, from fish to mammals. Variety of life histories, they dominate food chains and food webs, both in mass and species richness (Marín, 2007).

6.2.6.6.6.4. SPECIES OF INTEREST

Entomofauna recorded in the area of Portuaria's facilities do not include species listed in the IUCN Red Book (IUCN, 2011) or on CITES lists of trafficked species (Inskipp and Gillett eds., 2011).

6.2.6.6.6.5. ENTOMOFAUNA SPECIES CONCLUSIONS

- In the area of influence of the Port Terminal project, a total of 31 individuals were recorded, 7 families distributed within 4 orders.
- The most representative family was Culicidae with a total of 8 individuals, followed by Pieridae and Muscidae with 5 individuals.
- According to the results of the indices obtained for the entomofauna, it was found that the diversity in the project area is low.
- Entomofauna recorded in the area of Portuaria's facilities do not include species listed in the IUCN Red Book (IUCN, 2011) or on CITES lists of trafficked species (Inskipp and Gillett eds., 2011).
- None of the species recorded in the project area are used for commercial or food activities.

6.2.6.7. SANTA ROSA ESTUARY FAUNA

In the project area, specifically in the area of the docks, there is the Santa Rosa Estuary. The National Fishing Institute conducted a study to determine the amount of catch in this process and obtained the following conclusions: May, June and December are the months with the highest catch and the most caught species were corvina, red sea catfish,

menudo, rajiforme and coto catfish, which together with the rest of the months it was determined that the approximate amount of catch is 500,000 tons.

Taking into account the importance of artisanal fishing in Ecuador and the need to provide development strategies to their communities, in relation to the use of their fishing resources, in the parish of Puerto Bolívar, belonging to the Machala canton, a number of fish species were identified in the study area, being Peciformes the order with the greatest presence of species in the project's area of influence.

To quantify the ichthyological component, a tour of the sector located in front of the docks and in the area of influence of the project was conducted, where the technique used by local fishermen to catch fish was observed.

Species identification was carried out using the guide text *Peces marinos del Ecuador continental*, Volume 2; *Guía de especies* by Pedro Jiménez and Philippe Bearez. 2004.

The fish species found in the study area are detailed in the following table:

Table 56: List of Fish Species

Order	Family	Name Scientist	Common Name
Mugiliformes	Mugilidae	Mugil cephalus	Flathead grey mullet
Peciformes	Sciaenidae	Cynoscion analis	Peruvian weakfish
Peciformes	Centropomidae	Centropomus undecimalis	Common snook
Peciformes	Sciaenidae	Umbrina xanti	Common yellowtail croaker
Perciformes	Polynemidae	Polydactylus approximans	Blue bobo
Siluriformes	Ariidae	Galeichthys jordani	Catfish
Beloniformes	Belonidae	Belone	Needlefish
Peciformes	Stromateidae	Peprilus medius	Pacific harvestfish
Tetraodontiformes	Tetraodontidae	Sphoeroides trichocephalus	Pygmy puffer

Prepared by: *Ecosfera Cía. Ltda, 2017.*
Location: *Puerto Bolívar Parish, Machala - El Oro*
Date: *April 16 and 17, 2017*

Picture 80: Fish Abundance

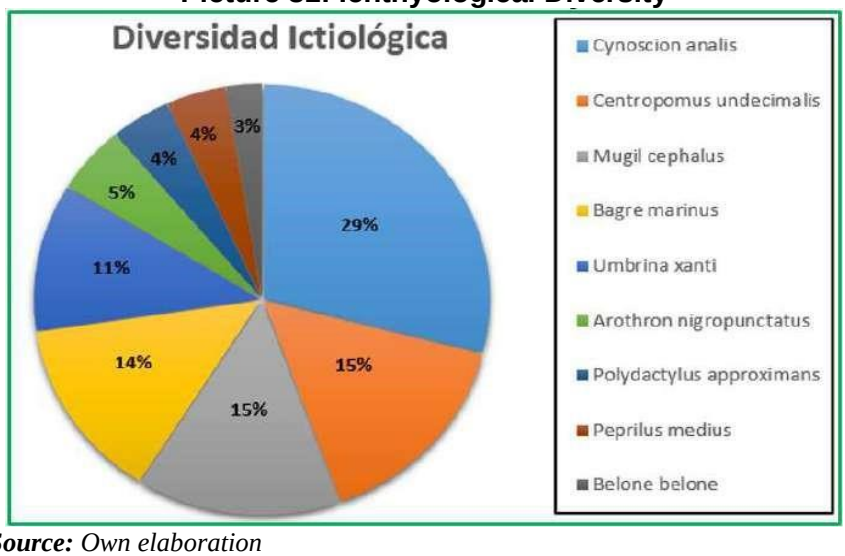
Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal.*
Date: *July 5, 2017*

- **Shannon-Wiener Index**
  In calculating the diversity data, the Shannon-Wiener Index showed a value of 1.82 for point one, 1.45 for point 2 and 1.75 for point 3. This index usually presents values between 1.5 and 3.5 and only rarely exceeds 4.5 (Margalef 1972, cited in Magurran 1987).

- **Simpson's Index**
  When analysing the diversity data, Simpson's Index showed a value of 0.18 for point 1, 0.26 for point 2 and 0.18 for point 3. In relation to the total number of species, which is 9, this is interpreted as low diversity.

- **Jaccard and Sorensen index**
  The Jaccard and Sorensen indices measure the similarity between the two sampled points. Calculating these indices gave us a value of 43% or 0.67 of similarity between the two points. This data indicates that there is an average similarity.

Picture 81: Ichthyological Diversity



Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda. Consulting Team*
Location: *Area of Influence of the Puerto Bolívar Port Terminal*
Date: *July 5, 2017*

In the area of influence of the project, a total of 117 individuals were recorded, 8 families distributed within 5 orders. The most representative family was Sciaenidae with a total of 34 individuals, followed by Mugilidae with 17 individuals.

According to the results of the indices obtained for the ichthyofauna, it was found that the diversity in the project area is medium.

The Ichthyofauna recorded in the project area, does not record species within the IUCN Red Book lists (IUCN, 2011) or on CITES lists of trafficked species (Inskipp and Gillett eds, 2011).

All species recorded in the project area are used for commercial or food activities.

PHYTOPLANKTON AND ZOOPLANKTON

To determine the phytoplankton and zooplankton of Santa Rosa Estuary, a phytoplankton and zooplankton analysis was carried out by performing surface trawls to obtain a zooplankton sample and a phytoplankton sample at a speed of 2 knots/hour in a time of 2 minutes.

Sampling determined that the zooplankton net had a mouth opening of 0.30 m in diameter and a mesh length of one meter with a net pore size of 300 µ. Samples were poured into 500 ml plastic bottles and preserved in 70% alcohol. For phytoplankton capture, a 0.30 m diameter and 1.00 m long net with a 60 µ mesh eye opening was used, the samples were emptied into 500 ml plastic bottles and preserved with lugol.

RESULTS

- **Phytoplankton analysis (60µ net)**
  The species with the highest abundance found in the sample were in order:
  - Skeletonema costatum with 10.5x105 cell/m3
  - Biddulphia sinensis with 4.7x104 cell/m3
  - Coscinodiscus concinnus with 4.3x104 cells/m3
  - Biddulphia mobiliensis with 2.19 x104 cell/m3
  - Chaeroceros debilis with 1.8x104 cell/m3
  - Coscinodiscus radiatus with 1.6X104 cells/m3
  - Navicula sp. with 1.46x104 cell/m3
  - Chaetoceros sp. with 8463 cell/ m3
  - Ditylum brighwellii with 457 cell/ m3
  - Chaeroceros affinis with 343 cells/ m3
  - Dinophuysis caudatas and Paralia sulcata with 229 cell/ m3

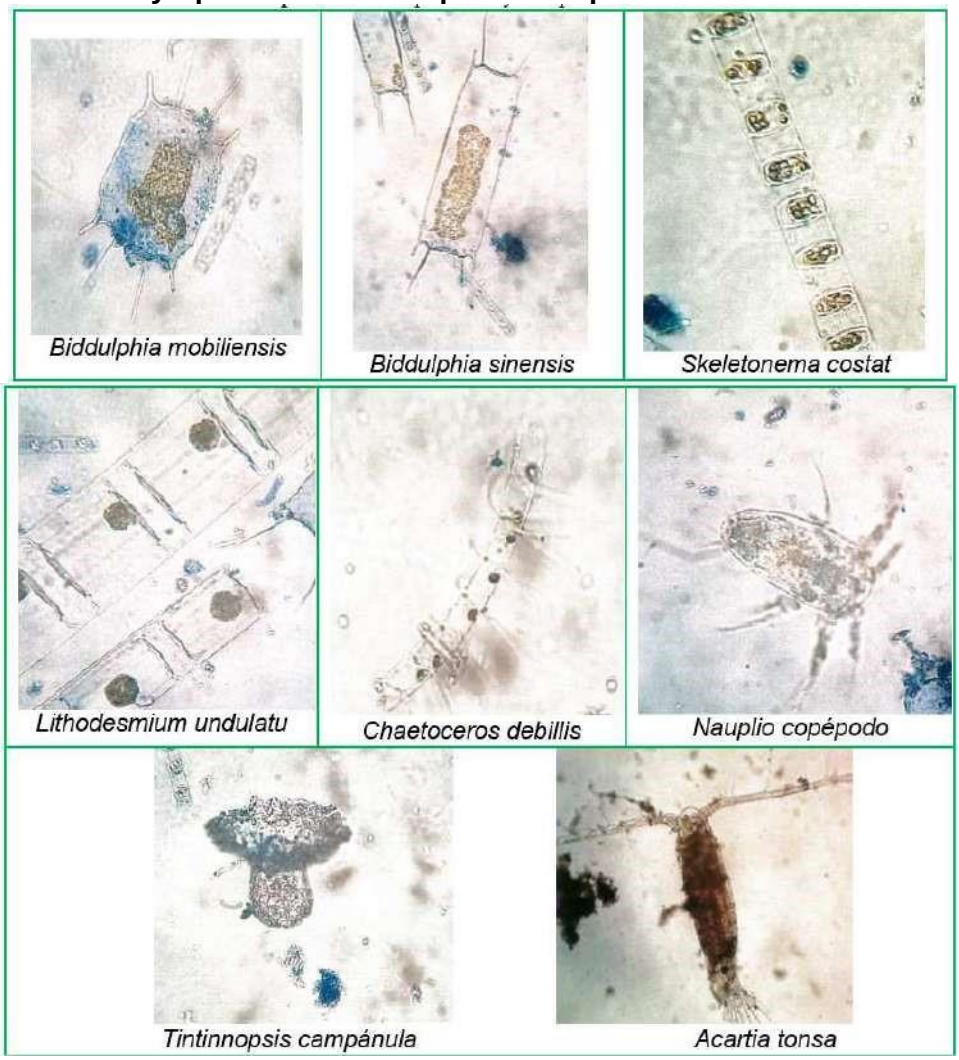
- **Zooplankton analysis (60µ net)**
  In this sample the species with the highest abundance were the copepods in Copepodito state with 24.4x104 org/10m2, followed by the copepods in Nauplio state with 21.9x104 org/10m2, Tintinnopsis dadayi with 7.3x104 org/10m2; and lastly, with the lowest abundance was the tintinnid Tintinnopsis campanula with 4575x104 org/10m2, and Tintinnopsis campanula with 4575x104 org/10m2.

- **Zooplankton analysis (300µ net)**
  In this sample only the species Acartia tansa was found, which presented a low abundance of 343 org/10m2 cell/m3.

The analysis found 16 phytoplanktonic species grouped into two divisions: Bacillariophyta (15 species) and the division Dinophyta (1 species):

- The total phytoplankton captured was 16.6x105 cells/m3; the most abundant species was Skeletonema costatum, which comprised 83% of the total phytoplankton collected.
- In the microzooplanktonic analysis (60µ) the following groups were found: Copepoda and Ciliophora.
- The total microzooplankton collected was 54.2x104 org/10m2; where copepods in the copepod stage reached the highest abundance, with 45% of the total microzooplankton collected.
- In the zooplanktonic analysis (300µ) only one species was found, which was the copepod Acartia tonsa, with an abundance of 343 org/10m2.

Picture 82. Phytoplankton and Zooplankton Species of Santa Rosa Estuary



Source: *Water Quality Report 6755-4 (Grupo Quimico Marcos)*
Prepared by: *Ecosfera Cía. Ltda.*

6.3. SOCIO-ECONOMIC ENVIRONMENT

The socioeconomic characterization process of this Environmental Impact Study was carried out on the basis of rapid research procedures, organized according to two sources: primary sources consisting of the application of three research techniques: Surveys, Interviews and direct observation. Secondary sources are based on bibliographic information such as the Population and Housing Census prepared by INEC in 2010 and the Territorial Development and Planning Plans of the province of El Oro 2014 - 2025, Machala canton and Puerto Bolívar parish.

6.3.1. DEMOGRAPHIC ANALYSIS

POPULATION

According to the 2010 Census, El Oro Province has a population of 600,659 inhabitants, 304,362 are men and 296,297 are women.

Picture 83: Population of the Province of El Oro

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

In relation to the total number of provinces in Ecuador, in 2010 the province of El Oro represented 4.15% of the total population of Ecuador, being the fifth most populated province in the country.

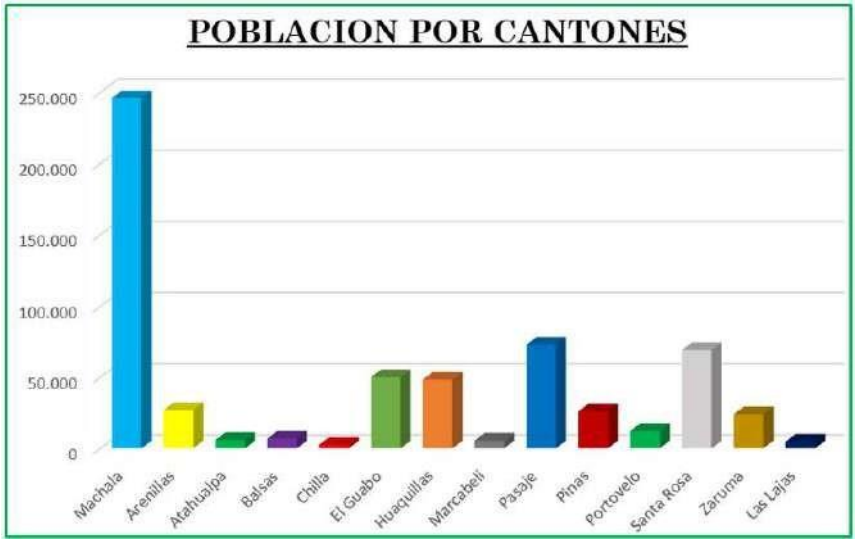
Regarding the cantons that make up the province of El Oro, we have the following information regarding the population of each one of them:

Table 57: Population and surface area of the cantons of the province of El Oro

CANTON NAME	AREA KM2	NUMBER OF INHABITANTS
Machala	330,18	245.972
Arenillas	268,44	26.844
Atahualpa	58,33	5.833
Balsas	69,56	6.861
Chilla	332,26	2.484
El Guabo	606,55	50.009
Huaquillas	63,78	48.285
Marcabeli	148,68	5.450
Pasaje	455,79	72.806
Pinas	616,90	25.988
Portovelo	288,07	12.200
Santa Rosa	821,84	69.036
Zaruma	648,74	24.097
Las Lajas	298,23	4.794

Source: *Development and Territorial Planning Plan of the Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 84: Population by canton of the province of El Oro.



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

6.3.1.1. POPULATION OF MACHALA CANTON

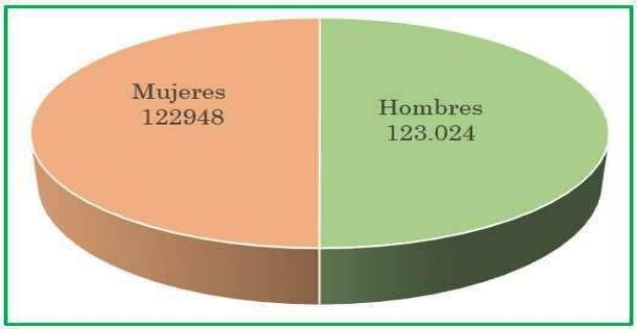
According to the Census carried out in November 2010 by the INEC, Ecuadorian Institute of Statistics and Census, Machala has 245,972 inhabitants, of which 122,948 are women and 123,024 are men. In other words, 50.02% of Machala's population is male and 49.98% is female. There is a minimal difference of 0.04%, which corresponds to only 76 more male than female inhabitants.

Table 58: Population of Machala Canton

POPULATION BY SEX	NUMBER OF INHABITANTS	PERCENTAGE (%)
Men	123.024	**50,02%**
Women	122948	**49,98%**
TOTAL	245.972	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 85: Population of Machala canton



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

With these numbers, Machala in the category of urban agglomerations of the Ecuador is the fifth most populated, being surpassed by Guayaquil-Durán-Milagro-Daule (3,200,205), Quito-Sangolqui (2,325,043), central Manabí (676,140) and Cuenca-Azogues (602,566).

The population of Puerto Bolívar parish is 6,174 people, 3,235 men and 2,939 women.

6.3.1.2. AGE GROUPS

In the province of El Oro, according to the five-year age groups, 10.51% of people are under 14 years of age, which means that most of the province's inhabitants are young, with no significant differences in the ratio of women to men.

The population from 0 to 14 years of age shows a considerable increase in both men and women. From the age of 15 onwards, there are newcomers in the pyramid, especially in the 25 to 30-year-old age group. This phenomenon could be justified by the fact that this population group leaves the province for study, work or other reasons.

The population of the city of Machala, according to the three age groups considered, is distributed as follows:

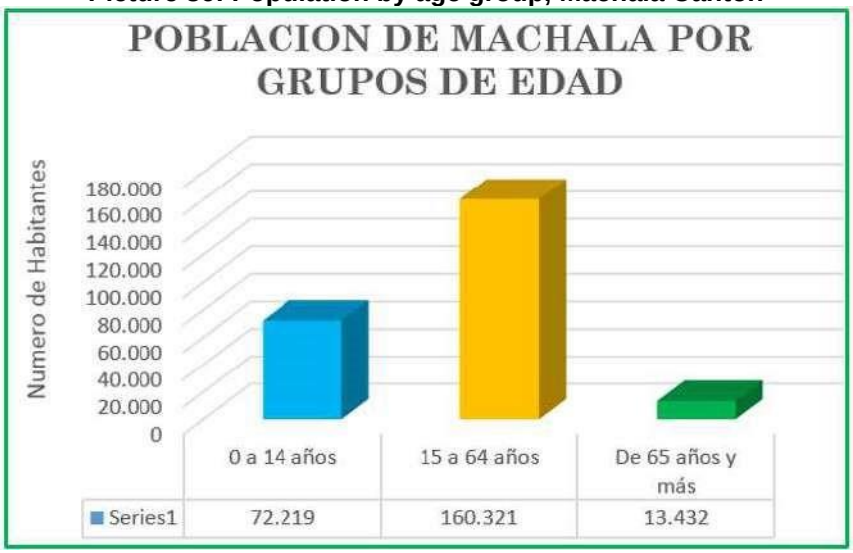
- Machala's 160,321 inhabitants are between 15 and 64 years of age.
- 72,219 inhabitants are between 0 and 14 years of age.
- 13,432 are 65 years of age or older.

Table 59: Population by age groups in Machala Canton

DETAIL	TOTAL	PERCENTAGE
0 to 14 years	**15 to 64 years old**	**65 years old and over**
72.219	160.321	13.432

Source: *INEC-Census 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 86: Population by age group, Machala Canton



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

6.3.1.3. POPULATION GROWTH RATE

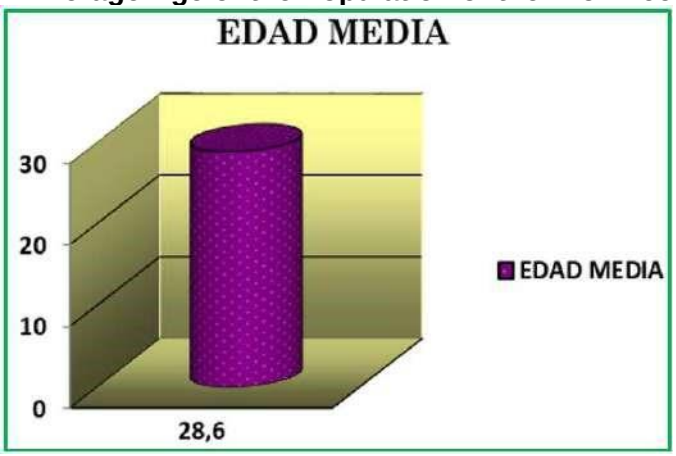
Regarding the evolution of the population of the Province of El Oro during the last decades, the population of the Province has grown continuously and intensely, although in recent years this growth has slowed down considerably, a trend that has also occurred in the total population of Ecuador. The evolution of the average annual growth rates, for the intercensal periods of 1990, 2001 and 2010, of all the cantons of El Oro Province, shows important differences in growth.

Within the demographic projections made by INEC in 2010, we can see that in the province of El Oro, the population between 14 and 65 years of age (Economically Active Population), shows a continuous decrease from 2010 to 2020. This phenomenon is due to the fact that the birth rate continues to decline.

6.3.1.4. AVERAGE AGE OF THE POPULATION

According to the 2010 Census conducted by INEC, the average age of the inhabitants of El Oro Province is between 28 and 29 years old.

Picture 87: Average Age of the Population of the Province of El Oro



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cia. Lda.*
Date: *April 20, 2017*

6.3.1.5. SELF-IDENTIFICATION OF THE POPULATION

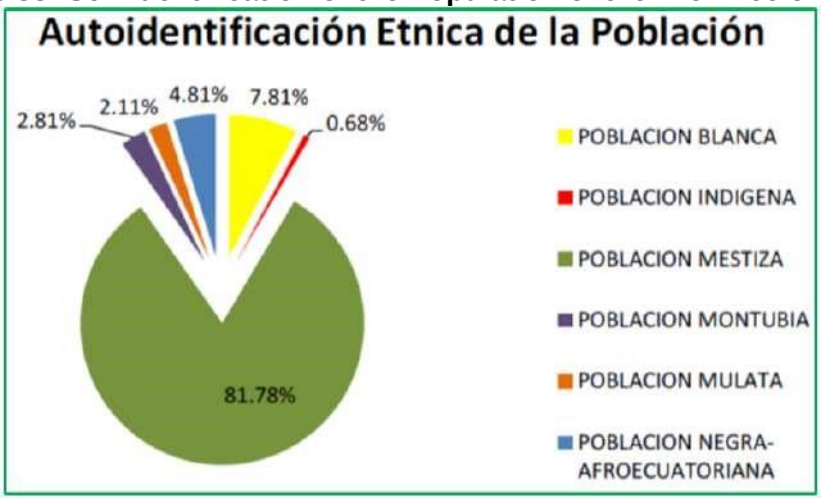
According to the customs and traditions of the citizens, the results of the 2010 Population and Housing Census determined that the citizens of the Province of El Oro self-identify themselves as shown in the following table:

Table 60: Ethnic Self-identification of the Population of the Province of El Or

INDICATOR	POPULATION	PERCENTAGE
White	46801	7,81
Indigenous	4060	0,68
Mestizo	489843	81,78
Montubian	16858	2,81
Mulatto	12613	2,11
Black – Afro-Ecuadorian	28828	4,81
TOTAL	**599003**	**100%**

Source: *SISE, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 88: Self-identification of the Population of the Province of El Oro



Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Secretary of Planning of the Provincial Government of El Oro*
Date: *2014*

According to the last census conducted in 2010, the majority of the population of El Oro Province self-identified as mestizo (81.78%). This miscegenation is understood as a complex process of biological and cultural contact between indigenous people, whites, blacks and others.

The population self-identified as mestizo is linked to various economic activities, such as agriculture, construction, professional and professional field or owning their own businesses. In the minority, 7.81% consider themselves white, 4.81% consider themselves black-Afro-Ecuadorian, 2.81% consider themselves Montubian, 2.11% consider themselves mulatto, and only 0.68% consider themselves indigenous.

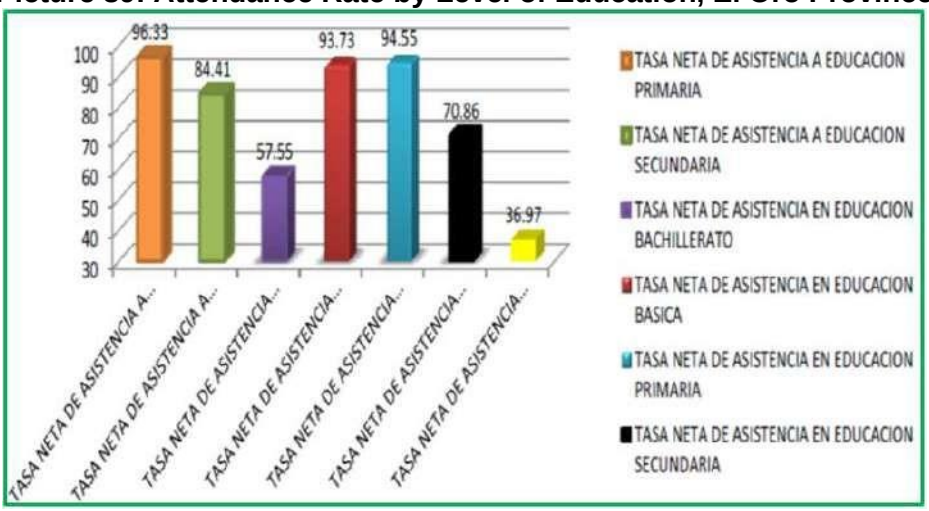
According to statistics gathered by INEC during the 2010 census, the inhabitants of Machala, considering their culture and customs, consider themselves to be 79% MESTIZO. In 9% of the population of Machala, they consider themselves WHITE. While

5% claim to be AFRO-ECUATORIAN and 3% MULATTO. 2% claim to be MONTUBIAN, and only 1% claim to be INDIGENOUS. 0.8% do not consider themselves to be in any of the variables.

6.3.2. EDUCATIONAL CHARACTERISTICS

One of the most important aspects to be taken into account in the development of any country, province, city, etc. is the education of the population. Having a population with good educational levels is a sign of development, of progress, of greater participation, of citizen quality, in short, of a society that is the engine of its own progress and active protagonist of the steps that are taken.

Picture 89: Attendance Rate by Level of Education, El Oro Province



Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Secretary of Planning of the Provincial Government of El Oro*
Date: *2014*

Education in Ecuador is the responsibility of the central government and is regulated by the Ministry of Education, divided into public, public-religious, municipal, private, secular, religious and bilingual Hispanic education.

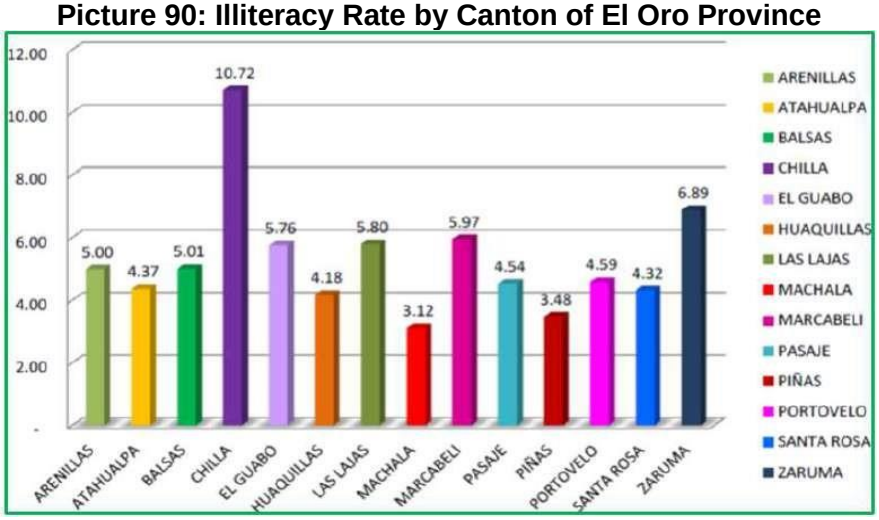
El Oro has a significantly lower rate -4.1%- than the country's average and is the third province with the lowest rates, after Galapagos and Pichincha, which have 1.31% and 3.6%, respectively. However, it is still above the rate considered by the UN -3.9%- to consider a territory free of illiteracy.

6.3.2.1. ILLITERACY

Illiteracy, in addition to limiting the full development of individuals and their participation in society, has repercussions throughout their life cycle, affecting the family environment, restricting access to the benefits of development and hindering the enjoyment of other human rights.

In Ecuador, although there has been a gradual decrease in illiteracy rates in recent years, the illiteracy rate in Ecuador is 6.8%, 2.2 points lower than that recorded in the 2001 Census, when it reached 9%.

Picture 90: Illiteracy Rate by Canton of El Oro Province



Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Secretary of Planning of the Provincial Government of El Oro* ***Date:*** *2014*

The illiteracy rate in the province of El Oro is 4.12%, occupying third place with the lowest rate in comparison to other provinces. Regarding illiteracy, Machala canton has an index of 3.10%, which means that its population is considered illiterate and 96.90% is literate.

6.3.2.2.2. SCHOOL DROPOUTS

According to the results of the 2010 Population and Housing Census, 9% of the population over 15 years of age that regularly attends school has not yet completed basic education (dropout), 2.07 points less than in 2001, when it reached 11.07%.

his report indicates that the province with the lowest student dropout rate is El Oro with 7.25% and Cotopaxi with 7.82%, while Napo and Morona Santiago have the highest dropout rates with 13.15% and 14.53%, respectively.

Table 61: School dropout in the province of El Or

CANTON	Number of Students who drop out of the school system	TOTAL ENROLLMENTS	RATE OF ABANDONMENT (%)
Arenillas	40	1188	3,4
Atahualpa	40	548	7,3
Balsas	19	349	5,4
Chilla			
El Guabo	304	4759	6,4
Huaquillas			
Las Lajas	3	354	0,8
Machala	40	796	5,0
Marcabeli	2	46	4,3
Pasaje	101	3568	2,8
Piñas	35	1537	2,3
Portovelo	6	449	1,3

Santa Rosa	132	3174	4,2
Portovelo	118	2780	4,3

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

In the province of El Oro, the canton of Atahualpa has the highest dropout rate of 7.3%, followed by Guabo with 6.4%, Balsas with 5.4%, and the cantons with the lowest dropout rates were Chila and Las Lajas.

It is worth mentioning that the average schooling rate of the population in the province of El Oro is **9.2** years.

6.3.2.3. SCHOOLS AND LEVEL OF EDUCATION

According to the 2010 census conducted by INEC, there are 79,994 regular schools in the Machala canton.

Of these, 57,956 are public or under state administration and 20,821 are private, representing 72% and 26%, respectively. Meanwhile, 802 establishments are public-religious and 415 are municipal.

Data from which we can conclude that the coverage of the public education system is 74% (considering public, public-religious and municipal schools).

In Machala, according to the 2010 INEC census, 68,681 inhabitants state that they just reached the primary education level; 58,079 inhabitants secondary education level, and 36,790 inhabitants higher education, which corresponds to the population with access to university studies.

As a result, only 2,218 inhabitants have graduate studies. While the pre-school level corresponds to 2,630 inhabitants and basic education to 17,958. There are 21,738 inhabitants in high school and 3,125 in post-high school.

The Literacy Centres have been attended by 571 inhabitants. And 5,410 people indicate that they have not attended any centre. It should be noted that 6,433 inhabitants do not know their level of education.

6.3.3. HEALTH CHARACTERISTICS

Through adequate and timely health care, the availability of maximum vital energy is guaranteed. This is an essential factor in the integral construction of the human being, allowing (its treatment) to improve the quality of life of the population.

6.3.3.1. MORTALITY

One of the most important aspects to analyse in terms of health is mortality, especially infant and maternal mortality.

Infant mortality, which, according to 2009 data, has been maintained after a considerable reduction in relation to recent years.

Table 62; School dropout in the province of El Oro

YEAR	INFANTS
2006	14,4
2007	2,5

2008	3,2
2009	2,9
2010	2,9
2011	2,9

Source: *Health Resources and Activities Annual Report, INEC.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 91: Infant Mortality Rate of Province of El Oro

Prepared by: Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025*
Prepared by: *Ecuadorian Institute of Statistics and Census.*
Date: *2014*

As for maternal mortality, it is the one that we have tried to combat to a greater degree, since it has been a very high percentage compared to the last few years, but it is being reduced according to the support programs for this problem.

Table 63: Maternal Mortality Rate of the Province of El Oro

YEAR	INFANTS
2006	65
2007	63
2008	59,24
2009	61,36
2010	58,2
2011	55

Source: *Health Resources and Activities Annual Report, INEC.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 92: Maternal Mortality Rate in the province of El Oro

Prepared by: Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025*
Prepared by: *Ecuadorian Institute of Statistics and Census.*
Date: *2014*

At a general level we can observe the mortality rate (per 100 thousand inhabitants) at the cantonal level, statistical data taken from INEC in 2012.

Table 64: Mortality Rate per Inhabitant, province of El Oro

CANTON	Number of deaths	Population projection	Mortality Rate (per 100,000 inhabitants)
Machala	1060	266638	397,5
Arenillas	109	29566	368,7
Atahualpa	38	6216	611,3
Balsas	23	7714	298,2
Chilla	14	2548	549,5
El Guabo	206	55385	371,9
Huaquillas	173	53237	325,0
Marcabeli	23	5871	391,8
Pasaje	351	79451	441,8
Piñas	95	28086	338,2
Portovelo	65	13146	494,4
Santa Rosa	293	75089	390,2
Zaruma	110	25432	432,5
Las Lajas	20	5021	398,3
TOTAL	**2580**	**653400**	**394,9**

Source: *Vital Statistics INEC, 2010 - 2013*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

6.3.3.2. HEALTH COVERAGE

There are fundamental factors that influence a society to reach a higher level of development in a more equitable and collective way; one of these factors is health, which is a key indicator of human development. Under this preamble, health must be considered as a basic need that the State must cover (guaranteed in the 2008 constitution) for the integral wellbeing of the different social actors, at the same time it must go hand in hand with the construction of infrastructure, physical expansion and human resources, extension and qualitative improvement of health services, provision of supplies, medicines and sanitary systems, etc. It should be emphasized that the

practice of Preventive Health should be promoted as a necessary measure to achieve the full wellbeing of the social group.

Health service coverage in the province of El Oro has a high influence in the northern part, which corresponds to the high population concentration, which does not mean that accessibility to this service is guaranteed.

Table 65: Health Coverage by Population, El Oro Province

CANTON	PHYSICIANS	POPULATION	RATE
Machala	884	263161	33,59
Arenillas	23	29002	7,93
Atahualpa	8	6175	12,96
Balsas	2	7507	2,66
Chilla	3	2569	11,68
El Guabo	28	54212	5,16
Huaquillas	14	52200	2,68
Marcabeli	3	5808	5,17
Pasaje	70	78213	8,95
Piñas	21	27752	7,57
Portovelo	9	13005	6,92
Santa Rosa	57	74013	7,7
Zaruma	21	25361	8,28
Las Lajas	5	5022	9,96

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Table 66: Ratio of Physicians per Inhabitants in the province of El Oro

CANTON	RATE OF PHYSICIANS PER 10,000 INHABITANTS	NUMBER OF BEDS PER 10,000 INHABITANTS
Machala	34	26
Arenillas	8	9
Atahualpa	13	7
Balsas	3	0
Chilla	12	0
El Guabo	5	0
Huaquillas	3	11
Marcabeli	5	0
Pasaje	9	16
Piñas	8	24
Portovelo	7	0
Santa Rosa	8	11
Zaruma	8	11

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

The number of physicians and beds per patient is still very low compared to the high rate of demand that currently exists, in many cantons such as Balsas, Las Lajas, Portovelo

do not have a properly equipped hospital with the necessary human resources for the care of patients.

6.3.3.3.3. EPIDEMIOLOGICAL PROFILE

The province of El Oro is affected mainly by the alcoholism that exists in the population, today there are many bars, discos and other entertainment centres where people go. This is not the only thing, the sale of alcoholic beverages freely.

During the winter season, Dengue is one of the diseases that comes with it, due to pollution sources, stagnant rainwater, among others. About this issue we can say that there are several programs and projects that are being implemented in the Province of El Oro, mainly in the Machala canton, for example SOLCA with the support of the municipality of Machala, conducts campaigns continuously to prevent cervical cancer and breast cancer. The last one was attended by 1,067 women, all this with the support of mobile clinics of the Municipal Health Network, Municipal South Hospital and Pomerio Cabrera Hospital.

Table 67: Epidemiological Profile of Province of El Oro

POPULATION HEALTH	RATE PER 10,000 INHABITANTS
Alcoholism	26,5
Dengue	66,4
Diabetes	102,3
Drug dependence	1,3
Arterial hypertension	138,5
Malaria	1,5
Measles	0,6
AIDS	5,2
Tuberculosis	33,1
Victims of violence and abuse	10,8

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

6.3.3.4. FERTILITY RATE

This indicator shows the potential for demographic changes in the country. An average greater than two children per woman is considered the replacement rate for a population, resulting in relative stability in terms of total numbers. Averages above two children per woman indicate growing populations whose median age is decreasing. Higher rates may also indicate difficulties for families, in some situations, to feed and educate their children and for women wishing to enter the labour force. Averages below two children per woman indicate a declining population size and a rising median age.

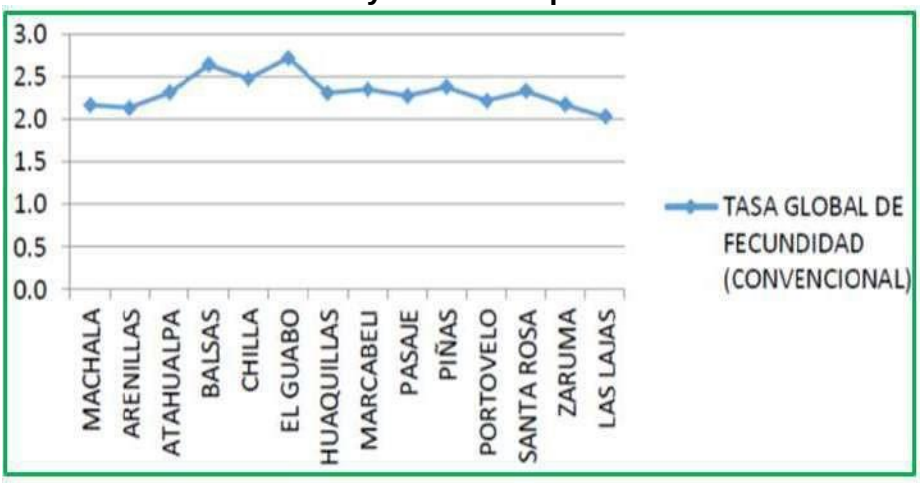
Table 68: Total fertility rate in El Oro province

CANTON	TOTAL FERTILITY RATE
Machala	2,2
Arenillas	2,1
Atahualpa	2,3
Balsas	2,6
Chilla	2,5

El Guabo	2,7
Huaquillas	2,3
Marcabeli	2,3
Pasaje	2,3
Piñas	2,4
CANTON	**TOTAL FERTILITY RATE**
Portovelo	2,2
Santa Rosa	2,3
Zaruma	2,0

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 93: Fertility Rate in the province of El Oro



Source: *Territorial Development and Planning Plan for the Province of El Oro, 2014 - 2025.*
Prepared by: *Secretary of Planning of the Provincial Government of El Oro.*
Date: *2014*

In the province of El Oro, the average fertility rate is 2.3%, which indicates that our population is increasing.

6.3.3.5. MALNUTRITION

According to statistics, the problem of malnutrition affects 22 out of every 100 children under 5 years of age. Anaemia, due to iron deficiency in the diet of the Ecuadorian population, is around 60% in children under 2 years of age and 44% in women between 15 and 49 years of age.

Ecuador has reduced the malnutrition rate in children under 5 years of age by 18% in the last 20 years. Informative data from the Observatory for the Rights of Children and Adolescents (ODNA) indicate that in the 1980s malnutrition registered 41% of the total child population, while in 2011 it was reduced to 23%. Despite this significant reduction, the Government seeks through its actions to have a country free of chronic malnutrition and anaemia.

Insufficient and inadequate nutrition forever affects their normal physical and intellectual development. Decreased intellectual capacity, learning difficulties, poor development, lower defences against diseases, overweight and obesity are some of the associated disadvantages.

In El Oro, in recent years, malnutrition has decreased thanks to the implementation of programs promoted by the MSP, aimed at the most vulnerable sectors, the malnutrition rate according to the National Health and Nutrition Survey in 2012 is 4.1.

Table 69: Total fertility rate in El Oro province

Mortality rate	Malnutrition
2,9%	4,1

Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

6.3.4. ECONOMIC ACTIVITIES

6.3.4.1. PRODUCTIVE STRUCTURE OF THE PROVINCE OF EL ORO

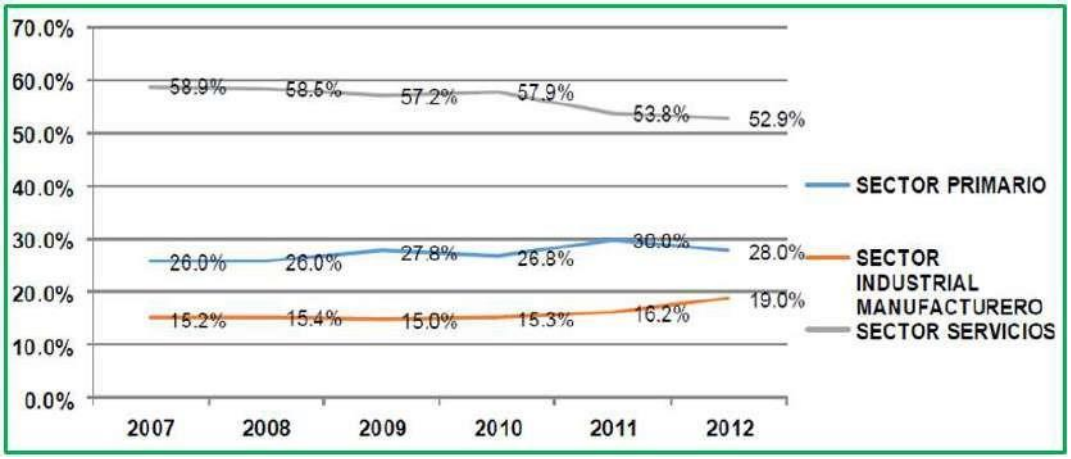
The productive structure of El Oro Province is described in the following tables and Pictures.

Table 70: GVA by Economic Sector of the Province of El Oro

GVA	2007	2008	2009	2010	2011	2012
PRIMARY SECTOR	385.765	484.923	571.662	562.118	752.524	800.182
INDUSTRIAL SECTOR	225.070	287.423	307.126	320.201	407.201	544.305
SERVICES SECTOR	874.541	874.541	1.090.100	1.174.465	1.213.081	1.512.858
TOTAL	**1.485.376**	**1.862.446**	**2.053.25**	**2.096.129**	**2.510.806**	**2.857.345**

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 -2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

Picture 94: GVA by Economic Sector of the Province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

- **PRIMARY SECTOR**

  The Primary Sector in 2007 represented 26% of the provincial GVA, remaining constant until 2011 when it reached 30% of the GVA and in 2012 it reached 28%.

  It includes all activities based on the extraction of goods and resources from the natural environment: agriculture, livestock, fishing, hunting, logging and mining.

  "The employment situation and the origin of the income of the rural population in Ecuador is of primary interest for several reasons. In the first place, because it is one of the Latin American societies where the weight of the rural population is greater...", dedicated to agricultural tasks as the main activity. Secondly, most of the poor population is found in rural areas, affecting the peasant sector and "unskilled" agricultural wage employees.

- **INDUSTRIAL MANUFACTURING SECTOR**

  The Industrial Manufacturing Sector is the one that represents the lowest percentage of the GVA of the province of El Oro, the same that in 2007 reached 15.2% of the provincial GVA, increasing in 2011 to 16.2% and in 2012 grew to 19% of the GVA of the province.

  It groups together the economic activities responsible for the transformation of goods and resources extracted from the natural environment (raw materials) into processed products. The essential activities of the sector are construction and industry. The number of employees hired in the secondary sector is very small in underdeveloped countries (around 10%) and moderate in developed countries (around 30%) due to technological advances.

  In the case of Ecuador, a series of subsectors converge in this sector which, being transformers of raw materials, belong to this great division; this is the case of "handicrafts" which, due to the weak use of capital, offer goods with high production costs and prices, as opposed to industry which, due to heavy investments for construction, assembly and operation, uses state-of-the-art technology and economies of scale, which allows lowering costs and reducing final prices, discouraging and depressing competition.

- **SERVICES SECTOR**

  The tertiary sector of the economy of the province of El Oro is the one that represents the highest percentage of the Gross Value Added, which in 2007 represented 58.9% of the provincial GVA, remaining stable until 2011 and 2012, where it decreased to 53.8% and 52.9% of the GVA, respectively.

  It includes all those activities that do not directly produce material goods and, therefore, do not fit within the primary and secondary sectors. These activities are known as "services". Currently included under this denomination are: commerce, hotels and restaurants, transport and communications, finance, a set of auxiliary activities (consulting, information technology, etc.), social and personal services, activities related to leisure and many others.

Table 71: Activity branches by economic sector in the province of El Oro

ACTIVITY BRANCH	2007	%	2012	%
Agriculture, livestock, forestry and fishing	344957.47	23%	688447.47	24%
Mining and quarrying	40807.674	3%	111734.117	4%

Manufacturing	47644.423	3%	105368.037	4%
Electricity, gas, steam and air conditioning supply	8081.59303	1%	30666.918	1%
Construction	169344.364	11%	408270.115	14%
Trade	296821.209	20%	507196.43	18%
Transportation and communication	105451.263	7%	170801.729	6%
Accommodation and food service activities	24181.6614	2%	43092.6285	2%
Financial activities	27479.4548	2%	56971.3758	2%
Professional and real estate activities	95530.2363	6%	173724.484	6%
Public Administration	115717.22	8%	192631.346	7%
Education	118598.803	8%	181704.187	6%
Health	51459.4205	3%	105070.979	4%
Arts, entertainment and recreation	3430.3731	2%	70237.2731	2%
TOTAL	**1485376.5**		**2857345.1**	

Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

The provincial gross production of the Agricultural, Forestry, Fishing and Aquaculture Sectors in 2007, at constant 2000 prices, amounted to US$545,553,000, which represented 11.9% of the production of this sector in Ecuador and 18.8% of the production of the same sector in the Coastal Region. The sector's growth since 2001 has been very significant, almost doubling its gross production. In this evolution, it is worth noting the important dynamism of the fishing and aquaculture subsector, which has more than tripled its gross product in the aforementioned period, compared to an increase of 24% in the gross product of the agricultural subsector. The agricultural sector is considered one of the most important productive pillars of the Ecuadorian economy, due to its contribution to the GDP, in addition to being an important source of foreign exchange through the export of traditional and non-traditional products, the generation of employment and also for being the basis of the food sovereignty policy.

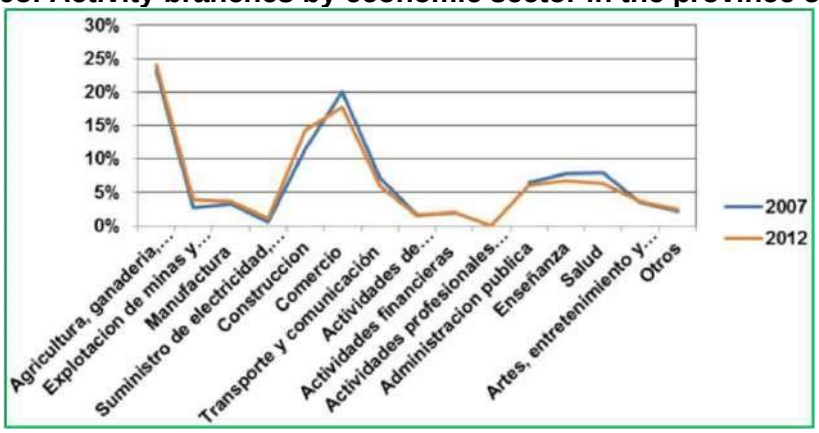
In recent years, the agricultural sector has had several problems, such as high input costs, making the cost of living more expensive for the inhabitants, favouring imports and preventing access to other markets and preventing the creation of economies of scale due to the low level of association.

Another problem in the sector is the low level of productivity of products for domestic consumption and export, which are low in comparison with those of other Latin American countries.

In addition, poverty levels in the rural sector are higher than in urban areas, due to several factors such as the abandonment of the rural sector in the granting of credit, limited technology, lack of adequate infrastructure in health, education, basic services, storage, irrigation, fishing docks and others that cause migration to large cities to provide for the welfare of their families. In addition, there is inequitable access to land, which produces a marked difference between social sectors.
One of the Government's challenges is to redesign the territorial structure in a more equitable manner, giving priority to small and medium-sized producers, creating a

positioning of differentiated products and incorporating added value to local and external production through technological innovation, in order to achieve the Good Living of its inhabitants.

Picture 95: Activity branches by economic sector in the province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

6.3.4.2. PROVINCIAL CONTRIBUTION TO GROSS VALUE ADDED BY ECONOMIC SECTOR

Table 72: GVA by economic sector in the province of El Oro

GVA	PRIMARY SECTOR	%	INDUSTRIAL SECTOR	%	SERVICES SECTOR	%
National	12579905	100%	15067622	100%	33840133	100%
El Oro	8001815897	1%	5443050701	1%	1512858447	2%

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*

Table 73: Economically Active Population of the province of El Oro

SECTORS	EAP	%
PRIMARY SECTOR	68337	27%
INDUSTRY SECTOR	15061	6%
SERVICES SECTOR	144516	57%
Undeclared	17391	7%
New employee	9702	4%
	255007	

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

In 2010, the agriculture, livestock, forestry and fishing sector was the source of employment for 61,592 people residing in the Province, or slightly more than a quarter of the EAP.

The agriculture, livestock, forestry and fishing sector continues to be characterized by a very relevant masculinization, so that 9 out of every 10 persons active in this sector are men. On the other hand, almost half of the active population aged 65 and over in the province (46%) belongs to this sector.

In El Oro 15,061 (6%) economically active people are concentrated in the secondary sector, 6% of the provincial EAP. In the province of El Oro 4062 men and 1274 women between 15 and 29 years of age are concentrated in the secondary sector of the economy, and represent 7% of the EAP in relation to the economically active provincial population between 15 and 29 years of age.

In Ecuador, the tertiary sector of the economy is the sector with the largest labour force; it is also the most heterogeneous, accounting for 55% of the country's economically active population.

In El Oro, there were 144,516 economically active people in the service sector in 2010. In the branch of "commerce" 35%, construction 11%, and 9% are located in "transportation and storage". In the province of El Oro, 48% of men and 69% of women between 15 and 29 years of age are concentrated in the tertiary sector of the economy, in relation to the economically active population between 15 and 29 years of age.

Commerce, with 50,792 people, has more than doubled the active population in just two decades, accounting for 20% of Orense's active population. In addition, the commerce sector is playing an important role in the incorporation of women into the Orense labour market.

Public Administration and Defence, with 10981 people, of which 8058 are men, and 2923 are women; noting that men continue to lead in this sector, however we see that in other activities women stand out as in Teaching which concentrates 7.2% of the sector's active population, of which 7890 are women and 4401 are men; likewise, in human health care activities we find 3318 women and 1409 men, sectors in which the active female population outnumbers the active male population. Public Administration and Defence are characterized by a clear masculinization, while Education and Health are characterized by the opposite, a significant feminization. Construction reached a record 15,781 people in 2010. The most masculinized sector in the Province is characterized by its youth.

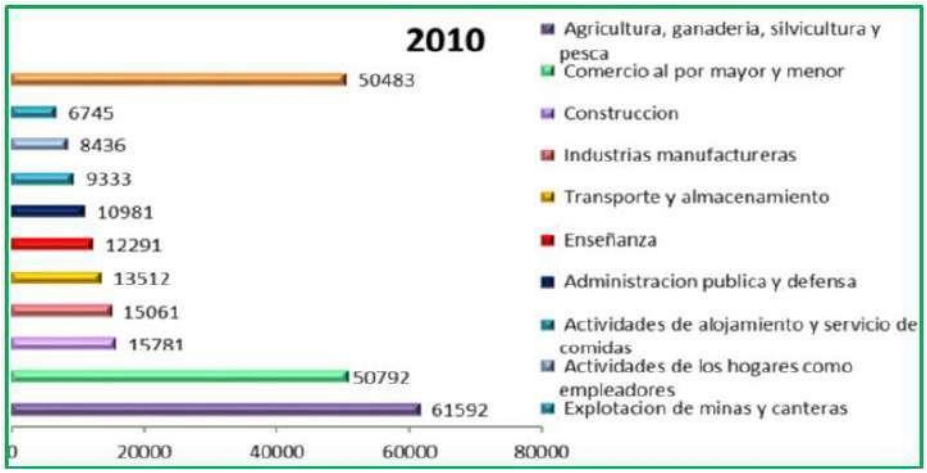
The Manufacturing Industries Sector, with 15,061 active employees in the Province, shows a clear stagnation, even a slight decline, in relation to the weight it has for the active population of Orense in relation to all economic sectors.

Three subsectors account for approximately two thirds of the sector's workforce: (i) the food and beverage industry; (ii) the textile, clothing and leather industry; (iii) the furniture and wood manufacturing industry.

The food industry is the source of activity for only 1 out of every 5 employees in the industrial sector and 1.5% of the assets of the province, which would indicate the low capacity of the agri-food sector as a whole to generate added value and take advantage of its great economic potential. For each person active in the agricultural sector, it can be estimated that the province has 0.06-0.08 people active in the agri-food industry. It is characterized by a scarce presence of a female labour force, 1 out of every 4 women.

The textile, clothing and leather products industry stands out due to the high presence of the female workforce, with 2/3 of women active in this industry.
The industrial subsector of the furniture manufacturing sector, which represents only 16% of the working population in the industrial sector, exceeds the levels of masculinization presented by the agri-food sector.

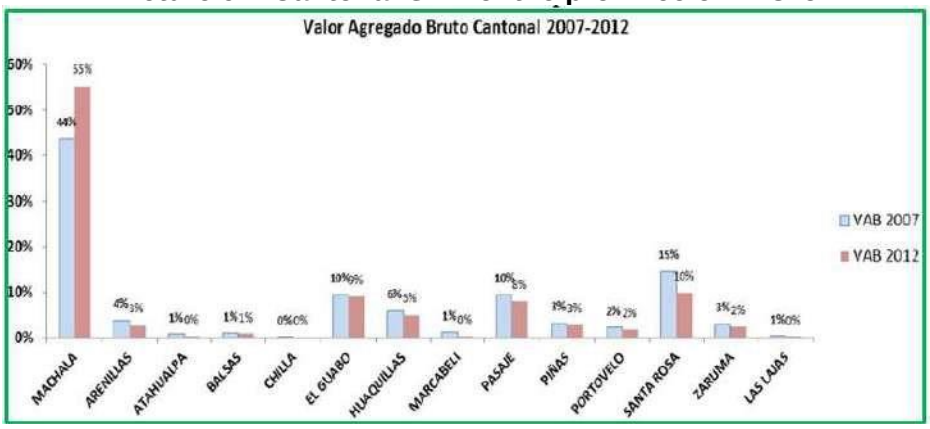
Picture 96: Economically Active Population by activity branch in the province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Autonomous Decentralized Government of El Oro.*
Date: *2014*

The Machala canton with 668,620 thousand dollars in 2007 represents 44% of the provincial Gross Added Value, noting an increase to 1'161,720 thousand dollars in 2012, being 55% of the GVA of the province. The Santa Rosa canton in 2007 represented 15% of the provincial GVA, and in 2012 it decreased to 10%, the same happens with the cantons of El Guabo and Pasaje that decrease the Gross Added Value to 9% and 8% respectively.

Picture 97: Cantonal GVA of the province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

6.3.4.3. EMPLOYMENT AND LABOR - ECONOMICALLY ACTIVE POPULATION

According to data from the National Survey of Employment, Unemployment and Underemployment of June 2014, the province of El Oro has contributed to the Economically Active Population - EAP with 55% of Region 7 and 4.3% of the country's labour force, and economically is the largest contributor to the Region 7 Zone, with 59% of the Gross Domestic Product.

According to data from the 2010 INEC census, in the Machala canton, of the total economically active population, 62.56% are engaged in some activity, of which 96% are employed, that is to say, they actually perform paid work, while 6% are not working, either because they are looking for a job (for the first time) or are unemployed.

According to the National Survey of Employment, Unemployment and Underemployment of June 2014, the population of the province of El Oro amounts to 662,671 inhabitants, i.e. 4.13% of the total national population. The Economically Active Population of the province of El Oro is 297,213 inhabitants as of June 2014; represented by 45% of the total population of the province, and 4.3% of the total national EAP. The population under 15 years of age in the province of El Oro is 187587 inhabitants, and the Working Age Population (WAP) is 475,084 inhabitants.

It is worth noting the strength of the Province's labour market when it comes to incorporating PET assets, a strength that has mainly affected the working generations that twenty years ago were younger, those between 15 and 29 years of age at the time.

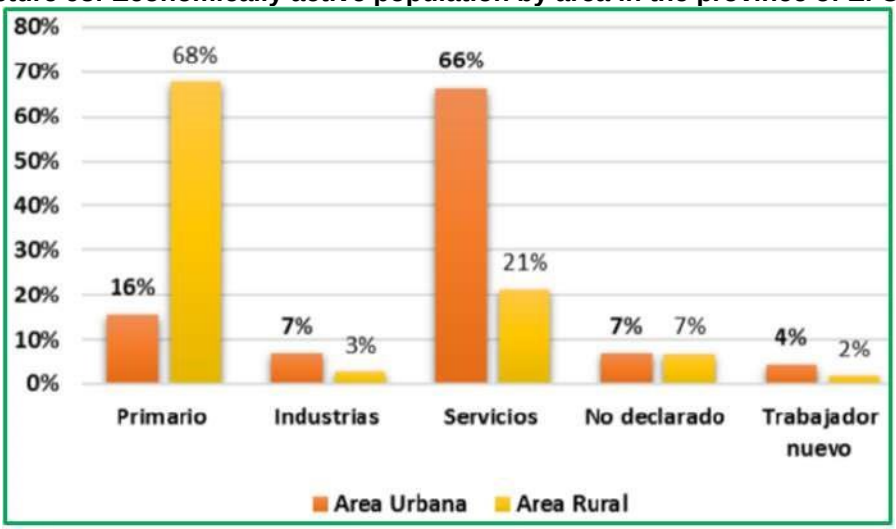
As a result of all this, the province of El Oro currently has activity rates very similar to those of the country as a whole, both in relation to the working age population and in relation to the large groups that comprise it, those between 15 and 64 years of age and those 65 years of age and older.

El Oro's activity rates for those over 15 years of age, currently at 60.02%, are the result of slow growth in recent decades, which have coincided, on the one hand, with a fall in the activity rates of men and a very significant rise in the activity rates of women, and on the other hand, with an increase in the activity rates of the population between 15 and 64 years of age and a fall in the activity rates of the population aged 65 and over.

In 2010, a total of 2,733 minors between the ages of 5 and 14 were engaged in some economic activity in the province of El Oro. This figure represented 2.2% of the census population for these age groups in the province and, when comparing the situation of the province with that of Ecuador as a whole, the better position of El Oro is clear, especially due to the lower proportional presence of minors in economic activity in the 9 to 14 age group.

Employed population by economic sectors according to rural and urban area. In the primary sector, agriculture, livestock, forestry and fishing, the EAP is concentrated in rural areas (68%), while in the service sector, the urban EAP stands out with 66% compared to 21% of the rural EAP.

Picture 98: Economically active population by area in the province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

6.3.4.4.4. EMPLOYED POPULATION BY ACTIVITY BRANCH ACCORDING TO RURAL AND URBAN AREA

According to the 2010 Population and Housing Census, the total EAP of the province of El Oro is represented by 17,1,622 (67%) men and 8,2993 (33%) women.

22% of the EAP is concentrated in rural areas, especially in agricultural activities (62.24%), while the rest is distributed 5.53% in mining and quarrying, 2.54% in manufacturing industries, 2.53% in construction, 5.71% in wholesale and retail trade, 2.23% in transportation and storage, and 19.22% divided between electricity supply, water distribution, education, among others.

The intense growth of the economically active population is justified by changes that reflect the unstoppable incorporation of Orense women into the labour market.

6.3.4.5. UNEMPLOYMENT

According to data from the Employment, Unemployment and Underemployment Survey for June 2014, the unemployment rate in the province of El Oro is 3.91% as of June 2014, compared to the previous year (3.03%), increased 0.88%. In 2013 the underemployed reached 40,421 people, while in 2014 the underemployed decreased to 39,437 inhabitants.

Table 74: Unemployment and underemployment rates in the Province of El Oro

UNEMPLOYMENT RATE	UNEMPLOYMENT (%)	UNDEREMPLOYMENT (%)
National	4,65	12,26
El Oro	3,91	13,27

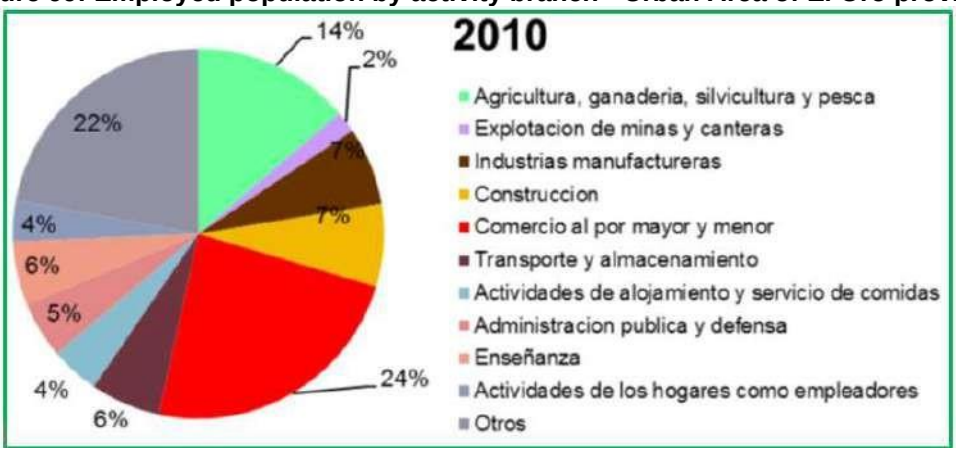
Source: *ENEMDU, June 2014*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The unemployment rate in June 2014 is lower than the national rate of 4.65% as of June 2014, while underemployment in the province of El Oro is higher than the national rate of 13.27%.

6.3.4.6. PRODUCTION OF THE PROVINCE

Favoured by the excellent climatic and ecological conditions of the western plains, the province has a high productive potential, with banana, cocoa, rice, coffee, sugar cane, corn, citrus, fruit and vegetable crops. Livestock production includes dairy and beef cattle, poultry, swine, and rabbits. The province has a high aquaculture potential, especially shrimp and tilapia farming, and artisanal fishing and shellfish harvesting are important economic activities. Mining is another important economic activity, with gold, silver, and stone materials being the main deposits.

Picture 99: Employed population by activity branch - Urban Area of El Oro province



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2010*

- **BANANA PRODUCTION AND SALES**

  Annual banana production in El Oro represents 43.3% of the national production of this crop; it corresponds to 29% of the annual planted area and 33% of the annual harvested area with respect to the national production of this crop.

Table 75: Banana production in El Oro Province

YEARS	Planted (Has)	Harvested (Has)	Production (mt)	Sales
2005	50402	49290	2257812	2033675
2006	52347	50648	2273532	1992146
2007	53439	50496	2179639	1950380
2008	57994	52721	2421374	2252980
2009	65285	62046	3744583	3105517
2010	67934	63975	3887126	3446460
2011	55163	54625	2443673	2279247
2012	63892	62836	2259688	2220666
2013	64094	62667	2594000	2490056

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 2025.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The Coastal Region is the main banana producer in Ecuador. With 185,827 ha planted and 160,920 ha harvested in 2013, it accounted for 85% of the planted area and 85% of the harvested area in the country. Its production, with 5,730,329 MT, represented 96% of Ecuador's production for that year. Three provinces concentrate both the area under cultivation and the production obtained in the region: El Oro, Esmeraldas and Los Ríos. These three provinces together account for 82.1% of the area planted in the region, 82.7% of the harvested area and 95% of production in the coastal region.

The province of El Oro leads in harvested area at the national level with 33.22% of the agricultural area, while the province of Los Ríos leads with 33.43% of the planted area at the national level.

In 2013, the province of El Oro ranked as the main producer with 2,594,000 tons per year, representing 43.3% of total national production, leaving behind the province of Los Ríos with 28.84% of national banana production.

The average area planted during the 2005-2013 period in El Oro was 57,720 hectares, with an average harvested area of 55,431 hectares and an average production of 2,020,044 MT.

El Oro, with an average annual yield of 36.44 MT/ha over the 2005-2013 period, has an average yield 7% lower than that of Guayas and 24% lower than that of Los Ríos. The average annual national production yield per hectare is 32.81 tons during the 2005-2013 period.

At the national level, the banana harvested area has maintained a downward trend with an average growth rate of -0.66% between 2005 and 2013. During 2013 there was a growth of 9.86%, or approximately 18,921 ha; despite the above, production shows an average growth rate of 1.92% between 2005 and 2013. In 2013, there was a reduction of 5.59% compared to the previous year. Export bananas are mainly located in the Coastal Region. In 2013, the provinces of Los Ríos, El Oro and Guayas accounted for 78.54% of the total area harvested of this product. It is observed that the province of El Oro, is the most dedicated to the cultivation of bananas, with a share of 29.42% and a production of 33.22% of the metric tons of bananas harvested in 2013 at the national level. The following provinces in importance are Los Ríos and Guayas with 28.23% and 21.21% of the harvested area respectively. These, in turn, accounted for 28.84% and 23.16% of the total metric tons of bananas produced.

There are several reasons for the lower yields in the Province, beyond possible climatic circumstances or plant health that may have affected the productive cycle of the plants. Among the most significant are those related to the size of the farms, the productive age of the plantations, their level of technology, access to irrigation and the degree of intensity with which the production processes are carried out. The size of banana farms, and especially the size of the plots cultivated by the farms, condition the producers' access to agricultural inputs, limit their applications and vary production costs. El Oro has the smallest production structure in the Coastal Region.

El Oro has a greater polarization between small and large farms in the Province, with a greater presence of small farms than in the Region as a whole, although possibly with a smaller area under small farms. The age composition of banana plantations in El Oro reflects a higher average ageing than in the Region as a whole. The older the plantations get, the lower their average yields.

According to figures provided by the Ecuadorian Association of Banana Exporters, 61 million 368 thousand 396 boxes of fruit were exported from the province of El Oro to the international market during 2014.

In 2013 the export volume was lower. From January to December 2013 a total of 55'555,669 boxes were exported. Exports were maintained during all these months with an average of five million boxes per month. With the exception of January when 7 million boxes were exported, and September which was the lowest month with 4 million boxes exported. For 2013 the national average calculated up to October is 246'195,861 boxes of fruit, according to the Ecuadorian Association of Banana Exporters.

The monthly evolution of shipments in Puerto Bolívar shows the maintenance of banana production and export activity throughout the year, which ensures a permanent flow of income to producers and the sector as a whole. On the other hand, the higher level of export activity, and therefore production, which occurs between the months of December and May, where there is a higher export of boxes, coinciding with the decrease in

production activity of competing Caribbean countries, which greatly benefits the market position of Ecuadorian bananas and, in this case, Orense.

In 2010, four exporting companies from Orense were among the top 30 banana exporters in Ecuador. Between them, they accounted for 8.04% of Ecuador's banana exports that year. The

The Ecuadorian Agency for Quality Assurance in Agriculture has a Border Control Unit centre (Huaquillas), a Port Control Unit centre (Puerto Bolívar) and an Airport Control Unit centre (Santa Rosa Regional Airport) in El Oro.

PRODUCTIVE ECONOMIC SYSTEM OF THE MACHALA CANTON

Machala, capital of the province of El Oro, is a productive agricultural canton with a great commercial and banking movement, becoming the economic centre of southern Ecuador. Its population is mostly dedicated to the banana industry, which is why it is internationally recognized as the "Banana Capital of the World". The planting and harvesting of shrimp is another productive activity. In addition, a large part of the population is dedicated to the commercialization of machinery, vehicles, household appliances, clothing, etc. In addition, there has been a noticeable increase in tourism to nearby beaches and rivers, which has become an important commercial activity for those who offer tourism services. And additionally the capital has become in recent times in the axis for the crystallization of important businesses and opening of large companies.

From the point of view of productivity, the population of a community is classified into two groups, one refers to the economically active population (EAP) which is the labour force and is the one that generates goods and services, and may have the status of employed or unemployed, in the first case there is underemployment; the other group is known as the economically inactive population (EIP) and is made up of housewives, students, retirees and people with work disabilities.

The economically active population (EAP) is that part of the population dedicated to the production of goods and services of a society. The concept basically maintains consistency throughout the various population censuses carried out in the country, allowing the comparison of census data.
For the purposes of INEC's 2010 Census, the ECONOMICALLY ACTIVE POPULATION (EAP) is made up of persons 10 years of age and older who worked at least 1 hour in the reference week, or who did not work, but were employed (employed), or those who were not employed, but were available for work and were looking for work (unemployed).

In Machala, the Economically Active Population (EAP), according to INEC's 2010 Census, is 38%.

According to the latest report released at the end of 2011 by the National Institute of Statistics and Census (INEC), and the survey conducted by the agency in 127 population centres of Ecuador, the cities that report a sharp decline in unemployment are Guayaquil and Machala, after receiving the greatest impact of the international financial crisis in 2009.

Machala went from a rate of 9.5% in the third quarter of 2009 to 6% this year; a figure even lower than the 7.9% recorded between July and September 2008. Guayaquil, likewise, fell from 13% to 10%.

According to INEC and data from the 2010 Census, there are 11,215 economic establishments in Machala. While USD $.2.988 million dollars generated sales revenue.

41,633 is the total number of people employed in the Machala canton, according to the same census of 2010. And in terms of fixed assets, USD 24 million dollars were invested.

The main economic activities practiced in the canton are: productive activities, commerce and services.

- **ACTIVITY BRANCHES OF THE POPULATION IN MACHALA**

  The population in Machala is mostly engaged in 21 activities as the most important. Among these, three stand out as the ones with the highest percentage:
  - Wholesale and retail trade accounts for 27,192 of Machala's population, which corresponds to 25%.
  - The second most important sector is agriculture, livestock, forestry and fishing, with 14,244 inhabitants (13%).
  - The manufacturing industry accounts for 7%, with 7,670 inhabitants dedicated to this activity.
  - The construction industry also accounts for 7% of the population, with 7,593 inhabitants.
  - The undeclared employees' category was assigned 7%, transportation and warehousing 6%.
  - The Education category, which is the next one, occupies a percentage of 5%, corresponding to 5,312 economically active inhabitants in this branch.
  - It is also important to mention the Public Administration category with 5%, which corresponds to 5,215 inhabitants. Accommodation and food service activities with 5,089 inhabitants also have a percentage of 5%.
  - Public administration and defence, considered as an activity branch, comprises 5% of the Machala population; that is, 5,215 inhabitants are engaged in this activity.
  - The number of new employees reached 4,868 inhabitants, which represents a percentage of 4%.
  - The remaining percentage of the population ranges from 0% to 3%.

Table 76: Activity branches of the population of the Machala canton

ACTIVITY BRANCH	QUANTITY
Agriculture, livestock, forestry and fishing	14.244
Mining and quarrying	639,00
Manufacturing industries	7.670
Electricity, gas, steam and air conditioning supply	473,00
Water distribution, sewerage and waste management	487,00
Construction	7.593,00
Wholesale and retail trade	27.192
Transportation and storage	6.579
Accommodation and food service activities	5.089
Information and communication	1.301

Financial and insurance activities	362
Real estate activities	129
ACTIVITY BRANCH	**QUANTITY**
Professional, scientific and technical activities	1.615
Administrative and support service activities	2.384
Public administration and defence	5.215
Education	5.312
Human health care activities	2.768
Arts, entertainment and recreation	640
Other service activities	2.962
Household activities as employers	3.557
Activities of extraterritorial organizations and bodies	5
Undeclared	7.150
New employee	4.868
TOTAL	**108.234**

Source: *INEC- 2010 Census*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

SOCIOECONOMIC ACTIVITIES OF PUERTO BOLÍVAR

Puerto Bolívar is the main urban parish of the Machala canton, where one of the most important export ports in the country is located. It is estimated that approximately 85% of Ecuador's total banana production is marketed through the seaport of Puerto Bolívar.

However, other production and export activities are also developed around Puerto Bolívar, such as cocoa, coffee, shrimp, tropical fruits, timber, seafood and minerals, making Machala a centre of supply and trade for gold mining.

6.3.5. CHARACTERISTICS OF THE DWELLINGS

6.3.5.1. INFRASTRUCTURE AND ACCESS TO BASIC SERVICES

In 2010, there were 159,016 homes in the province, of which 97% had electricity, 56% had drinking water, 86% had garbage collection and 64% had sewage services.

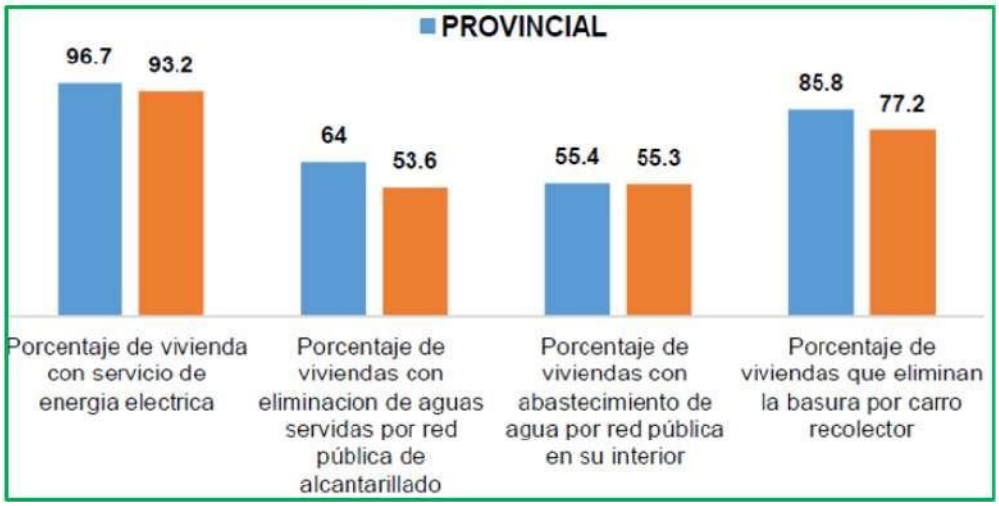
Table 77: Coverage of Basic Services in the province of El Oro

Territory Unit	Water Coverage (%)	Sewerage coverage (%)	Electric power coverage	Solid waste
El Oro	55,5	64,0	96,7	85,8
National	55,3	53,6	93,2	77,2

Source: *Social Indicator System of Ecuador, SIISE.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The coverage of basic services in the province of El Oro is above the national average, as shown in the following graph:

Picture 100: Coverage of basic services at the provincial to national level



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

6.3.5.2. COVERAGE OF BASIC SERVICES BY TERRITORY UNITS

Table 78: Basic Services Coverage by Canton and Area

Cantons	Total dwellings	Drinking Water		Sewerage		Electric power		Garbage collection	
		#	%	#	%	#	%	#	%
MACHALA	6416	37612	58,6	47790	74,4	62712	97,7	58895	91,79
Urban	3841	734	19,1	884	23	372	96,8	2443	63,6

Cantons	Total dwellings	Drinking Water		Sewerage		Electric power		Garbage collection	
		#	%	#	%	#	%	#	%
Rural	60319	36878	61,1	46906	77,7	58992	97,8	56452	93,59
TOTAL PROVINCE	**159016**	**88234**	**55,4**	**101845**	64	**153843**	**96,7**	**136343**	**85,74**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *April 20, 2017*

WATER PIPED THROUGH PUBLIC WATER SYSTEM

Table 79: Water Piped by Public Network cantons

Canton Province	Percentage	Number of dwellings	Total dwellings
EL ORO	79,4%	126.407	159.016
MACHALA	81,0%	52,01	64,16
Urban	84,0%	50.708	60.319

Rural	33,8%	1.302	3.841

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

WATER PIPED THROUGH PUBLIC WATER SYSTEM INSIDE THE DWELLING

Table 80: Water Piped by Public Water System inside the canton dwellings

Canton	Percentage	Housing	housing
EL ORO	55,4	88.234	159.016
MACHALA	58,6	37.612	64,16
Urban	61,1	36.878	60.319
Rural	19,1	734	3.841

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

SEWERAGE SYSTEM

Table 81: Sewerage system coverage by cantons

Canton Province	Percentage	Number of dwellings	Total dwelling
EL ORO	64,0	101.845	159.016
MACHALA	74,4	47.790	64.160
Urban	77,7	46.906	60.319
Rural	23,0	884	3.841

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.5.3. POPULATION ACCESS TO DWELLING

According to data from the National Institute of Statistics and Census (INEC) of the Results of the 2010 Population and Housing Census in Ecuador, the total number of homes in the province of El Oro amounts to 159,016 dwellings (163,290 households), of which 36,345 are located in rural areas and 122,671 in urban areas.

Regarding the quantitative housing deficit, there is a significant number of unrecoverable housing units: 27% of rural housing units (9,806 units) and 15.5% of urban housing units (18,881 units) are unusable. 37.6% of El Oro's housing has a qualitative housing deficit, which means that there are currently 59,846 homes that, due to their unsatisfactory quality, can be improved through repairs, replacement of materials, expansion of floor space or connection to basic services.

Table 82: Sewerage system coverage by cantons

HOUSING TENURE	HOUSEHOLDS	%
Owned and fully paid	72.956	44,7
Leased	36.169	22,2
Borrowed or loaned (not paid)	25.102	15,4
Owned (gifted, donated, inherited or by possession)	15.636	9,6
HOUSING TENURE	**HOUSEHOLDS**	**%**
Owned but not fully paid	9.502	5,8
By services	3.567	2,2
Antichresis	358	0,2
TOTAL	163.290	100%

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

In relation to basic services, the results of the 2010 Census show that the percentage of means of garbage disposal, sewage system and electricity service is higher than the national average. However, the exclusive hygienic service or the conventional telephone service present values below the average of the rest of the country. It should be noted that the use of firewood or charcoal for cooking is very low (1.59%) compared to the national average (6.80%).

Another important data that defines housing characteristics is what is used in households for cooking.

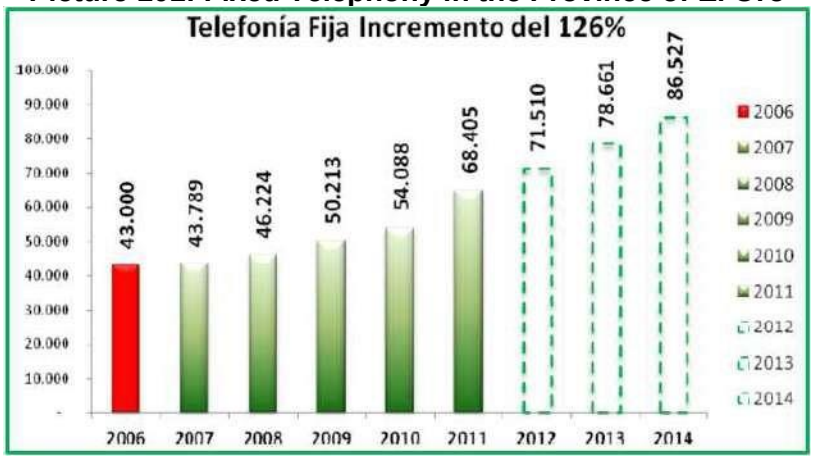
Basic housing services, including telephone service, have increased with respect to the 2001 Census. The largest percentage increase is in garbage disposal service by garbage cart.

6.3.5.4. ACCESS TO TELECOMMUNICATION SERVICES

In 2010, according to the National Institute of Statistics and Census (INEC), 36,120 homes had telephone service, or 22.7% of occupied homes with people present.

According to data from the National Telecommunications Corporation (CNT) El Oro Agency, at the beginning of 2007 only 43,000 users had fixed telephone service in the province of El Oro. With the deployment of the National Connectivity Plan in the province of El Oro, the infrastructure has increased by 126%, closing 2011 with 68,405 fixed telephony users.

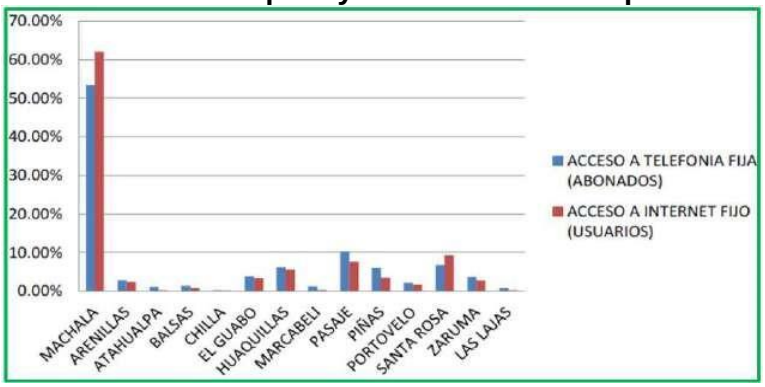
Picture 101: Fixed Telephony in the Province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Decentralized Autonomous Government of El Oro*
Date: *2014*

CNT has provided broadband internet service starting with speeds of 128Kbps, currently reaching speeds of 15 Mbps. Directly benefiting the student and productive sector of the province, up to the end of 2011, 17,114 Broadband Internet ports have been commercialized.

Picture 102: Access to Telephony and Internet in the province of El Oro



Source: *Territorial Development and Planning Plan of the Province of El Oro 2014 -2025.*
Prepared by: *Secretary of Planning of the Autonomous Decentralized Government of El Oro.*
Date: *2014*

According to the data obtained from the 2010 Census, we can determine that there is greater telephone and internet coverage in Machala Canton, followed by Pasaje and Santa Rosa, the cantons that have less coverage are Chilla and Las Lajas, due to the distance from the central office.

INFOCENTER

Infocenters are community spaces for participation and development, which guarantee inclusive access to Information and Communication Technologies for the populations of rural and marginal urban parishes in Ecuador.

The proposal is to introduce citizens to ICT knowledge in order to reduce the digital gap and illiteracy, motivating them to use technology to their advantage, thus improving their quality of life and promoting the productive development of their community, providing access to online products and services, both local and international.

Table 83: Access to telecommunication services in El Oro province

PROVINCE	COVER
Fixed telephony	37,12%
Mobile telephony	92,72%
Internet access	33,71%

Source: *Development Plan for the province of El Oro*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.5.5.5. HOUSING IN MACHALA CANTON

According to the 2010 Population and Housing Census, conducted by INEC, there are a total of 75,479 dwellings in the Machala canton. Of these, 72.9% are houses or villas, which is considered the highest percentage.

A 9.9% are apartments and a percentage of 7.92% are rooms in tenement houses. Farms add up to 4.10% and storage rooms 1.09%.

The remaining 4.09% is divided with percentages of less than 1% among dwellings considered as collective, nursing homes or orphanages, shacks, hotels, guesthouses houses, shelters, etc. As can be seen in the following table:

Table 84: Type of dwelling in Machala Canton

TYPE OF DWELLING	CASES	%
House/Villa	54.867	72.69
Apartment in house or building	7.541	9.99
Room(s) in a tenement house	5.975	7.92
Mediagua	253	0.00
Farm	3096	4.10
TYPE OF DWELLING	**CASES**	**%**
Storage room	824	1.09
Shack	108	0.14
Other private home	460	0.61
Hotel, guesthouse, hostel or inn	20	0.03
Military Barracks or Police/Fire Department	4	0.01
Social rehabilitation centre/prison	3	0.00
Shelter and protection centre for children, women and indigent people.	2	0.00
Hospital, clinic, etc.	11	0.01
Convent or religious institution	7	0.01
Nursing home or orphanage	1	0.00
Other group housing	24	0.03
No Housing	6	0.01
Total	75.479	100.00

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **DWELLING CCUPANCY CONDITIONS**
  Of the 71,401 dwellings considered by INEC during the 2010 Census, 85.09% are occupied by people present and 4.4% by people absent. While 7.65% are unemployed and 2.86% are under construction.

Table 85: Dwelling Occupancy Conditions in Machala Canton

Dwelling Occupancy Condition	CASES	%
Occupied by people present	64.016	85.09
Occupied by persons absent	3.317	4.40
Unoccupied	5.765	7.65
Under construction	2.159	2.86
Total	**75.401**	**100.00**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **MAIN ACCESS ROAD**
  As for the main access to a dwelling in Machala, according to INEC in its 2010 census, out of 75,401 homes, 53.80% have a paved, cobblestone or concrete street or road. With ballasted street or road with 23.42%. A percentage of 20.33% have a cobblestone street access road. While the remaining 2.45% have as an access road a pathway, a trail, rich, sea or lake.

Table 86: Main access road to a dwelling in Machala Canton

MAIN ACCESS ROAD TO A DWELLING	CASES	%
Cobblestone, paved or concrete streets or roads	40.566	53,80
Cobblestone street or road	15.328	20,33
Ballasted or dirt road or street	17.661	23,42
Road, path, chaquiñán (rural path)	1.639	2,17
River / sea / lake		0,05
Another		0,23
Total	**75.401**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **BASIC HOUSING SERVICES**
  According to the 2010 INEC census, basic public services include electricity, water, toilets and waste disposal. In Machala, the percentage of homes with basic public services is 67%.

- **WATER COVERAGE IN HOMES**

  Machala canton has potable water service and covers about 85% of the population. In the urban area the coverage of this service is 71%, while in the rural area it is 29%.

  Water is collected from the Casacay River and deep wells. Work is currently underway on the construction of a new drinking water treatment plant with a loan from the government of Denmark.

Table 87: Main source of water in Machala canton

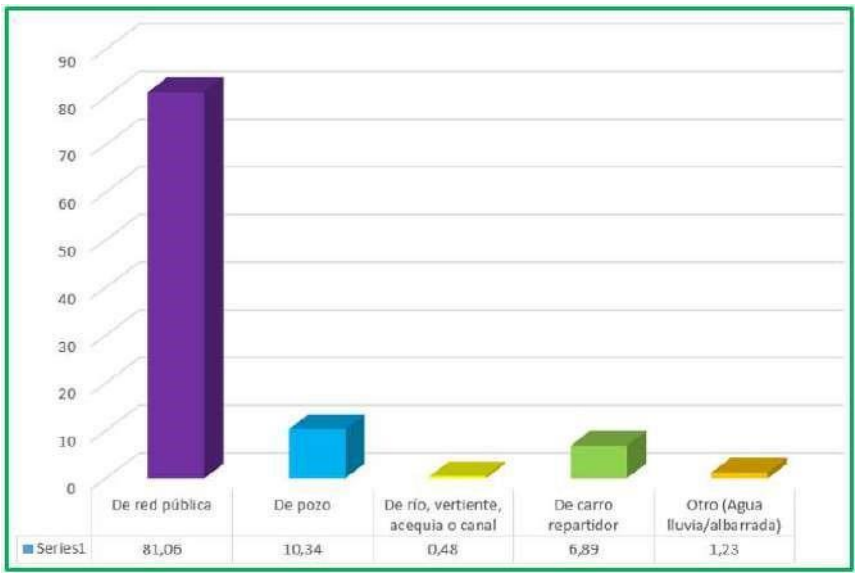
Main source of water received	CASES	%
Public system	52,01	81.06
Well	6,631	10.34
River, stream, ditch or channel	311	0.48
Delivery truck	4,42	6.89
Other (Water rain)	788	1.23
Total	**64,16**	**100.00**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

81.06% of the homes in Machala receive their water service from the public water supply. 10.34% receive it from a well, while 6.89% of the homes in Machala receive water from a delivery truck.

1.23% receives it from others (rainwater) and the remaining 0.48% receives it from rivers, springs, irrigation ditches or channels.

Picture 103: Water sources in Machala Canton



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

Piped Water Connection

64.17% of the households in Machala obtain water through pipes inside the house. While 23.06% obtain water by piping outside the dwelling but inside the building.

3.20% of the dwellings receive water through pipes outside the building or land. And 9.57% do not receive water through pipes, but by other means.

Table 88: Piped water connection in the Machala canton

Piped water connection	CASES	%
By piping inside the dwelling	41,174	64.17
By piping outside the dwelling but inside the building, lot or land	14,793	23.06
By piping outside the building, lot or land	2,054	3.20
It does not receive water through pipes but by other means	6,139	9.57
Total	**64,16**	**100.00**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The data shown in the table shows that 83.8% of the homes in Machala Canton have water service from the public network.

Picture 104: Piped Water Connection in Machala Canton

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

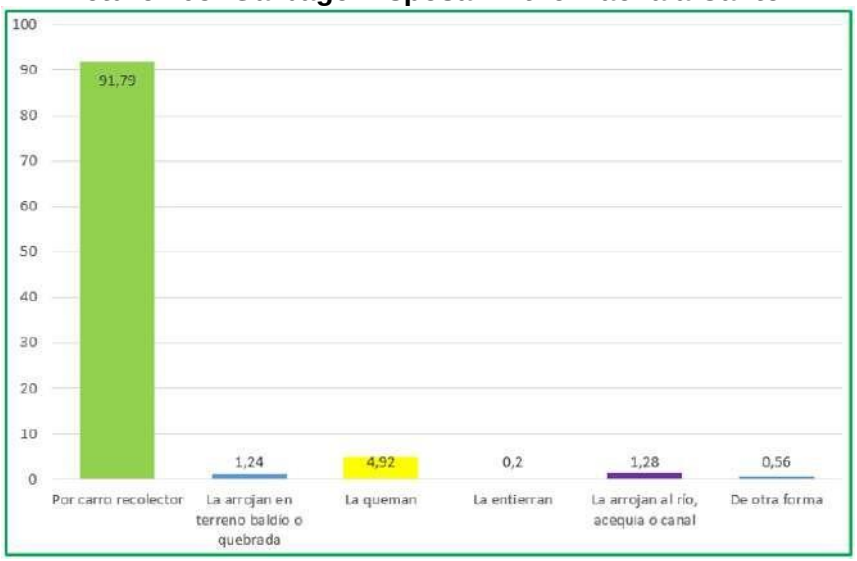
- **ARBAGE DISPOSAL IN HOMES**
  Of the 100% of households registered in the province of El Oro, according to the 2010 INEC Census, 91.79% of them dispose of their garbage by garbage truck. While 4.92% burn garbage and 1.24% throw it in vacant lots. Finally, the remaining 2.01% dispose of garbage in other ways.

Table 89: Garbage Disposal in the Machala canton

GARBAGE DISPOSAL	CASES	%
Garbage collector truck	58,895	91.79
Dumped in wasteland or creek	798	1.24
Burnt	3,154	4.92
Buried		0.20
Thrown into the river, ditch or channel.	822	1.28
Otherwise	360	0.56
Total	**64,16**	**100.00**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

Picture 105: Garbage Disposal in the Machala Canton



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **HOUSING TENURE OR OWNERSHIP**

In Machala canton, 41.16% of households own their homes and have paid for them in full. Homes that are owned but are currently being paid for amount to 8.42%. While borrowed or ceded housing corresponds to 14.49%.

Those considered to be owned (given, donated, inherited) correspond to 9%. Leased housing has an important percentage of 25.29%. And the remaining 1.09% correspond to housing for services and antichresis.

Table 90: Housing Tenure or Ownership in Machala Canto

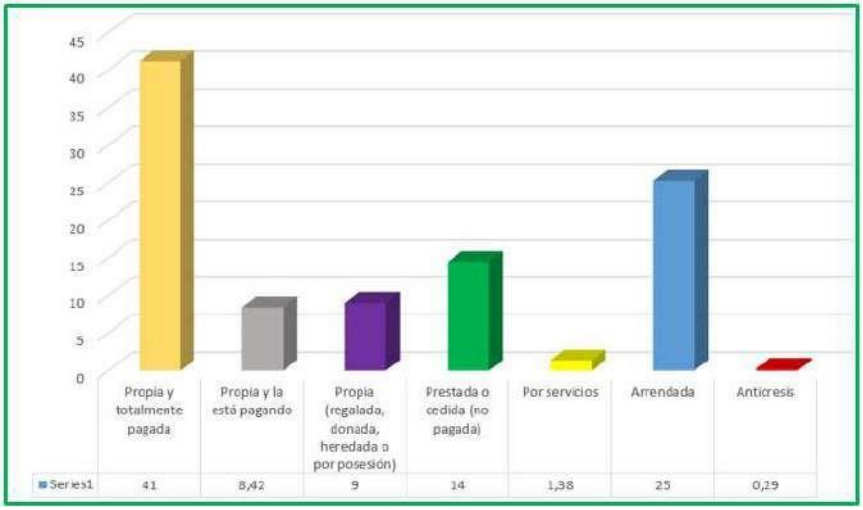
HOUSING TENURE OR OWNERSHIP	CASES	%
Owned and fully paid	27.144	41,16
Owned but not fully paid	555	8,42

Owned (gifted, donated, inherited or by possession)	5.935	9,00
Borrowed or loaned (not paid)	9.557	14,49
By services	910	1,38
Leased	16.657	25,26
Antichresis	190	0,29
Total	**65.943**	**100.00**

T

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

Picture 106: Tenure of Housing in Machala Canton



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **HOUSING CONSTRUCTION MATERIALS**

Roof Material

In Machala, the predominant roofing material used in the houses is zinc, which occupies 53.79%. The next material, in terms of percentage, is concrete (slab or cement) with 25.74%. And a percentage of 19.04% of the roof of the houses is for the supply. Tile is the predominant material in 1.15% of the houses in Machala.

The percentage of the roofs of the houses are made of palm, straw, leaves or other various materials.

Table 91: Roofing material of houses in Machala Canton

ROOFING MATERIAL	CASES	%
Concrete (slab, cement)	16.517	25,74
Asbestos (eternit, eurilit)	12.216	19,04
Zinc	34.512	53,79
Tile	739	1,15
Palm, straw or leaf	48	0,07
Other materials	128	0,20
TOTAL	**64.160**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

External Walls Material

Regarding the external walls of the houses in Machala, 62.20% are predominantly built with brick and block.

18.82% are of concrete and 4.68% are of uncoated reed; while 4.46% are of coated reed. Wood roofs account for 2.43% of the roofs and the remaining 0.24% are attributed to other materials.

Table 92: Material of external walls of houses in Machala Canton

MATERIAL OF EXTERNAL WALLS	CASES	%
Concrete	12.077	18,82
Brick or block	44.398	69,20
Adobe or mud	113	0,18
Wood	156	2,43
Coated cane or wattle-and-daub	286	4,46
Uncoated cane	3	4,68
Other materials	152	0,24
TOTAL	**64.160**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

Floor Material

In the Machala canton, the predominant material used for the floor of the houses is brick or cement, with a percentage of 46.17%.

In second place is ceramic, tile, vinyl or marble with 37.81%. A percentage of 11.01% of the floors of the homes in Machala are of untreated board.

Only 1.08% of the homes have hardwood, parquet, plank or floating floors. The remaining 3.93% is made of earth and other materials.

Table 93: Material of external walls of houses in Machala Canton

MATERIAL OF EXTERNAL WALLS	CASES	%
Stave, parquet, plank or floating floor	692	1,08
Untreated table	7.062	11,01
Ceramic, tile, vinyl, or marble	24.256	37,81
Brick or cement	29.625	46,17
Cane	169	0,26
Earth	1.989	3,10
Other materials	370	0,58
TOTAL	**64.160**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **MAIN FUEL OR ENERGY FOR COOKING**

In Machala, 96.34% of households use GAS as cooking fuel. Firewood and charcoal are used by 0.34%. While a percentage of 0.23% use electricity.

2.95% of households DO NOT cook. And 0.01% do so with vegetable or other waste.

Table 94: Main fuel for cooking in Machala Canton

MAIN FUEL OR ENERGY FOR COOKING	CASES	%
Gas (tank or cylinder)	63.532	96.34
Centralized gas	83	0.13
Electricity	151	0.23
Firewood, charcoal	224	0.34
Plant and/or animal wastes	1	0.00
MAIN FUEL OR ENERGY FOR COOKING	**CASES**	**%**
Other (e.g. gasoline, kerosene or diesel etc.)	6	0.01
No cooking	1.946	2.95
Total	**65,943**	**100.00**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **AVAILABILITY OF CONVENTIONAL TELEPHONE**

In Machala, 28.73% of its population has a conventional telephone in their homes. While 71.27% do not have this service.

Table 95: Availability of Conventional Telephone in Machala Canton

AVAILABILITY OF CONVENTIONAL TELEPHONE	CASES	%
Yes	18,943	28.73
No	47	71.27
Total	65,943	100.00

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **CELL PHONE AVAILABILITY**

According to INEC data, 84.20% of households in Machala have a cell phone and 15.80% do not have one.

Table 96: Availability of cellular telephone in the Machala canton

Availability of cellular telephone	CASES	%
Yes	55,523	84.20
No	10,42	15.80
Total	65,943	100.00

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **COMPUTER AVAILABILITY**
  According to INEC data from the 2010 census, 70.92% of households in Machala canton have a cell phone and 29.08% do not have one.

Table 97: Computer availability in the Machala canton

Computer availability	CASES	%
Yes	19,177	29.08
No	46,766	70.92
Total	65,943	100.00

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

- **INTERNET AVAILABILITY**
  16.73% of households DO HAVE INTERNET. And 83.27% do not have this service.

Table 98: Computer availability in the Machala canton

Internet availability	CASES	%
Yes	11,035	16.73
No	54,908	83.27
Total	65,943	100.00

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.6. ELECTRICAL ENERGY

The electric service in the province is provided by CNEL Regional El Oro, which since 1966, when it installed a thermal plant in Machala, has been gradually increasing its generation capacity and expanding its service network.

The insufficient provision of equipment and defective maintenance have conspired against an adequate electric service throughout the province. The incorporation of the provincial grid into the national interconnected system in 1987 alleviated the chronic deficiency.

Access to electricity is one of the elements that influence the quality of housing and, therefore, people's quality of life. According to INEC data, in 2010, 153,843 homes had public electricity service.

Electricity is supplied to the different communities of the Jambelí Archipelago by CNEL Regional El Oro through distribution networks.

In the case of CNEL Regional El Oro, as a company that generates provincial and regional development, its main function is to satisfy the requirements of its market, which are directly related to the demand for power and energy, which, according to the Electricity Sector Regime Law, must be delivered in optimal conditions of quality, continuity and in the desired opportunity.

6.3.6.1. PUBLIC LIGHTING

The Public Lighting system covers the entire concession area and includes everything related to the illumination of streets, avenues, squares, parks and multipurpose courts.

As of December 2011, there are a total of 62,787 luminaires, classified by type of light source, i.e. differentiating whether they are mercury vapour or high pressure sodium vapour, as well as classified by their unit power.

6.3.6.2. POWER GENERATION

There is electric power generation through the exploitation of gas from the gulf located in Bajo Alto.

Basically, it depends on the interconnected system, but the province has hydraulic resources that can help to sustain the energy consumption to be only hydroelectric, since the cost of the thermal power plants is very high, representing higher user tariffs.

The former INECEL gathered information on the province's generation capacity through small hydroelectric power plants.

- Generation plant on the Luis river located in Portovelo (15 Mw).
- Generation plant at Minas La Unión (320 MW).
- Tahuin dam hydroelectric power plant (1.5 MW).

The Autonomous Provincial Government of El Oro, with good criteria, requested the concession of waters in the sectors where energy can be generated in order to favour the province when this resource is exploited and is looking for partners to generate hydroelectric energy. In addition, in relation to wind energy, information is being gathered on the sectors that could generate this type of energy.

6.3.6.3. ENERGY SERVICE COVERAGE

Energy service coverage in housing, according to INEC's 2010 census, includes the use of energy-saving and conventional light bulbs in homes and the availability of a light meter.

Table 99: Electricity Sources in the Machala canton

ELECTRICITY SOURCES	CASES	%
Utility grid	62,712	97.74
Solar Panel	25	0.04
Light generator (Power plant)	43	0.07
Another	288	0.45
None	1,092	1.70
Total	**64,16**	**100.00**

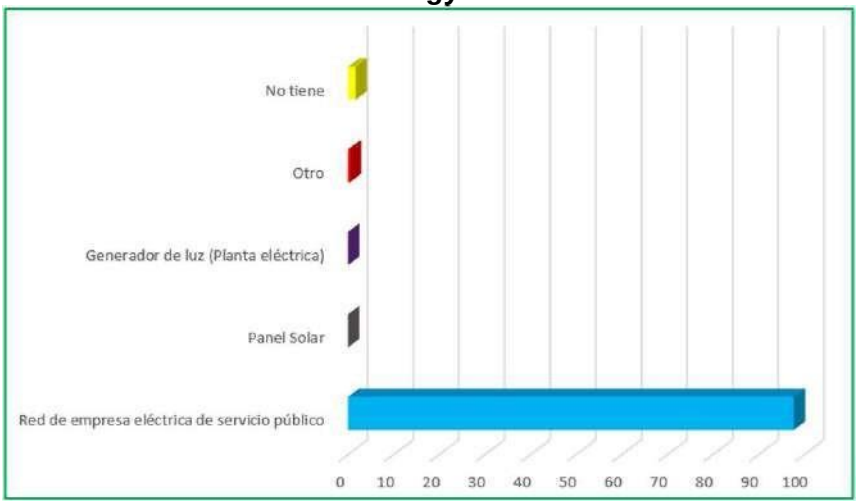
Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

97.74% of the homes in Machala receive electricity through the public electric company network, while 1.70% of the homes do not have this service, which corresponds to 1,092 homes in the canton.

A percentage of 7.7% receives electricity from an electric generator and 0.04% from solar panels.

And 0.45% of the homes receive electricity in Machala by other means.

Picture 107: Sources of energy in Machala Canton homes



Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.7. MIGRATORY MOVEMENTS

One of the demographic phenomena that has most affected Ecuador in general, and the Province of El Oro in particular, is emigration. For many years, part of the population of El Oro Province has emigrated, mainly to other countries for economic and labour reasons.

During the last 10 years, the migratory balance of El Oro Province has been negative. Specifically, in the five-year period 2001-2005, the migration balance in El Oro was -3.74‰, while in Ecuador the rate was positive (0.28‰). The following five-year period (2006-2010) shows a significant decrease in the migratory balance, both in the province and in Ecuador as a whole.

If we take as a reference the data from the 2010 Population and Housing Census, we can observe that the emigrant population in the 1990-2010 period in the province of El Oro is 13,529.

There is clear evidence that emigration has declined markedly in El Oro Province in recent years. As can be seen, in 2002 the number of people who emigrated from El Oro Province was 2880, while in 2010 only 570 people left El Oro Province. This trend shows an important change that can be very significant for El Oro Province. The permanence of the population in the territory is an indicative factor of its own development as well as a factor in its own development. Therefore, it is important to take into account this phenomenon, which is very important to analyse and deepen, since it responds to multiple variables and factors that must be taken into account in everything related to the planning of provincial development.

According to INEC in the 2010 census, of the 100% of migrants, 51% are men and 49% are women.

Table 100: Migrants by sex in Machala Canton

POPULATION	CASES	%
Man	3.336	51,0
Woman	3.205	49,0
TOTAL	**6.541**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

According to the year of departure from the country, considering the decade from 2001 to 2010, the largest number of migrants has been during 2002 with 1,349 people, corresponding to 20.62%.

The year in which the fewest people left the country during this period was precisely 2010, with 316 cases, which corresponds to a percentage of 4.83%.

Table 101: Years of departure from the country of the migrant from the Machala canton

YEAR OF DEPARTURE	CASES	%
2001	1.187	18,15
2002	1.349	20,62
2003	782	11,96
2004	408	6,24
2005	420	6,42
2006	370	5,66
2007	420	6,42
2008	471	7,20
2009	277	4,23
2010	316	4,83
2011	541	8,27
TOTAL	**6.541**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

According to INEC, 2010 census, the main reason for migrant travel is for work in a number of 4,482 cases and a percentage of 68.52%.

1,206 people have traveled for family union, with a percentage of 18.44%. While 557 people have traveled for studies, for a percentage of the total 8.52%.

And 296 people have traveled, representing 4.53% of the total number of migrants.

Table 102: Main reason for travelling of migrants from Machala Canton

Reason for travelling	CASES	%
Job	4.482	68,52
Studies	557	8,52
Family	1.206	18,44
Another	296	4,53
TOTAL	**6.541**	**100%**

Source: *INEC Census, 2010*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.8. ROAD NETWORK AND TRASNPORTATION

ROAD NETWORK

In the province of El Oro there are 400.94 kilometres of State Road Network and 2652.58 kilometres of Provincial Road Network, of which 1145.01 kilometres correspond to Strategic Axes and 1507.57 kilometres of local roads, without considering the bridle paths.

6.3.8.1. STATE ROAD NETWORK

The State Road Network is made up of a set of primary and secondary roads that register the highest vehicular traffic, intercommunicate the province capitals, canton capitals, international border ports with or without customs and large and medium-sized centres of economic activity, administered by the Ministry of Transportation and Public Works.

- **PRIMARY ROADS**
  Primary roads, or arterial corridors, comprise routes that connect border crossings, ports, and province capitals forming a strategic mesh. Their traffic comes from secondary roads (collector roads), must have high mobility, controlled accessibility, and adequate geometric standards.

  A primary road is considered a trunk road if it runs north-south, and transversal if it runs east-west. A total of 225.83 km of primary roads cross the province, defined as follows:
  - E25 Coastal Trunk Road.
  - E50 Transversal South.

- **SECONDARY ROADS**
  Secondary roads, or collector roads, include routes whose function is to collect traffic from a rural or urban area and carry it to the primary roads. The following secondary roads pass through the province for a total of 175.11 km:
  - E59 Cumbe - Y of Corralitos.
  - E583 Puerto Bolívar - Y of El Cambio.
  - E584: Pasaje - Y of El Enano.
  - E585: Y of Pasaje - Piñas - Y of Zaracay.

6.3.8.2. PROVINCE ROAD NETWORK

The Province Road Network of El Oro is the set of roads administered by the province government. According to the Road Plan 2014-2025, this network is composed of tertiary roads divided according to their importance in four strategic axes and local roads. The tertiary roads connect parish seats and production areas with the roads of the National Road Network and local roads, which have little traffic.

Table 103: Province road network

PROVINCE ROAD NETWORK	TOTAL KM
Main province strategic axis	488.90
Secondary province strategic axis	375.32
Main canton strategic axis	209.74
Secondary canton strategic axis	71,05
Country roads	1507,57
PROVINCE ROAD NETWORK	**2.652,58**

Source: *Territorial Development and Planning Plan Province of El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

18% (488.90 km) belong to the main province strategic axis, 14% (375.32 km) to the secondary province axis, 8% (209.74 km) to the main canton axis, 3% to the secondary province axis, 8% (209.74 km) to the main canton axis, and 3% (71.05 km) to the canton axis and 57% (1507.57 km) to country roads.

State of Road Network

In the province, 80% of the state roads are in good condition and only 20% are in poor condition. Regarding the current state of the province roads, according to the road report of the Department of Public Works as of December 2014, it has been analysed that only 6% of the total has a very good condition, 16% in good condition, while 68% of the total roads have a bad and very bad condition.

Table 104: Road conditions in the province of El Oro

PROVINCE ROAD NETWORK	Very Good	Good	Regular	Bad	Very Bad	TOTAL (KM)
Main province strategic axis	57,40	166,59	125,36	69,95	69,90	488,90
Secondary province strategic axis	66,80	91,16	119,46	79,20	18,70	375,32
Main canton strategic axis	21,35	44,09	12,18	121,98	10,14	209,74
Secondary canton 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
PROVINCE ROAD NETWORK	**154,35**	**414,16**	**469,52**	**1.33,35**	**283,20**	**2.652,58**
PERCENTAGE	6%	**16%**	**18%**	**50%**	**11%**	**100%**

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 202.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

The most relevant causes determined in the Province Road Plan 2014-2025 that cause 1614 .55 km of roads to be in bad and very bad condition are:

- Insufficient financial and operational resources to rehabilitate, provide periodic maintenance and routine maintenance of the roads.

- Indiscriminate use of the roads without the existence of maintenance in accordance with their use and the lack of consequent payment for the service in order to provide self-sustainability to the process.
- Lack of support from the private sector (Industries, Exporters, Carriers, etc.), in the management of the Province's road problem.

In addition, the strong winter seasons cause constant landslides due to the instability of the slopes in the upper part of the province.

In the "Type of Wearing Course" table, we can see that of the total of 2652.58 kilometres (excluding bridle tracks), 19% of the roads are asphalt; only 0.1% are paved; 43% are ballasted and 38% are dirt (natural soil); in other words, 81% are ballasted and dirt.

Table 105: Types of road surface in the Province of El Oro

PROVINCE ROAD NETWORK	Asphalted		Cobblestone	Ballasted	Earth (natural soil)	TOTAL KM
	DTSB	Asphalt layer				
Main province strategic axis	161,25	18,0		240,11	69,54	488,90
Secondary province strategic axis	69,56	97,75		162,01	46,00	375,32
Main canton strategic axis	13,12	33,85	1,46	107,69	53,62	209,74
Secondary canton strategic axis	14,20	14,68		42,17		71,05
Country roads	40,19	45,62		593,20	829,56	1.507,57
PROVINCE ROAD NETWORK	**298,32**	**209,90**	**1,46**	**1.145,18**	**997,72**	**2.652,58**
PERCENTAGE			**0,1%**	**43%**	**38%**	**100%**

Source: *Territorial Development and Planning Plan for the Province of El Oro 2014 - 202.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

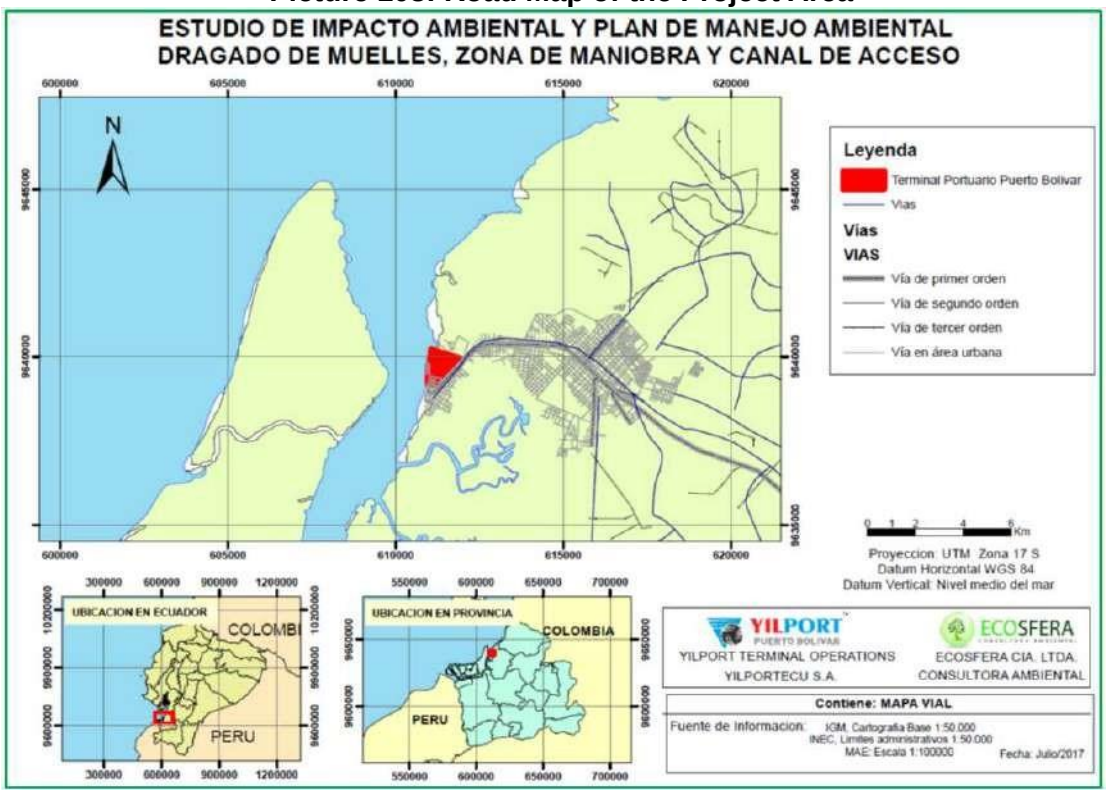
6.3.8.3. TRANSPORT NETWORKS

The transportation sector has grown and has the following characteristics:

- The main transportation system is **by land**. There are 18 cooperatives with 644 buses and vans for interprovince and intercanton transport. Heavy transport is provided by 7 cooperatives with 110 trucks and light cargo transport is provided by 12 cooperatives with 236 vans and light trucks; there are also 23 cab cooperatives with 608 units.
- **Air transport** has its main base in the new Santa Rosa Regional Airport, located in the city of Santa Rosa (Jumón Road), built during 2008 and 2010 by the Army Corps of Engineers. It is a civilian airport, with national operation, with international projection, and is administered by the General Directorate of Civil Aviation (DGAC).

- **Maritime transportation** is mainly from Puerto Bolívar, located in the northwest of the province, in the jurisdiction of the urban parish of Puerto Bolívar in the Machala canton. It is located south of the Gulf of Guayaquil, at the entrance of the Santa Rosa channel, protected by the Jambelí Archipelago. At a national level, Puerto Bolívar is the second most important port in the country, due to the volume of cargo it handles, since 80% of the national banana production is exported through it. It is a terminal that can handle all types of vessels and cargo: banana ships, refrigerated pallets and containers, dry containers, vehicles, machinery, coils and others.

Picture 108: Road Map of the Project Area



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal - Machala, El Oro*
Date: *July 10, 2017*

6.3.9. TERRITORIAL AND SOCIAL ORGANIZATIONS

The local stakeholders identified in the province of El Oro, in relation to land use planning, i.e. those who have a direct capacity to influence the land management process, are included in the following categories:

- Central State Institutions.
- Decentralized Autonomous Governments.
- Economic Stakeholders.
- Social Stakeholders.
- Higher Education Stakeholders.
- Central State Institutions.

GOVERNMENT INSTITUTIONS

Table 106: Government Organizations in the Province of El Oro

CENTRAL GOVERNMENT STAKE HOLDERS	COMPETENCE	RELATED SUBSYSTEM
Government	Representative of the executive in the province	Political - Administrative
Senplades	Coordination of the province, canton, and parish planning	Political - Administrative
MIDUVI Province Directorate	Housing Land Management (only for province)	Physical - Spatial - Political - Administrative
Ministry of Public Works Province Bureau	Infrastructure works Roads0	Physical - Spatial
Ministry of Agriculture, Livestock, Aquaculture and Fisheries Province Bureau	Productive development programs	Economic Productive
Ministry of Environment Province Bureau	Environmental Management	Ecological Territorial
Ministry of Mines and Petroleum Province Bureau	Mining Control and Development	Economic Productive
Ministry of Economic and Social Inclusion Province Bureau	Social development, employment	Economic Productive
SENAMI Province Coordination	Rights and integration of migrants	Cultural Partner Economic Productive

CENTRAL GOVERNMENT STAKEHOLDERS	COMPETENCE	RELATED SUBSYSTEM
National Department of Risk Management	Risk Prevention	Ecological Territorial
Binational Plan SENPLADES Loja Assistant Department	Economic Development	Economic Productive
National Institute of Irrigation (MAGAP - INAR) Province Bureau	Administrative and legal irrigation water management	Ecological Territorial
National System Port Authority Port of Puerto Bolívar	Economic Development	Economic Productive

Source: *Territorial Development and Planning Plan for the El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

In the province, there have been some dynamics of integration between the municipal and province levels of government, around territorial development proposals in the Jubones Basin, which comprises a territory of 436,170 hectares, which includes 3 provinces: Azuay, with the cantons of Nabón, Girón, San Fernando, Santa Isabel, Oña and Pucará; El Oro, with the cantons of Machala, El Guabo, Pasaje Chilla, and Zaruma, and the province of Loja with the canton of Zaraguro.

Based on this territorial element, municipalities and province councils have been integrated. The Jubones River commonwealth is made up of 12 municipalities, 2 province governments and about 45 parish councils, with a population of 241,552 inhabitants, most of which are in the lower middle basin, corresponding to the cantons of Machala, El Guabo, Pasaje Chilla and Pucará.

Another integration process occurs at the binational level between the border municipalities of southern Ecuador and northern Peru, within the framework of the Binational Development Plan for the Border Region, based on the peace agreements. It is oriented to the execution of binational development projects in the border area.

The municipalities of the province have an institutional space that allows the articulation of the 14 canton governments of the province in the Association of Municipalities of Ecuador - AME EL ORO; likewise, the Council of Rural Parish Governments of El Oro - CONAGOPARE, which brings together the 49 Rural Parish Boards of the province, is also constituted.

At the regional level, work is underway to build the Austro-South commonwealth between the provinces of El Oro and Azuay.

SOCIAL AND ECONOMIC STAKEHOLDERS

The economic stakeholders are all the sectors that develop productive activities and that are under some organizational form. Their union logic revolves around the defence and improvement of the conditions that favour the development of their activities; their relationship with land use planning is direct to the extent that these activities have an impact both on the territorial ecology (relationship with ecosystems, use of resources and energy, and environmental impact) and on the economic production (generation of employment and wealth; political pressure) and physical space (productive infrastructure).

Among the economic stakeholders identified in the province, we have the following:

Table 107: Civil Society Organizations in the Province of El Oro

CIVIL SOCIETY ORGANIZATIONS
Federation of Suburban Neighbourhoods of Machala (east, west and north)
FEPROCO Farmers Federation
National Board of Peasant Organizations
Association of Architects of El Oro
Association of Civil Engineers of El Oro
Bar Association
Association of Economists
Association of Biologists
Association of Sociologists
Association of Agricultural Engineers
Women's Movement (Piñas, Santa Rosa, El Guabo, Arenillas, Marcabeli)
Black Women's Movement of El Oro
Women from popular sectors
Province Association of Savings and Credit Banks (Asociación Province de Cajas de Ahorro y Crédito)
XXI Foundation
Women Leaders Forum
Colibrí Movement
Quimera Foundation
ESPOIR Foundation

Source: *Territorial Development and Planning Plan for the El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

Table 108. Economic stakeholders in the province of El Oro

ECONOMIC STAKEHOLDERS
Production Chambers Association of the province
Machala Chamber of Commerce
El Oro Chamber of Tourism
Chamber of Agriculture
Machala Agricultural Centre
Chamber of Small Industry
Chamber of Construction
Chamber of Industries of El Oro
Chamber of Mines
Chamber of Small Mining
Chamber of Microenterprises
Chamber of Craftsmen
Chamber of Shrimp Producers
Maritime Chamber of Puerto Bolívar
Province Cattlemen's Association

Canton Agricultural Centres (Arenillas, El Guabo, Pasaje, Santa Rosa, Las Lajas, Piñas, Zaruma, Atahualpa, Balsas, Marcabeli)
Santa Rosa Cattlemen's Association
Banana Growers Association
Cocoa Growers Association
Shrimp Farmers Association
Concheros Association
Fishermen's Association
Association of Processing Plants
Muluncay Miners Association
Atahualpa Sugarcane Growers' Association

Source: *Territorial Development and Planning Plan for the El Oro 2014 - 2025*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *April 20, 2017*

6.3.10. CUSTOMS AND TRADITIONS

Within the customs of religious faith and paganism, there is one in which a certain Christian image was worshiped, such as the commemoration of the Virgin of Mercy, who is our patron and protector, all these customs ended with a celebration or "party", the same that were tinged with prolonged and lively dances.

Another activity of singular distraction was that of bidding farewell to family and friends when the cabotage ships departed from Puerto de Bolívar, the coasting ships:

Olmedo, Bolívar, Jambelí, etc. to Santa Rosa or Guayaquil, before the completion of the Oro-Guayas highway.
The Machala inhabitant always liked seafood, which was available in abundance, even in the surroundings of the town, because especially in aguajes, the sea reached to where today we find the 9 de Octubre school and the airport. A great variety of seafood was offered by the fishermen who traveled through the centre of Machala, hanging from a pole over their shoulders.
Among the main festive events in the city of Machala are:

- Patron saint festivities: In honour of the Virgin of Mercy, celebrated on September 24 of each year, during these festivities the election of the World Banana Queen is held, with the participation of candidates from several producing and exporting countries of the fruit. In this month the Chamber of Industries Fairs, the Banana Fair, expo-sciences and artistic presentations take place.
- Cantonization Festivities: Celebrated on June 25 of each year, in which cultural and social events, literary contests, painting and handicraft exhibitions, civic-military parades and popular dances with artistic presentations are held.
- Arts Month: This is a national event, proposed by the Ecuadorian House of Culture, and is held during the month of August; the El Oro Centre of the House of Culture organizes a series of artistic and cultural events, painting exhibitions, etc., including free nautical excursions in Puerto Bolívar.
- Trolley Battle: In homage to the liberal movement that took place in Machala, on May 9, 1895, where the leader General Manuel Serrano stood out, supporting General Eloy Alfaro Delgado.
- Foundation of Puerto Bolívar: On December 18 of each year, since 1883, the anniversary of this important seaport, named in honour of the liberator of America, is celebrated.

6.3.11. TOURIST ATTRACTIONS

The main tourist attractions within the project area are:

- **Puerto Bolívar**
  Named in honour of the liberator Simón Bolívar. It communicates the province of El Oro with other ports in the world, since 85% of the national banana production is exported through it. In Puerto Bolívar you can enjoy the sea breeze, the landscapes, the beautiful sunsets and the delicious dishes made with seafood, especially the restaurants, known as the Best Ceviches of the World. On the other hand, Puerto Bolívar is the starting point to visit the Jambelí Island, the Love Island (Isla del Amor) and Santa Clara or the Island of the Dead (Isla del Muerto).

- **Old cabotage dock at Puerto Bolívar**
  It was inaugurated on May 9, 1902 and built by the engineer Gastón Thoret. The coasting ships that transported passengers and cargo to and from the city of Guayaquil and Santa Rosa (Puerto Pital, originally) departed from this site. There were several ships that offered this service, such as: Olmedo, Jambelí, Bolívar, Colón, Dayse Edith, Quito, etc. Until 1973 when the Oro-Guayas highway was completed. Currently it was remodeled, becoming an interesting place where a marine museum, belonging to the Casa de la Cultura and an elegant restaurant called El Viejo Muelle.

- **Jambelí Island**
  Machala is the starting point to this cozy island, located 35 minutes by boat from Puerto Bolívar. It should be noted that this island does not belong to this canton, however it is from Puerto Bolívar in Machala, where you take the boats to go to the archipelago; the tour becomes an exciting adventure, watching the attractive landscape, the variety of birds and mangroves in the area. Jambelí is the largest open sea beach of the archipelago and also the most populated; it has several restaurants, lodging, recreation and water sports. You can also visit the Geo-Mer marine museum.
  The shrimp industry is located towards the eastern part of the island, bordered by the Santa Rosa estuary, which restricts the possibilities for expansion of the tourist and residential zone.
  Currently the mangrove area has decreased, because with the beginning of shrimp production these areas have been exploited indiscriminately. As part of the tourism activities undertaken in the parish, especially in the community of Isla Costa Rica, an establishment has been set up in recent years to provide lodging for visitors to the area.
  In Costa Rica, Bellavista and Las Huacas have also implemented facilities to provide drinks and food to locals and strangers, with great success especially on holidays or other special events.

- **Isla del Amor (Love Island)**
  Located five minutes by boat from Puerto Bolívar, visiting it is a great experience for nature lovers and ideal for an ornithologist, since it is home to a variety of bird species, hence its name; birds nest and reproduce on this island.

- **Santa Clara Island**
  Located 90 minutes from Puerto Bolívar, it was a temple of ancient indigenous cultures, where remains of an Inca shrine were found. Also known as the Dead Man's Island, by virtue of the fact that, seen from a certain distance, it appears as the figure of a man lying down with the appearance of a dead man. Santa Clara has similar characteristics to those of the Galapagos Islands, such as the

volcanic structure and the fauna, since it is the habitat of birds, sea lions, iguanas, blue-footed boobies, frigate birds, etc. And during the months from July to September, there is the sighting of humpback whales which is one of the most anticipated attractions for foreign tourists.

- **Machala City**
  Tourist activity, although new to the Machala canton, has had a considerable increase in the last six years, which is demonstrated by the increase of tourist establishments in the city and in the province in general.
  Machala has 183 tourist establishments (qualified by the Ministry of Tourism) with a Tourist Operating License.
  The hotel plant has 60 lodging establishments, with an average of 3,180 beds.

7. DESCRIPTION OF THE PROJECT

The Puerto Bolívar Port Terminal carries out operations of export and import of products by sea, having an installation capacity of 1,705,877 tons and 258,678 containers. Berthing, storage, equipment and access to the Port are being carried out.

The Puerto Bolívar Port Terminal is a fundamental pillar of trade mobilizing 80% of the Ecuadorian banana production, being the second most important port in the country. In 2002, Puerto Bolívar mobilized 1,523,206 tons, which represents 17.66% of the total export cargo of the four commercial ports.

The most important export product that passes through Puerto de Bolívar is bananas (99.9% of total cargo), which is why it is often referred to as a banana port.

7.1. TECHNICAL CHARACTERISTICS OF THE PROJECT

The entrance of the ships to the berthing sites is made by a short access channel of 4.5 nautical miles with calm sea by the natural breakwater that constitutes the Jambelí Island and with a maximum time of half an hour of navigation, without interruptions 24 hours a day, 365 days a year.

The following table shows the main products mobilized at the Port Terminal:

Table 109: Main products mobilized at Puerto Bolívar

EXPORT	**TOTAL**
Banana boxes	21.727.943
Metric tons of bananas	445.341
Shrimp (containerized cargo)	20
Frozen fish (containerized cargo)	50
Mango (containerized cargo)	253
Banana box lids	2
IMPORT	**TOTAL**
Coils	27.270
Vehicles	1.178
Wooden bundles	655
Chassis	613
General merchandise (containerized cargo)	502
Pallets with corner pieces	156

Accessories	81
Hazardous cargo (pallets with ink)	52
Packages with parts for machinery	33
Van	32
QDC Pallets spare parts	24
Front loader	17
Slings	3
General merchandise	2
Plastic sleeves	2

Source: *Puerto Bolívar Modernization Project Private Initiative (2015)*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *July 10, 2017*

The total cargo mobilized by Puerto Bolívar in 2014 was 1'827,394 MT, the participation of mobilized cargo was as follows:

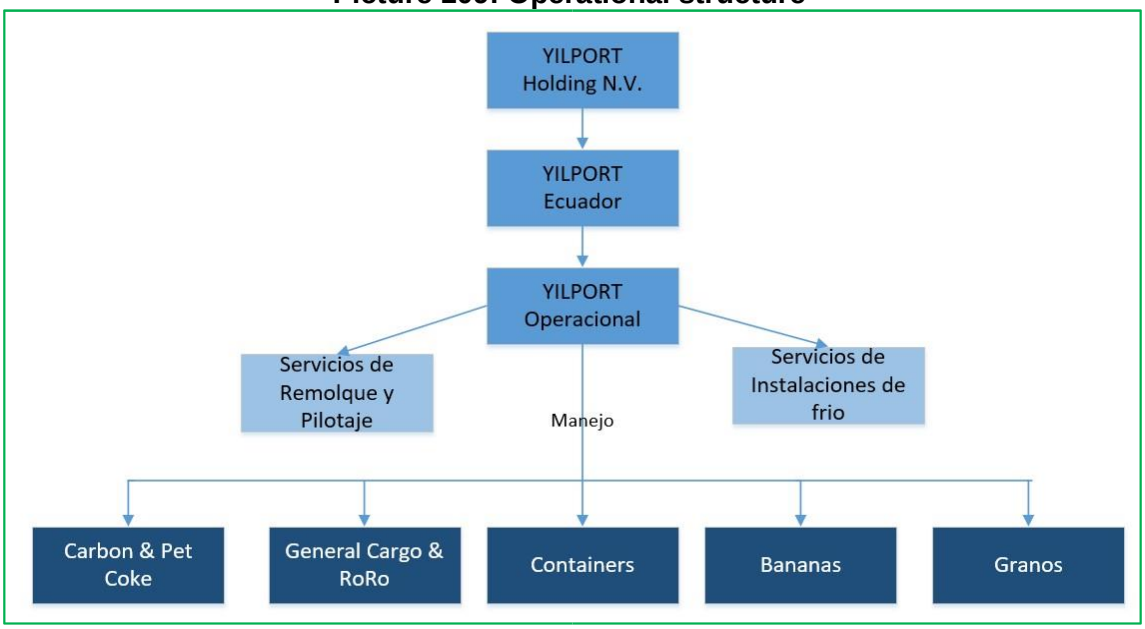
Table 110: Main products mobilized at Puerto Bolívar

TYPE OF LOAD	TONS (TM)	%
General	1’592.807	87%
Containerized	177.173	10%
Solid bulk	57.414	3%

Source: *Puerto Bolívar Modernization Project Private Initiative (2015)*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *July 10, 2017*

The operational structure is detailed in the following Picture:

Picture 109: Operational structure



Source: *Puerto Bolívar Modernization Project Private Initiative (2015)*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *July 10, 2017*

YILPORTECU S.A. for the operations of the Port Terminal subcontracts the services of:

- **Port Vessel Operators (OPB)**
  They are authorized to provide services to vessels, consisting of the management and execution of activities to assist vessels in accessing, staying and leaving ports and approaching and anchoring areas that are necessary for proper navigation and permanence.

- **Port Cargo Operators (OPC)**
  They are authorized to provide cargo services, which consist of the management and operation of cargo movement and storage in port areas and related activities.

- **Port Related Services Companies (ESC)**
  They consist of support or complementary management for port services.

7.2. ROADS

The of Puerto Bolívar Parish, where the Puerto Bolívar Port Terminal is located, has a transport network integrated by the road infrastructure that is quite developed, with multiple works of improvement and expansion that constitute a good transport road network for the handling of production; among the roads that can be named as outstanding for their magnitude, we have:

- The Guayaquil - Machala road axis (Route E40 and Route E25, distance 97 km, 1h17).
- Tumbes - Machala road axis (Route E25 and Route E50, distance 185 km, 3h)
- Cuenca - Machala road axis (Route E59 and E50, distance 168 km, time 3h17)
- Loja - Machala road axis (Route E35, E50 and E25, distance 233 km, time 4h20)
- Quito - Machala road axis (Route E25 and E87), distance 521 km, time 9h)
- Puerto Bolívar - Machala - Pasaje - Girón - Cuenca - Paute - Amaluza - Méndez - Puerto Morona road.
- Puerto Bolívar - Machala - Santa Rosa - Balsas - Chaguarpamba - Loja - Zamora - Yantzatza - El Pangui - Gral. Leonidas Plaza y Méndez road.

The Port Terminal is connected by first class roads to the following ports: Guayaquil 182 km, with Cuenca by Pasaje and Girón 180 km, with Loja 230 km and with Huaquillas 80 km, with Zamora 300 km and with Macas 440 km. Its geographical and commercial *hinterland* covers the southern sector of Ecuador, efficiently serving the provinces of El Oro, Azuay, Loja, Cañar, Zamora, the closest sector of the provinces of Guayas and Morona Santiago and northern Peru.

Locally, Puerto Bolívar is located 10 minutes by road from the city of Machala. The current system linking the city of Machala and its port with neighbouring areas, production centres, neighbouring provinces and the rest of the country is a well-functioning network.

The main access road to the port, Avenida Bolívar Madero Vargas, with two lanes in each direction, the new road to La Primavera, the road to Pajonal and the road to El Limon, all paved, cross the urban centre of Machala.

These, together with the north and south ring roads, constitute a circulation network that has so far ensured communication with the port.

However, there are congested sections, especially the section corresponding to the junction of the northern perimeter road with the congestion, especially in the section corresponding to the junction of the northern perimeter road with Avenida Bolívar Madero Vargas up to the entrance to the port facilities. This avenue was initially conceived as a development corridor linking Machala with the parish of Puerto Bolívar and not as a freight corridor. It is foreseeable that these problems will worsen as traffic flows increase due to the growth of exports and imports, as well as the development of new urban centres.
In 2001, the Puerto Bolívar Port Terminal already considered it necessary to build a road system that would efficiently contribute to the smooth flow of goods to and from the port *(Asociación DIPLAN-ASTEC, 2001).* There is currently a project for the construction of a northern access to Puerto Bolívar.

Picture 110: Project Access Roads

Source: *Google Maps*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *July 20, 2017*

Maritime access is from the sea buoy, 4.5 nautical miles to the port. Its depth is between 9 and 12 meters.
The time of entry or exit from an international navigation route to the sea buoy varies up to 3 hours and 45 minutes, depending on the wind that can change between 1.7 and 4.2 m/sec. And the average current speed is 1 knot (0.5m7sec).

7.3. LIFE CYCLE

The Puerto Bolívar Port Terminal Operation Project has a life cycle of 50 years.

7.4. LABOR

The personnel of YILPORTECU S.A. are detailed in the table below:

Table 111: Personnel by areas of the Port Terminal

WORK AREA	N°
GENERAL MANAGEMENT	2
LEGAL DEPARTMENT	1
OPERATIONS	34
HUMAN AND ADMINISTRATIVE RESOURCES	4
FINANCIAL DEPARTMENT	2

TECHNICAL PROJECT	3
MAINTENANCE	6
SALES AND MARKETING	4
DOCUMENTATION AND CUSTOMS	16
INDUSTRIAL SAFETY	1
INFORMATION TECHNOLOGY	1
ACQUISITIONS	1
SECURITY	12

Source: *YIPORTECU S.A.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *July 10, 2017*

In addition, it is necessary to emphasize that each Cargo, Vessel or Service Operator has its own personnel depending on the activities to be performed.

7.5. FACILITIES

The Puerto Bolívar Port Terminal has the necessary facilities for the mobilization and storage of export and import cargo.

The port area has a total surface area of 657,330 square meters. Its main facilities are:

- Administrative Building
- Warehouse
- Docks
- Storage Yards
- Parking
- Others

7.5.1. ADMINISTRATIVE AND OFFICE BUILDING

Administrative offices are available for the development of administrative activities, and some operators have their own offices on the premises.

The offices are strategically located according to the work organization. This area has all the necessary equipment. The walls and floors are tiled and are in good condition.

The different offices have excellent lighting and ventilation equipment for the comfort of the employees. Each employee in the area has a physical work space that is appropriate and adapted to his or her needs. This area has separate restrooms for both sexes.

Photograph 14: Administrative Areas

ADMINISTRATIVE AREAS






Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal*
Date: *July 10, 2017*

7.5.2. WAREHOUSES

The total area dedicated to storage at the Port Terminal is 218,240 m2, or 51.97% of the current land area.

The Port Terminal has 13 warehouses, both open and closed, with a total covered area of 26,054 m2, which is equivalent to 11.94% of the total storage area and 6.21% of the port's total area.
Open warehouses occupy 14,592 m2 (6.7% of the total), and closed warehouses occupy 11,462 ^{m}2 (5.3%).

The table below shows the existing warehouses of the Port Terminal, their surface area, use and location:

Table 112: Warehouses

AREA	SURFACE (m2)	USO	LOCATION
Warehouse 1	1,944	General cargo storage and other products	Next to the jetty, to the north of it. Warehouse closed
Warehouse 2	1,993	General cargo storage and other products	Next to the jetty, to the north of it, next to warehouse 1. Warehouse closed
Warehouse 3	2,016	General cargo storage and other products	Next to the jetty, to south of it, between warehouses 2 and 4. Warehouse closed
Warehouse 4	2,016	General cargo storage and other products	Next to the jetty, to south of it, next to warehouse 3. Warehouse closed
Warehouse 5	1,140	General cargo and other products	Between yard 3 and warehouses 6 and 7. Warehouse closed.
Warehouse 6	324	General cargo	Next to warehouse 5 and bordered to the south by the harbour fence
Warehouse 7	324	General cargo	
Warehouse 8	2,400	Palletized Banana	Between Terminal 4 and Yard 5. Opened warehouses.
Warehouse 9	2,400	Palletized Banana	
Warehouse 10	2,880	Palletized Banana	Between yard 5 and yard 8. Opened warehouses
Warehouse 11	2,880	Palletized Banana	
Warehouse 12	3,694	Palletized Banana, others	To the southwest, next to the APPB offices
Warehouse 13	2,043	General cargo	Next to Yard 3, at the rear of Warehouse 2. Closed warehouse (it is projected to be readapted)
TOTAL	**26,054**		

Source: *Puerto Bolívar Modernization Project Private Initiative (2015).*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Date: *July 20, 2017*

Photograph 15: Warehouses

WAREHOUSES

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar Port Terminal*
Date: *July 10, 2017*

7.5.3. DOCKS

The Port Terminal has 660 meters of second dock berthing line divided into three berths or terminals, Docks #3, #4 and #5. In addition, there is a 130-meter-long jetty, Dock #1: 130 meters Dock #2: 130 meters. Docks allow simultaneous berthing of up to 5 merchant vessels, which can be general cargo, container or bulk carriers.

7.5.3.1. JETTY

The jetty houses terminals (Docks) #1 and #2; and is an I-shaped reinforced concrete pile and slab jetty, with an apron of 130 meters long, 30 meters wide, and 12.5 meters deep for the simultaneous berthing of two vessels of up to 20,000 DWT, one on each side. This dock is connected to land by means of a 100 meters long and 14 meters wide gangway, whose axis is 300o with respect to the alignment of the coastline.

Photograph 16: Areas of Docks 1 and 2

DOCKS #1 AND #2

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Puerto Bolívar Port Terminal*
Date: *March 29, 2017*

7.5.3.2. SECOND DOCK

It is of piles and reinforced concrete slab, located on the alignment of the coastline, with a length of 660 meters, an old part of 360 m, a width of 15 meters, and 12.5 meters of draft allows the simultaneous berthing of up to three vessels of up to 20,000 DWT, one next to the other.

The old part of this 360-meter-long dock, which houses berths #3 and #4, is connected to land by three 27-meter-long, 14-meter-wide walkways that form two water mirrors.

Then there is a recent part of 300 meters long and a width of 38 m, and a depth of -14.5, connected to land by a platform that continues to the parts of storage, this dock houses the berth #5.

Photograph 17: Docks #3, #4 and #5

SPRINGS #3, #4 and #5

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Terminal Puerto Bolívar Port*
Date: *March 29, 2017*

The main characteristics of the Port Terminal Docks are described in the following table:

Table 113: Docks of Puerto Bolívar Port Terminal

DOCK	LOCATION	LONG (m)	WIDTH (m)	DRAFT (m over MLWS)	Features
#1	Jetty	130	30	-12,50	HA slab on piles
#2	Jetty	130	30	-12,50	HA slab on piles
#3	Secondary dock	180	25	-12,50	HA slab on piles
#4	Secondary dock	180	25	-12,50	HA slab on piles
	Secondary dock	300	38	-14,50	HA slab on piles

Sources: *Private Initiative for the Modernization of Puerto Bolívar, 2015.*
Location: *Puerto Bolívar Port Terminal, Machala - El Oro*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *June 15, 2017*

7.5.4. YARDS

The Puerto Bolívar Port Terminal has 9 yards occupying 192,186 m2, which is equivalent to 88.06% of the port's surface area dedicated to storage and 45.77% of the port's total surface area.

These are classified into paved yards (53.77%) and ballasted yards (46.23%), as detailed in the following table:

Table 114: Port Terminal Yards

AREA	SURFACE (m^2)	LOCATION	USO	FEATURES
Yard #1	9,793	Next to access road	Containers	Asphalted and enclosed by a wire mesh fence
Yard #2	3,989	To the south of Yard 1, it is the closest to the offices of the Puerto Bolívar Port Authority	Containers	Paved
AREA	**SURFACE (m^2)**	**LOCATION**	**USO**	**FEATURES**
Yard #3	1,506	West of Yard 1 and near the jetty, dedicated to equipment storage	Equipment	Paved with concrete. It is an open yard (no fence)
Yard #4	27,975	Next to the south terminal of the Second dock #3 (terminal 3)	Refrigerated containers *"reefers"*	Paved with asphalt and is fenced. It is equipped with sockets
Yard #5	8,242	Next to the north berth of second dock #4 (Berth 4) and surrounded by Warehouses 8, 9, 10 and 10. 11.	Vehicles	Its unfenced surface and paved with asphalt is used for the parking lot of vehicles
Yard #6	51,828	By the port fence	Vehicles and containers	Not fenced y asphalted
Yard #7	38,965	Surrounded by Yards 1, 4, 6 and 8	No use is currently being made of it	Open and unpaved
Yard #8	23,167	North of facilities between Yards 5 and 9	Container and vehicle storage	It is an open yard paved with concrete

Yard #9	26,721	North of Yard 6	It is used to perform container maintenance	Enclosed yard, paved with concrete
Yard #11	43,150	North of Yard 5	Containers	Open yard, paved with concrete
TOTAL	**218,240**			

Sources: *Private Initiative for the Modernization of Puerto Bolívar, 2015.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Puerto Bolívar Port Terminal, Machala - El Oro*
Date: *June 15, 2017*

Photograph 18: Yards

YARDS

Source: *Photographs taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Puerto Bolívar Port Terminal*
Date: *March 29, 2017*

In addition, within the Port Terminal there are other areas such as:

- Parking
- Maintenance Area
- Agro quality offices
- Service Entities
- Among others

7.6. DESCRIPTION OF ACTIVITIES

The activities carried out at the Puerto Bolívar Port Terminal are as follows:

- Administrative Activities
- Use of dock by Vessels.

- Full Container Transfer, "Ship to gate" (dock to gate)
- General Cargo Transfer, "Ship to gate".
- Banana Cargo Transfer, "Ship to gate".
- Container Storage
- General Cargo Storage in Yards
- Non-containerized General Cargo Storage in Warehouses
- Non-containerized General Cargo Storage in Special Warehouses
- Empty Container Transfer
- Container Restowage
- Vehicle Weighing
- Container Consolidation/Deconsolidation
- Refrigerated Container Power and Connection ("Reefers")
- Operations for Container Inspection and Gauging
- Operations for the Gauging or Inspection of non-containerized General Cargo.
- Container portering
- General Freight Forwarding
- Containers Reception / Dispatch
- General Cargo Reception / Dispatch
- Facility Use Fee for Tugboats.

The main activities carried out at the Port Terminal are detailed below:

7.6.1. USE OF ACCESS FACILITIES

It allows navigability for the safe entry of vessels into the port.

7.6.2. ANCHORAGE USE

By vessels to offer them the use of a safe and secure area while awaiting dock, cargo availability or for reasons justified by competent authority authorizing them to anchor.

7.6.3. USE OF DOCKS BY SHIPS

Consists of the use of the docks, apron and facilities of a site for the care of a ship, vessel or naval artefact requested by Shipowners, Ship Agents or their representatives.

7.6.4. TRANSFER OF FULL CONTAINERS

All stevedoring or unstowage, lashing or unlashing, loading or unloading, inland transportation, storage, issuance of documents of receipt or dispatch of full containers, Ship to Gate, Gate to Ship, Ship to yard and transfer of containers transshipment Ship to yard to Ship including its administration and management shall include all resources and activities necessary for the provision of such services.

7.6.5. GENERAL CARGO TRANSFERS

Including stevedoring or unstowing, lashing or unlashing, loading or unloading, inland transportation, warehousing, issuance of receiving documents or general cargo clearance, Ship to Gate and Ship to Yard, including their administration and management, and shall include all resources and activities necessary for the provision of services.

7.6.6. TRANSFER OF BANANA CARGO (GATE TO SHIP)

Set of activities that includes unloading from land transportation, reception, preparation for shipment, porterage, loading, stowage and lashing of banana export cargo not mobilized in containers.

7.6.7. GENERAL LOAD TRANSFER

Activities of stevedoring or unstowing, lashing or unlashing, loading or unloading, inland transportation, warehousing, issuance of documents for reception or dispatch of cement and bulk cargo, Ship to Gate, including their administration and management, and shall include all resources and activities necessary for the provision of such services.

7.6.8. STORAGE OF CONTAINERS

It is composed of the deposit of containers, which is the service of permanence and custody that is provided to the cargo that will remain in the places of deposit fixed by YILPORT, until its delivery to the consignees or those who represent it, and by the storage, service that consists of the care of the cargo during the time that it remains under custody of the company; which will be responsible for the custody of the cargo, according to the current legislation from the moment it receives and until its delivery to the consignee or its representative.

7.6.9. STORAGE OF GENERAL CARGO IN YARDS

Service of permanence and custody that is provided to the cargo that remains in the places of deposit fixed by the company YILPORT until its delivery to the consignees or those who represent them and for the storage, service that consists in the care of the cargo during the time that it remains under custody, according to the legislation in force from the moment it is received and until its delivery to the consignee or his representative.

7.6.10. STORAGE OF NON-CONTAINERIZED GENERAL CARGO AT WAREHOUSES

Deposit of non-containerized general cargo, which is the service of permanence and custody provided to the cargo that remains in the deposit warehouses set by YILPORTECU S.A. until its delivery to the consignees or those who represent it, and for the storage, service that consists of the care of the cargo during the time it remains under the custody of the company, from the moment it is received and until its delivery to the consignee or its representative.

7.6.11. STORAGE OF NON-CONTAINERIZED GENERAL CARGO AT SPECIAL WAREHOUSES

It is composed of the deposit of non-containerized general cargo, which is the service of permanence and custody provided to the cargo that remains in special warehouses until its delivery to the consignees or their representatives, and storage, a service that consists of the care of the cargo during the time it remains under the custody of YILPORTECUA S.A., which will be responsible for the custody of the cargo, according to current legislation from the time it is received until its delivery to the consignee or his representative.

7.6.12. TRANSFER OF EMPTY CONTAINERS

All activities of stowage or unstowage, lashing or unlashing, loading or unloading, inland transportation, storage, issuance of documents for reception or dispatch of empty containers, including their administration and management, and shall include all resources and activities necessary for the provision of such services.

7.6.13. CONTAINER RE-STOWAGE

- **Re-stowage via dock:** consists of a set of operational activities and resources necessary for the reordering of cargo that for operational reasons must be moved from the interior of the vessel to the dock and then from the dock to the vessel. This service varies according to the cargo conditions, i.e. full or empty containers whose final disembarkation is not at the Puerto Bolívar Port Terminal, the

issuance of documents evidencing the new location or stowage plans, including its administration and management, and will include all the resources and activities necessary for the provision of such services.

- **On-board re-stowage:** consists of a set of operational activities and resources necessary for the reordering of cargo that for operational reasons must be moved on board the vessel. This service will vary according to cargo conditions, i.e. full or empty containers.

7.6.14. WEIGHING OF VEHICLES

The set of weighing activities, by means of a properly calibrated scale, of trucks or other transport vehicles, with or without cargo, and the issuance of documents that record or certify the weight recorded, including their administration and management, and shall include all the resources and activities necessary for the provision of such services.

7.6.15. CONSOLIDATION AND DE-CONSOLIDATION OF CONTAINERS

It consists of arranging the operational actions and resources necessary for the filling, stowage and lashing of any type of cargo in a container and will include the issuance of documents that provide evidence of the operation, this service generally consists of:

- An area within the port enclosure is available for these operations.
- The cargo will be received in the established area, prior to the beginning of the operation, as long as it has complied with the legal formalities.
- Must include sufficient personnel and equipment to fill the container and lash the cargo inside the container

The container deconsolidation service consists of the set of activities of unbundling, unstowing and emptying of any type of cargo inside a container, and includes the issuance of documents that provide evidence of the operation, this service generally consists of:

- To have an area within the port enclosure to carry out these operations.
- With regard to deconsolidated goods, in the case of direct delivery, the cargo can be delivered on the consignee's truck platform or in the case of indirect delivery, the goods will enter the warehouse for storage.
- The container will be received in the established area, prior to the beginning of the operation as long as it has complied with the legal formalities.
- Must include sufficient personnel and equipment to empty the container - Cutting/removal of security seals on containers

7.6.16. CONNECTION AND POWER TO REFRIGERATED CONTAINERS (REEGERS)

It consists of the connection and disconnection of refrigerated containers to a power source, electrical power supply and monitoring, including the issuance of documents evidencing the operation, its administration and management and all the resources and activities necessary for the provision of such services.

7.6.17. OPERATION FOR GAUGING OR CARGO INSPECTIONS GENERAL NON-CONTAINERIZED OR CONTAINERIZED

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

This service applies to the following types of cargo: general cargo (AFG) or containerized cargo (AFC).

For the latter also includes the opening of the container, eventual deconsolidation, refilling, closing of the container. The interested party must request this service by signing the respective service request, when this is not the result of an imposition by the authorities.

7.6.18. CARRIAGE OF GENERAL CARGO OR CONTAINERS

Internal transportation or portage: is the transfer or transportation, including gathering or ungathering, stowage or unstowage in yards or warehouses, of general cargo (TPG) or container (TPC) inside the Terminal, including all the resources and activities necessary for the provision of such service.

7.6.19. RECEPTION AND DISPATCH OF CONTAINERS

- Receiving service: action of taking ISO containers from a means of land transportation, transferring them and placing them in their storage or storage place, including all the necessary resources to provide such services.
- Dispatch service: means taking the ISO measured containers from their storage or stockpiling place, transferring them and placing them on a means of land transportation, including all the necessary resources for the provision of such services. The securing or lashing of the containers on the means of transport will be the responsibility of the carrier designated by the end customer.

YILPORTECU will receive or deliver the containers through the authorized checkpoints, where it will issue the transfer of responsibilities document called EIR, which will indicate the status of the unit at the time of the exchange.

Hazardous cargo will not be allowed to enter the port facilities if it is declared as such in the system and does not have the corresponding labels (one per side of the container).

7.6.20. RECEPTION AND DISPATCH OF GENERAL CARGO

- Receiving service: the action of taking general cargo from a means of land transportation, transferring it and placing it in its storage or storage place, including all the resources necessary for the provision of such services.
- Dispatch service: means taking the general cargo from its place of storage or stockpiling, transferring it and placing it on a means of land transportation, including all the necessary resources for the provision of such services. The securing or lashing of the cargoes on the means of transport will be the responsibility of the carrier designated by the end customer.

YILPORTECU receives and delivers cargoes at the storage place, where it will issue the document of transfer of responsibilities called delivery/receipt record in which the state of the cargo at the moment of the exchange will be indicated.

Goods will not be disappointed if their packaging or container is deficient, damaged or in poor condition.
No IMO class cargo may enter Yilport without being labelled. At the customer's request, we can provide labelling services for IMO containers or IMO packages, which consists of placing the respective labels according to the IMO code.

No refrigerated cargo may enter YILPORTECU S.A. if it does not have the temperature charge issued by the exporter containing the instructions regarding the maintenance of the cold chain and/or conservation of the goods.

All general cargo received for both export and import must be labelled with sufficient information for proper storage according to international standards.

7.6.21. USE OF TUGBOAT FACILITIES

This service consists of making available to tugboat operators the infrastructure and facilities for the provision of their services to vessels arriving at the terminal.
The tugboats will use for their stay at the terminal, exclusively the docks enabled for this purpose.

7.7. NEW CONSTRUCTIONS

At the Puerto Bolívar Port Terminal, the lack of container handling capacity directs these volumes to other ports in the region, which increases the cost of the supply chain for bananas and in turn reduces competitiveness.

A cold storage plant is planned for Puerto Bolívar that would expand the current supply chain opportunities for the banana market. Puerto Bolívar could be positioned as a logistics hub for the banana market supply with value-added services such as increasing the shelf life of the product.

For grain storage and distribution, YPH will build several silos with a capacity of 45,000 MT, which will be expanded to 75,000 MT if demand requires it. Initially, horizontal transportation from the ship to the silo (import) will be done with dump trucks and hoppers, and later, depending on demand, will switch to conveyor belt systems.

Storage of coal, cement, pet coke or similar bulk materials will be open-air at first, with tarpaulins to cover them if necessary. This will evolve to closed silos, probably Dome type, when demand justifies it.

YILPORTECU will provide new tugboats (1 in principle), with greater power and traction, and will implement the necessary systems to improve pilotage and mooring.

7.7.1. CONSTRUCTION OF DOCK #6

YILPORTECU will start the construction of a dock (Dock #6) aligned with the previous one and of 450 m. additional, prepared for dredging to -16.5 m.

In addition, three more STS cranes, the necessary RTG's to service them efficiently, and the necessary auxiliary equipment will be acquired. This new dock will increase the annual container handling capacity to 900,000 TEUs. Likewise, the container yard capacity will be expanded to accommodate containers.

Expansion in facilities and equipment for traffic. It will be planned according to the demand and its requirements. YILPORTECU will carry out the works to be able to store up to 20,000 MT of fertilizer.

The structural configuration of the dock is based on a concrete platform supported on steel piles. The structural configuration is considered to be based on longitudinal and transverse beams to give it adequate strength to receive container ships with a deadweight of 197,000 tons.

The total length of the dock is 450 m and is considered in five 90 m segments, which are connected transversely to each other by shear keys. The total width of the dock is 100 m, this is the minimum width necessary to have a slope of 1:5 which, according to RHDHV's experience, is stable (a slope stability study is being developed in detailed engineering).
In the transverse direction, the dock is divided into two segments, the first segment is 55.7 m wide and there is a 2.8 m wide transition slab followed by a second 41.50 m segment.

The first segment will be dedicated to the typical dock structure and the second will be part of the container yard.

The structural arrangement of the platform has been made based on planned operations and expected loads, which are:

- General cargo, containers and bulk cargo with the use of Mobile Harbour Cranes (MHC) and small pneumatic unloaders.
- Container handling using Ship-To-Shore Cranes (STS)
- Earthquake loads

The location of the piles should, in principle, follow the location of the major and governing design loads.

Ship-To-Shore cranes are usually the equipment that originate the highest load reactions and determine the position of the pile alignment. With a distance to the edge beam of 2.75 m (8 ft) and a 100 ft (30.48 m) spacing between rails, these pile rows should be perfectly defined (with uniform spacing). Five pile spans between rails are considered. Therefore, the transverse spacings are 30.48/6 = 6.096 m (100 ft). In the transverse direction 16 piles are foreseen for a total width of 100m.

The longitudinal pile spacing has been defined as 3.0 m for piles located at the rail girder position and 6.0 m for other positions. The reason for choosing 6 m is the presence of the Mobile Harbour Crane model 7 (Gottwald 7608) which is very heavy (630 t) and, in addition, with spacings greater than 6.0 m there would be large bending moments.

The platform on the piles has been designed with the main beams spaced in the longitudinal direction above each pile row. The longitudinal beams have a height of 1.50 m and a variable width of 1.8 m at the bottom and 2.8 m at the top.

The height of 1.5 m is related to the capacity of the beams to take vertical loads from the deck while a variable thickness is related to the reduction of the transverse spans of the slabs. A 0.60 m slab is considered between longitudinal beams.

With the position of the longitudinal beams, the transmission of vertical loads to the piles is ensured, transverse loads are only required for specific loads such as mooring and berthing loads or to improve the capacity of the structure in the transverse direction.

In terms of berthing loads, it is necessary to consider a transverse beam between the axis on the seaward side of the platform and the first row of piles. The purpose of this is to support the fenders and transmit their loads to the structure.
The longitudinal beams are cast on a lost formwork of lean concrete. This formwork has a "U" shape and a thickness of 25 cm, which is not taken into account in the design of the beams. Therefore, the effective height of the beam is 1.25 m. For the case of the slab in general, the approach has been different. As shown in the construction chapter, the slabs are composed of a 25 cm thick pre-slab and a 35 cm cast-in-place slab working together with an effective height of 0.60 m, the bond between both phases of the slab is achieved with the use of stirrups.

As previously mentioned, the total length of the dock is 450 m divided into five structures (each 90 m long). The function of the shear keys is to prevent transverse differential displacements between dock segments causing misalignment between the STS Crane rails.

The transverse displacement tolerance in the expansion joint is 0.30 m in order to prevent the separation of the structural bodies colliding against each other during an earthquake.

Four shear key connections to allow shear (horizontal loads) to be transferred across the joints and to connect the structures. This transfer of loads in the transverse direction ensures that the different structures work together and have the same horizontal displacements when subjected to large horizontal loads such as during an earthquake. Each shear key consists of a tongue and groove connection.

SCN1600 fender cones and panels are required for the dock, which need to be attached to the dock structure. However, the diameter of the fenders is too large to simply place them on the cantilever slab, a surface of 3.60 x 3.50 m is required. Thus, a cross beam is required every 18 m to allow for the installation of the fenders. Gradual transitions in the concrete section should be provided in order to prevent stress concentration and localized spalling or cracking that could occur considering the high loads on the fenders.

After the gradual reduction of their section, the beams present a constant geometry with 1.5 m height and 1.8 m thickness. In order to balance the bending moments, the beams in the fenders end only at the B axis.

In terms of the construction method, the beams in the fenders follow the same procedures as the longitudinal beams. This means that they are poured on top of a lost formwork of 25 cm thick concrete with an effective height of 1.25 m.

In addition, in the future we plan to build a refrigerated warehouse for storage or pre-cooling of bananas, or other perishables that need it. It will have a modular design, both in terms of the refrigeration equipment and the structure. It will have a capacity of approximately 30,000 m3, and will be easily expandable according to demand.

This warehouse will improve the quality of bananas and their life cycle within the cold chain. It will also offer new opportunities for Ecuador's perishable product exporters.

7.7.2. FUTURE ACTIVITIES TO BE DEVELOPED

The construction of the new facilities involves the following activities:

7.7.2.1. DOCK #6

- Area cleaning
- Excavation
- Pile driving
- Filling
- Concrete works
- Pavement

7.7.2.2.2. TERMINAL YARD

- Cleaning and demolition
- Yard excavations
- Water piping (potable, sewage, firefighting system)
- Wiring electrical systems
- Terminal yard backfill works
- Terminal yard and dock paving
- Building area pavement

7.7.2.3. ELECTRICAL BUILDINGS AND MINOR WORKS

- Construction of main sub-station
- Construction of various sub-stations

- Foundations for light poles
- Fire water tank & pump house foundation
- Reefer Platforms
- RTG Washer and Sedimentation Tank
- Fuel Station
- Emergency generator station
- Perimeter wall & interior fence

7.7.2.4. WATER SYSTEMS

- Installation of fire water tank
- Pump installation
- Tests and trials

7.7.2.5. ELECTRICAL SYSTEMS

- Installation of Main Sub-Station
- Installation of various sub-stations
- Light pole installations
- Tests and trials

7.7.2.6. WORKSHOP

- Foundations
- Construction of new workshop
- Installation of maintenance shop equipment and finishes

7.7.2.7. ENTRANCE DOORS

- Construction of entrance doors
- Installation of electrical wiring
- Concrete works of scales
- Installation of scales
- OCR Installation

7.7.2.8. ADDITIONAL WORKS

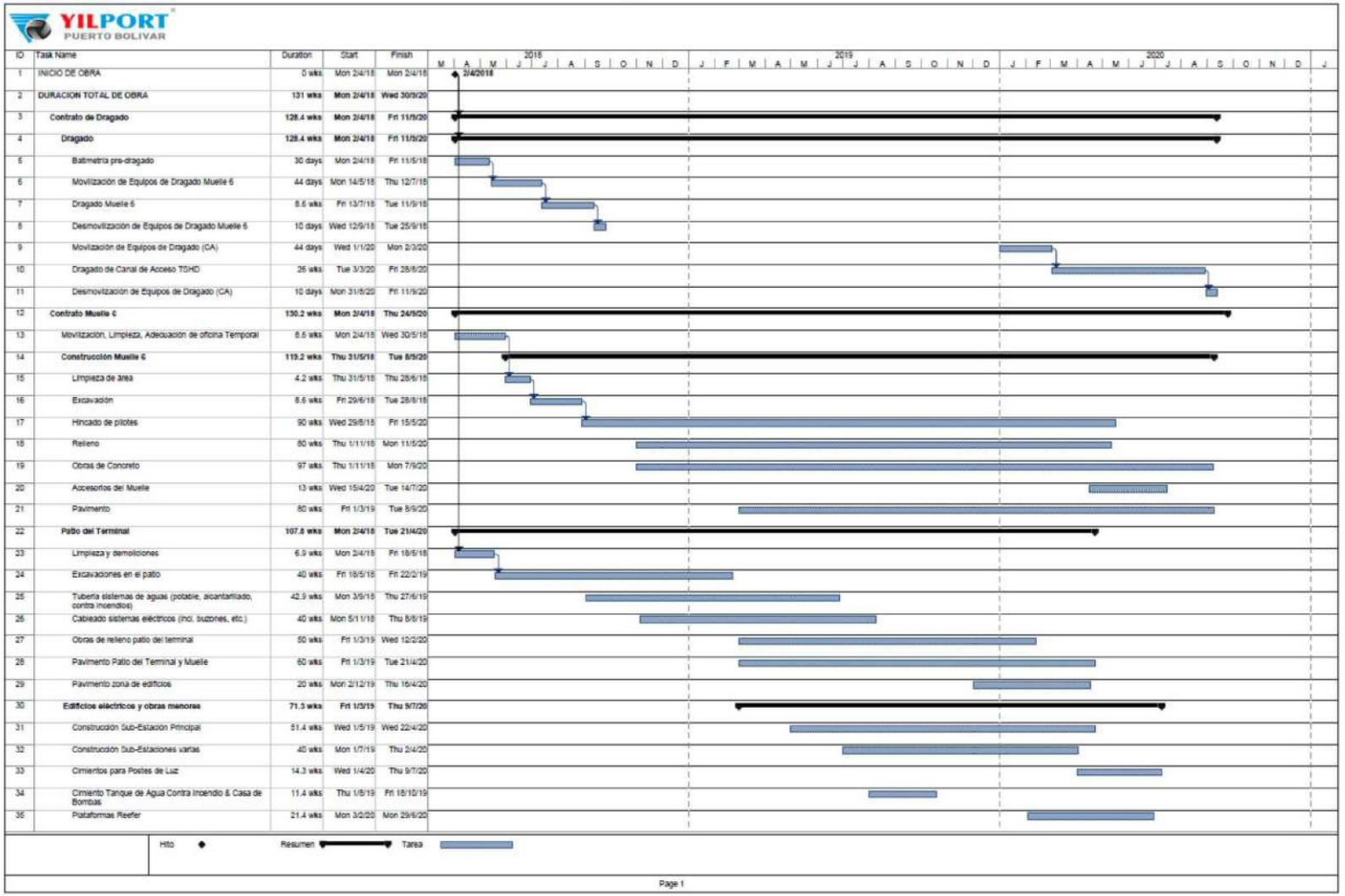
- Slope stability in dock
- Fire alarm system

7.7.3. DOCK EQUIPMENT #6

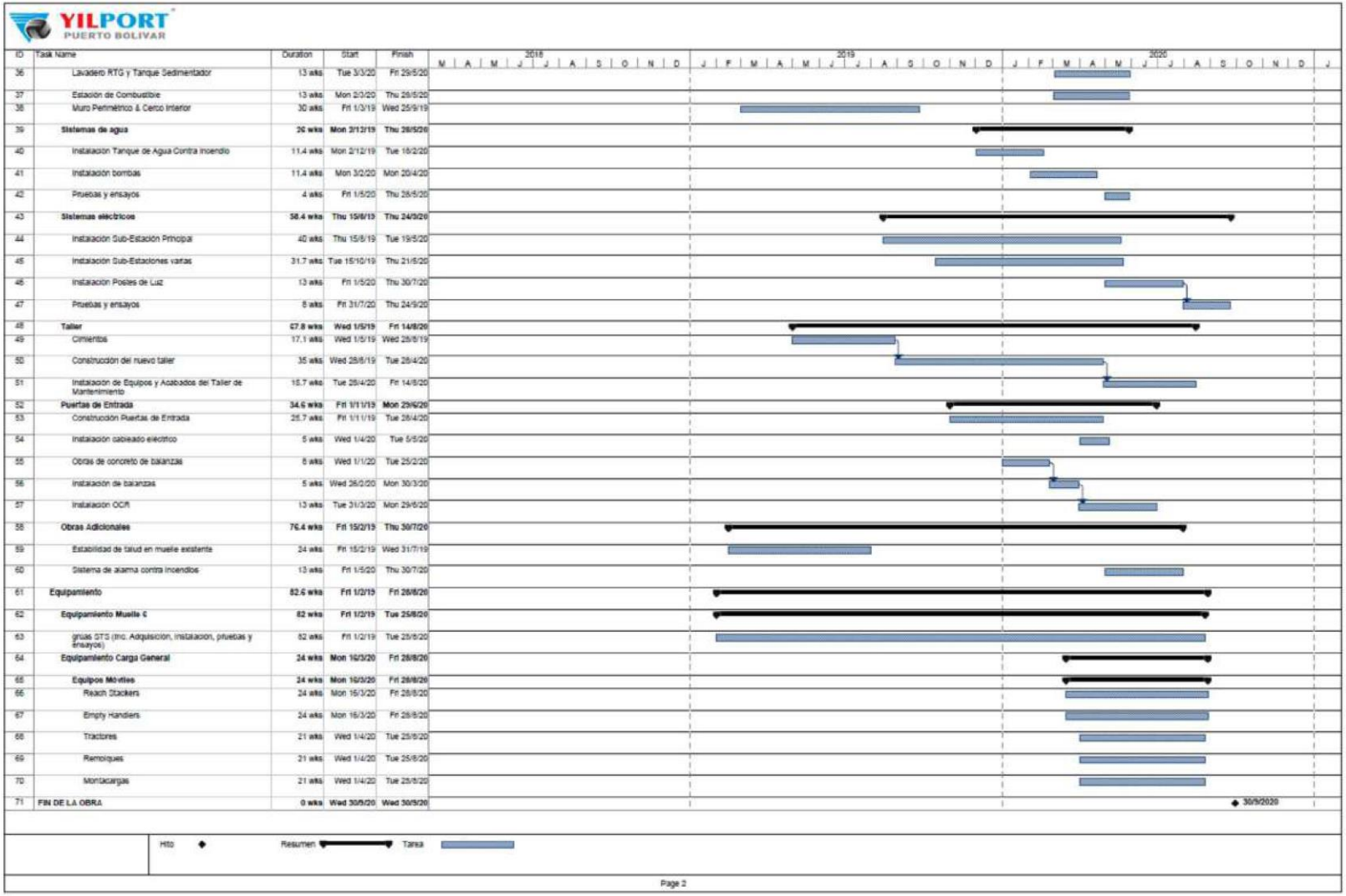
- Cranes (Acquisition, installation, testing, trials and commissioning)
- General cargo equipment
- Mobile equipment
  - o Reach Stackers
  - o Empty container applicators
  - o Empty Handlers
  - o Tractors
  - o Trailers
  - o Forklifts
  - o Forklifts

The following is the schedule of activities:

Picture 111: Schedule for carrying out activities



ID	Task Name	Duration	Start	Finish
1	INICIO DE OBRA	0 wks	Mon 2/4/18	Mon 2/4/18
2	**DURACION TOTAL DE OBRA**	**131 wks**	**Mon 2/4/18**	**Wed 30/9/20**
3	**Contrato de Dragado**	**128.4 wks**	**Mon 2/4/18**	**Fri 11/9/20**
4	**Dragado**	**128.4 wks**	**Mon 2/4/18**	**Fri 11/9/20**
5	Batimetria pre-dragado	30 days	Mon 2/4/18	Fri 11/5/18
6	Movilización de Equipos de Dragado Muelle 6	44 days	Mon 14/5/18	Thu 12/7/18
7	Dragado Muelle 6	8.6 wks	Fri 13/7/18	Tue 11/9/18
8	Desmovilización de Equipos de Dragado Muelle 6	10 days	Wed 12/9/18	Tue 25/9/18
9	Movilización de Equipos de Dragado (CA)	44 days	Wed 1/1/20	Mon 2/3/20
10	Dragado de Canal de Acceso TSHD	26 wks	Tue 3/3/20	Fri 28/8/20
11	Desmovilización de Equipos de Dragado (CA)	10 days	Mon 31/8/20	Fri 11/9/20
12	**Contrato Muelle 6**	**130.2 wks**	**Mon 2/4/18**	**Thu 24/9/20**
13	Movilización, Limpieza, Adecuación de oficina Temporal	8.6 wks	Mon 2/4/18	Wed 30/5/18
14	**Construcción Muelle 6**	**119.2 wks**	**Thu 31/5/18**	**Tue 8/9/20**
15	Limpieza de área	4.2 wks	Thu 31/5/18	Thu 28/6/18
16	Excavación	8.6 wks	Fri 29/6/18	Tue 28/8/18
17	Hincado de pilotes	90 wks	Wed 29/8/18	Fri 15/5/20
18	Relleno	80 wks	Thu 1/11/18	Mon 11/5/20
19	Obras de Concreto	97 wks	Thu 1/11/18	Mon 7/9/20
20	Accesorios del Muelle	13 wks	Wed 15/4/20	Tue 14/7/20
21	Pavimento	80 wks	Fri 1/3/19	Tue 8/9/20
22	**Patio del Terminal**	**107.8 wks**	**Mon 2/4/18**	**Tue 21/4/20**
23	Limpieza y demoliciones	6.9 wks	Mon 2/4/18	Fri 18/5/18
24	Excavaciones en el patio	40 wks	Fri 18/5/18	Fri 22/2/19
25	Tuberia sistemas de aguas (potable, alcantarillado, contra incendios)	42.9 wks	Mon 3/5/18	Thu 27/6/19
26	Cableado sistemas eléctricos (incl. buzones, etc.)	40 wks	Mon 5/11/18	Thu 8/8/19
27	Obras de relleno patio del terminal	50 wks	Fri 1/3/19	Wed 12/2/20
28	Pavimento Patio del Terminal y Muelle	60 wks	Fri 1/3/19	Tue 21/4/20
29	Pavimento zona de edificios	20 wks	Mon 2/12/19	Thu 16/4/20
30	**Edificios eléctricos y obras menores**	**71.3 wks**	**Fri 1/3/19**	**Thu 5/7/20**
31	Construcción Sub-Estación Principal	51.4 wks	Wed 1/5/19	Wed 22/4/20
32	Construcción Sub-Estaciones varias	40 wks	Mon 1/7/19	Thu 2/4/20
33	Cimientos para Postes de Luz	14.3 wks	Wed 1/4/20	Thu 9/7/20
34	Cimiento Tanque de Agua Contra Incendio & Casa de Bombas	11.4 wks	Thu 1/8/19	Fri 18/10/19
35	Plataformas Reefer	21.4 wks	Mon 3/2/20	Mon 29/6/20



Source: *YILPORTECU S.A. Company.*
Prepared by: *YILPORTECU S.A.*
Date: *July 20, 2017*

7.8. MACHINERY AND EQUIPMENT

The equipment and machinery located at the Puerto Bolívar Port Terminal are described in the following table:

Table 115: Machinery and Equipment

UNIT	MACHINERY	TYPE	CAPACITY
1	Jubones River Tugboat	Tugboat	1500 HP per motor (2 motors)
1	Puna Island Tugboat	Tugboat	900 HP per engine (2 engines)
1	Tomebamba Tugboat	Tugboat	750 HP per engine (2 engines)
1	Arenillas Tugboat	Tugboat	400 HP per motor (2 motors)
1	Containership	Containership	45 t
4	Containership	Containership	35 t
1	Containership	Containership	10 t
1	Head and Platform	Terminal Truck	35 t
12	Head and Platform	Terminal Truck	30 t
10	Head and Platform	Terminal Truck	20 t
23	Electric forklift	Electric Pallet Truck	2 t
21	Pallet Truck	Pallet truck	1 t
12	Forklift	CPQYD 30	3,0 t
4	Forklift	GP30-G/LP	2,8 t
46	Forklift	6FGU25	2,5 t
6	Forklift	5FDC20	2,0 t

Sources: *Private Initiative for the Modernization of Puerto Bolívar, 2015.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Puerto Bolívar Port Terminal, Machala - El Oro*
Date: *June 15, 2017*

For future construction, various equipment will be used as described in the following table:

Table 116: Machinery and Equipment construction activities

MACHINERY AND EQUIPMENT
Crawler cranes
Marine platform
Cantitravel structure

Concrete mixer trucks
Tractors
Excavator
Gantry cranes
Barges and tugboats
Auxiliary equipment

Sources: *YILPORTECU S.A. Company.*
Prepared by: *Ecosfera Cía. Ltda., 2017*
Location: *Puerto Bolívar Port Terminal, Machala - El Oro*
Date: *July 25, 2017*

7.9. MATERIALS AND INPUTS

The materials and inputs used at the Port Terminal include a large number of materials and supplies in accordance with the development of the different activities. Among the most important we can highlight:

- Diesel
- Lubricants
- Oils
- Electricity
- Water

The materials to be used in the construction of the new facilities are:

- API 5Lx52 or S355 jr tubular steel piles
- Concrete f'c of 420 kg/cm2 w/c ratio 0.40 cement type IP or V
- Epoxy paint for piles
- Welding electrodes for piles
- Cathodic protection for piles
- Steel reinforcement fy = 420 kg/cm2 type ASTM A616 GR60
- Aggregates for concrete
- Reinforcing elements for temporary works
- SCN spring fenders with accessories
- Bollards
- Crane rails
- Electrical equipment
- Sanitary equipment, water pipes
- HDPE pipes
- Rock and gravel for slope protection and revetments
- Sand for backfill
- Geotextile
- Paving block, asphalt

8. ANALYSIS OF ALTERNATIVES

The Puerto Bolívar Port Terminal is an expost type project, so an analysis of alternatives is not required; however, as mentioned above, new constructions will be carried out, the most important of which is the construction of Dock #6.

8.1. DESCRIPTION OF ALTERNATIVES

The construction of Dock #6 involves the placement of piles that are the foundation for the dock.

The alternative to be selected will consider the technical, environmental and economic aspects of the project.

8.1.1. ALTERNATIVE 1

Steel piles, driven

For this alternative the first iteration for the pile diameter is 914 mm with a wall thickness of 25 mm (reduced thickness is 21 mm if corrosion allowance is considered).

The advantage of steel piles is that they can be perfectly driven for the soil conditions of the site. The construction process is fast.

8.1.2. ALTERNATIVE 2

Concrete piles, driven

The driven concrete piles work well and the capacity of the piles is slightly less than steel piles (considering the same diameter of 914 mm). However, considering the expected embedded depth of these piles, their weight becomes quite significant and will require heavy lifting equipment.

An alternative would be to consider a larger diameter with the consequent increase in the quantity of the same, which in the end represents a longer construction time.

8.1.3. ALTERNATIVE 3

Concrete piles, drilled

For this alternative a steel casing can be used and, considering the diameter of the piles, a minimum pile thickness of 12 mm will be required. Moreover, considering the geotechnical conditions: soft and unstable soil layers, it will be necessary to bury them to the base of the piles to avoid pile failure. This makes the design costly due to the fact that a steel jacket + reinforcing steel has to be provided.

8.2. ANALYSIS OF ALTERNATIVES

After the analysis and evaluation of the alternatives, it was concluded that the most feasible alternative for the project from the economic, environmental, technical and operational point of view is Alternative 1.

This alternative has been chosen because this type of pile has a good performance under seismic loads.

It is important to point out that the growing development of trade and the evolution of maritime transportation require ports to expand their infrastructure and modernize their equipment in order to provide an efficient service in the treatment of cargo handled in large volumes and in various forms, which has an impact on the economic development of the area of influence.

9. DETERMINATION OF AREAS OF INFLUENCE

The methodology for determining the area of influence is based on the characterization of the area in its different components (baseline) and the location of the project, for which criteria were considered that are related to the geographical scope, duration and environment, which are translated into spatial, administrative and ecological limits.

The area of influence is considered to be the entire surface area of the project where the operational activities of the Puerto Bolívar Port Terminal are carried out. The area of influence is the zone or spatial area where the possible socio-environmental impacts, positive or negative, resulting from the development of a new project or activity are manifested.

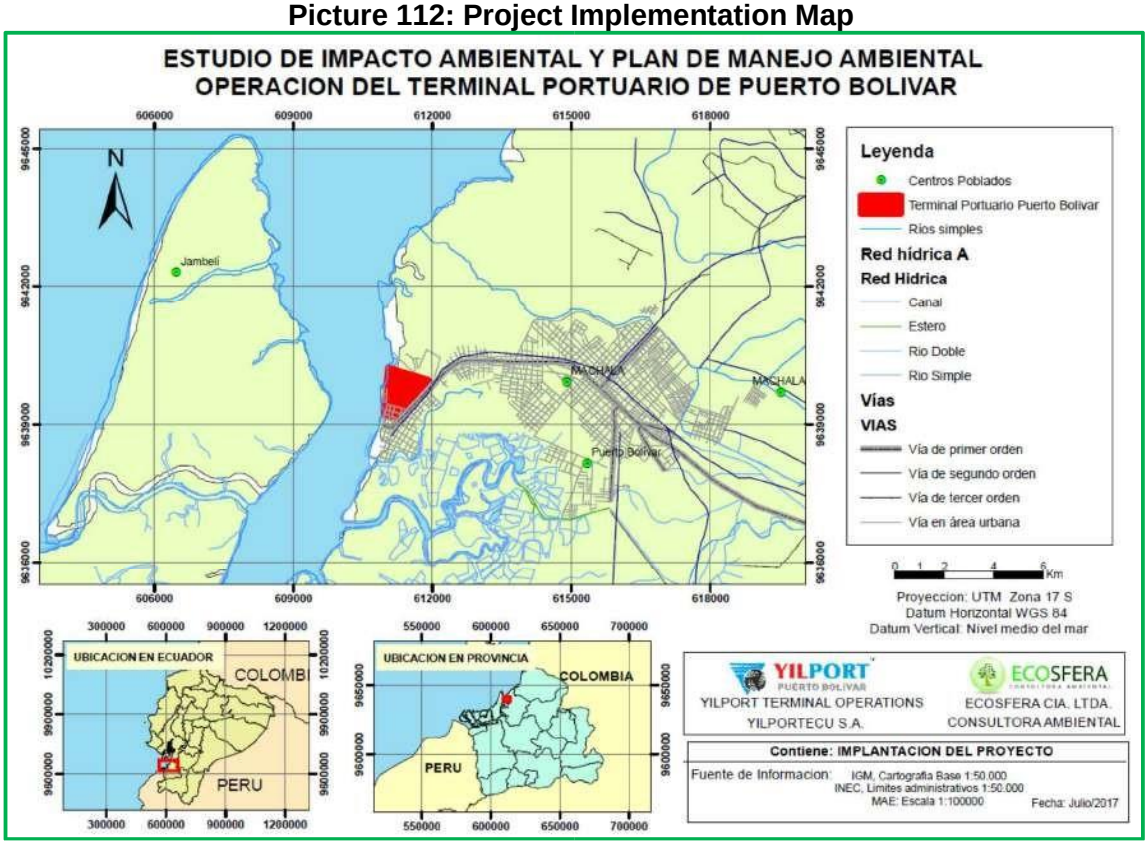
The environmental impacts generated by the project are of a significant range, which would affect the environment in a medium proportion. The significant environmental impacts are hazardous waste management, hydrocarbon management, and occupational health and safety; these impacts could affect the sensitive areas of the port terminal, but will be adequately controlled.

On the other hand, considering the physical dimension of the project, the impacts may transcend from the local to the regional level, considering environmental and climatic factors such as rainfall, wind, temperature and relative humidity, which influence the dispersion of polluting substances that could be produced, since these would be confined to the dimensions of the project area.

The determination of a port's internal zone of influence refers to the geographic areas to and from which the products that are handled in the port for both import and export can be characterized as a continuous area and generally adjacent to the port.

The provinces of El Oro, Azuay, Cañar, Loja, Zamora Chinchipe and Morona Santiago are an essential part of PPB's zone of external influence, making up region 7 with an area of 82,374 km2 and a population of more than 2.2 million inhabitants.

Picture 112: Project Implementation Map



Source: *www.geoportaligm.gob.ec, Military Geography Institute*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolivar - Machala, Santa Rosa - El Oro*
Date: *July 15, 2017*

9.1. AREA OF DIRECT INFLUENCE

Based on the above criteria, the area of direct influence of the project is defined by different components of the project, limited to the project execution areas (access channel, docks, yards, buildings, access roads).

By area of influence, we refer to the adjacent spaces where both the social and environmental components may be significantly or non-significantly affected by each of the activities that will be carried out during the stages of the project.

It should be noted that the area around the construction and development zone of the project is not located in a housing complex and that the nearest populated areas are between 750 meters and one kilometre, so it is considered that the direct influence of the project is very limited.

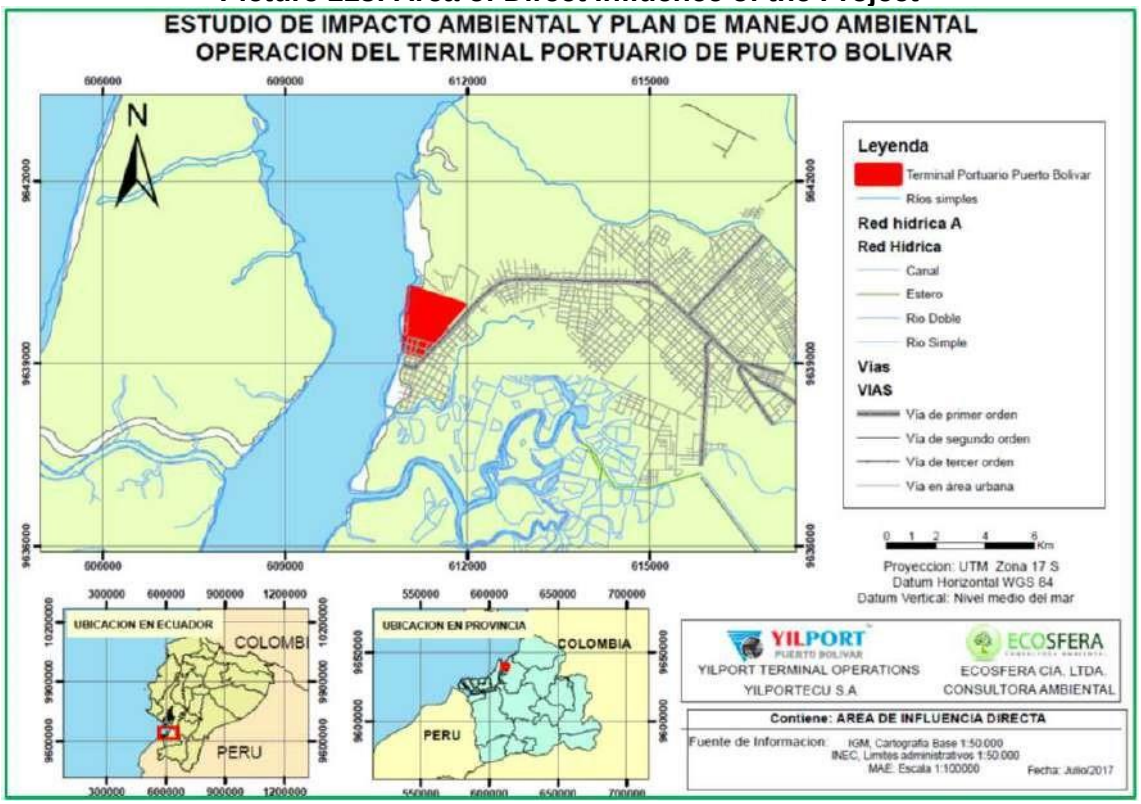
According to the areas of the project, an area of direct influence of 2000 meters in the surrounding area is considered.

Table 117: Determination of Area of Direct Influence

COMPONENT	AREA OF DIRECT INFLUENCE (ADI)
ABIOTIC	There are three general criteria under which the area of direct physical influence was determined, these are: 1. **Reference to the land:** ADI is considered to be the area where the different infrastructures required for the operation of the Port Terminal are installed, such as warehouses, yards, docks, offices, among others. 2. **Reference to Air Quality -** Noise generation from the use of machinery and equipment could have an effect on the surrounding environment, since sound pressure levels can be picked up by a receiver at a distance of approximately 1,000 m vector distance.
BIOTIC	The development of the project activities does not involve vegetation clearing activities; it is an anthropic zone where there is evidence of the displacement of birds and terrestrial species due to the development of the Port Terminal activities.
SOCIOECONOMIC	In social terms, the area of social influence is not limited to the exact place where the project is located, but extends to the sites of interaction of services demanded by the project activities, for example the requirement of labour and inputs. In the case of the Port Terminal, which is located in the parish of Puerto Bolívar, in addition to the parish, it involves the Machala canton and the entire province of El Oro. The parish of Puerto Bolívar is a developed parish both in its social organization and its infrastructure as an urban parish of the canton. The neighbourhoods are fully identified and there are different types of social groups that actively participate.

Source: *Own elaboration* ***Prepared by:*** *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala, Santa Rosa - El Oro*
Date: *May 5, 2017*

Picture 113: Area of Direct Influence of the Project



Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala - El Oro*
Date: *July 20, 2017*

Photograph 19: Areas of Direct Influence

AREA OF DIRECT INFLUENCE

Source: *Photograph taken with MAVIC Drone (7km transmission range)* ***Prepared by:*** *Ecosfera Cía. Ltda. consulting team.*
Date: *April 28, 2017*

AREA OF DIRECT INFLUENCE

Port terminal external part

Dock #1 and Dock #2

Docks of the Port Terminal

Docks of the Port Terminal

Docks of the Port Terminal

Docks of the Port Terminal

Santa Rosa Estuary

Puerto Bolívar Cabotage Dock

AREA OF DIRECT INFLUENCE

Puerto Bolívar Church

Puerto Bolívar Health Centre

Puerto Bolívar Theme Park

Bolívar M. Vargas Avenue

Bolívar M. Vargas Avenue

UPC and Port Captaincy of Puerto Bolívar

Old Cabotage Dock

AREA OF DIRECT INFLUENCE

Puerto Bolívar Market

Pomerio Hospital of Puerto Bolívar

Source: *Photograph taken by Consulting Team*
Prepared by: *Ecosfera Cía. Ltda.*
Date: *June 28, 2017*

9.2. AREA OF INDIRECT INFLUENCE (AII)

The Area of Indirect Influence is the area surrounding the area of direct influence where indirect impacts are generated. It is considered to be the area that may be impacted by the development of project activities with a lesser degree of impact (positive or negative).

Given the degree of intervention in the study area, the main component by which it is feasible to define the IIA is the socioeconomic component, given that its effects may be felt outside the IDA, mainly as a result of the hiring of labour from the sector during the development of the project.

The Area of Indirect Influence corresponds to the political-administrative limits of Puerto Bolívar parish, Jambelí parish, Machala canton and El Oro province.

Table 118: Determination of Area of Indirect Influence

COMPONENT	AREA OF INDIRECT INFLUENCE
ABIOTIC	The AII is extended 2,000 m around the area of direct influence determined in the ADI. 1. **Reference to the land:** The parish of Puerto Bolívar, city of Machala, part of the territory of the province of El Oro, is considered an AII. 2. **Reference to the noise:** The use of machinery and equipment could have an effect on the surrounding environment; however, there will be no effect on the area of indirect influence. 3. **Reference to water:** mainly considering the Santa Rosa Estuary, which is the closest body of water to the project.

COMPONENT	AREA OF INDIRECT INFLUENCE

BIOTIC	Considering the mobility of the species, the IIA is extended to 2,000 m around the area of direct influence for this component. The mangrove species located near the Santa Rosa Estuary, which serves as access to the Port Terminal, will be the main ones considered.
SOCIOECONOMIC	It is related to the political-administrative division, in this case, according to the location of the project, it corresponds to the parish of Puerto Bolívar, Machala canton, province of El Oro, because the economic aspect of the project involves the productive activities of the entire province. Puerto Bolívar's zone of influence is mainly determined by the points of origin and destination of the cargo handled through the port and mobilized by the land transportation network. The geographical location of the Port determines the southern region of the country as the natural area of influence, including the provinces of Azuay, Cañar, Loja, Zamora Chinchipe, Morona Santiago and El Oro, both for export and import products. In addition, the north of Peru is considered, especially the Tumbes region.

Source: *Own elaboration*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala- El Oro*
Date: *May 5, 2017*

Picture 114: Area of Indirect Influence

Source: *www.geoportaligm.gob.ec, Military Geography Institute, INEC*
Prepared by: *Ecosfera Cía. Ltda.*
Location: *Cantons in the province of El Oro*
Date: *July 20, 2017*

9.3. SENSITIVE AREAS

The definition of environmentally sensitive areas has been made taking into account the degree of vulnerability of the environmental components in relation to the activities carried out at the Port Terminal of Puerto Bolívar.

Vulnerability is a function of the characteristics of the environmental parameter at risk, its likelihood and magnitude of being affected by project activities. Environmental susceptibility is described for those components that are sensitive to project development.
In order to determine the sensitivity of the project, the degree of vulnerability of a given area to the project's activities, which entails impacts, effects or risks, was established.
The greater or lesser sensitivity will depend on the conditions of the area where the project will be developed. The biotic and socioeconomic environment will be considered in determining sensitivity.
Environmental and social sensitivity is defined as the potential impact (transformation or change) that a given area may suffer or generate as a result of the alteration of its physical, biotic and socioeconomic processes that characterize it, due to the intervention of an activity or project.

The objectives of the sensitivity analysis are:

- To identify areas by degree of sensitivity
- To provide useful information for decision making.
- To serve as a tool for the determination of intensity in the evaluation of environmental impacts.

Environmental sensitivity involves defining a rating scale to indicate the degree of vulnerability of the environment in relation to the disturbance-generating agent (the Project).
The classes in question and the assigned valuations are focused on the variables considered most relevant to the project.

In order to provide a qualitative assessment, three categories of sensitivity have been defined and are presented in the following table:

Table 119: Sensitivity category criteria

CATEGORY	DESCRIPTION
High	**ALTERED COMPONENTS** Criteria are highlighted where the intervention processes significantly modify the original conditions and where the application of complex mitigating measures is necessary.
Medium	**SEMI-ALTERED COMPONENTS** Where there is a fragile ecological or social balance. Therefore, its recovery and control requires, at the time of project implementation, the application of measures that involve some complexity.

Low	**UNCHANGED COMPONENTS** It recognizes those criteria whose original conditions tolerate without complications the actions of the project, where the recovery could occur in a natural way, can occur with the application of some relatively simple measure.

Prepared by: *Ecosfera Cía. Ltda.*
Date: *July 20, 2017*

9.3.1. PHYSICAL COMPONENT SENSITIVITY

Sensitivity analysis has been performed in the environmental areas where this concept is applied; they include: hydrogeology, geomorphology, soils, air quality, and hydrology.

The degree of sensitivity in the Physical Component is classified as Medium, mainly because the project area has a high risk of flooding due to its proximity to the Santa Rosa Estuary; however, there are no sensitive areas in terms of other factors such as geological, geomorphological and soil.

9.3.2. BIOTIC SENSITIVITY

The study area where the project is located is a zone of low biotic sensitivity, because it corresponds to an area where there is a coastal marine ecosystem, with the presence of mangrove species and small remnants of secondary forest.

The sensitivity of the flora in the study area is low, because it is already a disturbed area and the operation of the project will not affect any species of flora.

In addition, in order to obtain the Intersection Certificate of the project with the National System of Protected Areas (SNAP), State Forest Heritage (PFE), Forests and Protective Vegetation (BVP), the relevant documentation was submitted to obtain the Intersection Certificate through the platform of the Single Environmental Information System of the Ministry of Environment for the project ***"CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR' PORT TERMINAL"***, located in the province/s of (EL ORO), from which it was obtained that the project **DOES NOT INTERSECT** with the National System of Protected Areas (SNAP), State Forest Heritage (PFE), Forests and Protective Vegetation (BVP).

9.3.3. SOCIOECONOMIC SENSITIVITY

Taking into account that sensitivity levels are defined according to the possible weakening of various factors that make up a social structure, which may be caused by the intervention of external human groups, we proceeded to rate sensitivity in the criteria of culture, economy, health, education and landscape.

The culture criterion has a low sensitivity, due to the small number of personnel that will work on the development of the project, but is determined as medium sensitivity, because the population is less than 1,000 m from the project.

The economic criterion acquires a high sensitivity in a positive way, because the project stimulates economic aspects by increasing foreign investment, increasing exports from Puerto Bolívar, generating employment and underemployment, developing additional service contracting, among others.

The health criterion has a Low sensitivity, as the health conditions of the personnel and the community are not affected by the project activities to a considerable extent.

The education criterion has a low sensitivity, because although there are schools nearby, they are not affected by the development of the project for any reason.
The landscape criterion acquires a medium sensitivity, because the development of the Port Terminal activities is carried out in an area considered as a tourist area, however with the application of mitigation measures it will be tried that the project does not cause a great impact.

Table 120: Sensitivity Analysis of Environmental Components

COMPONENT	CRITERIA	TYPE OF SENSITIVITY
PHYSICAL	Geological aspects	Low
	Geomorphological changes	Low
	Water Bodies	Medium
	Flood Risk	Medium
BIOTIC	Flora - Vegetation cover	Low
	Fauna - Abundance, diversity of species	Low
SOCIO - ECONOMIC	Population	Medium
	Culture	Low
	Economy	High
	Health	Low
	Education	Low
	Landscape - Change in structure	Medium

Source: *Own elaboration* ***Prepared by:*** *Ecosfera Cía. Ltda.*
Location: *Puerto Bolívar - Machala - El Oro*
Date: *July 20, 2017*

Once the corresponding evaluation has been carried out, we could say that in the area of influence of the project the only sensitive area that could be affected would be the Santa Rosa Estuary and its surroundings near the project, with a Medium level in the Physical Component, Low in the Biotic Component and Medium in the Social Part, the latter being of limited sensitivity.

The project will not affect the nearby population through damage to housing, community infrastructure, water sources, or other activities of the population, since the nearest population conglomerates are located between 750 meters to one kilometre away from the construction site.

10. IDENTIFICATION AND EVALUATION OF ENVIRONMENTAL IMPACTS

Due to the characteristics and components of the Puerto Bolívar Port Terminal, the main environmental aspects to be evaluated are: Occupational Safety and Health and Solid Waste Management.

This Impact Identification and Evaluation was carried out using a Findings Identification Matrix.

10.1. AUDITABLE CRITERIA

The auditable criteria used in the preparation of this Identification and Evaluation include the following:

- Ministerial Resolution 061, Official Gazette dated May 4, 2015.
- Ministerial Resolution 097, July 30, 2015.
- Regulation to the Environmental Management Act for the Prevention and Control of Environmental Contamination.
- Regulations for the prevention and control of hazardous waste pollution.
- Environmental Quality Standard for the management and disposal of non-hazardous solid waste.
- Environmental Quality Standard and effluent discharge: water resource.
- Environmental Quality Standard for soil resources and remediation criteria for contaminated soils.
- Permissible limits of ambient noise levels for stationary sources, mobile sources and vibrations.
- IESS Occupational Health and Safety Regulations.
- Executive Decree 2393 Regulation on Occupational Safety and Health and Improvement of the Working Environment
- Substitute Regulation to the Environmental Regulation for Hydrocarbon Operations in Ecuador (RAOHE 1215).

The matrix evaluated the Project with the Environmental Regulations, the criteria were as follows:

10.1.1. LEVEL OF COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

This refers to the boxes where compliance or non-compliance with the approved Environmental Management Plan is marked, determining Total, Partial or Null compliance. It verifies whether each environmental measure or article of the Environmental Legislation has been executed in each of the activities to be developed, in the scheduled times and with the established frequency, according to what was stipulated in the EMP.

10.1.2. MEANS OF VERIFICATION

The type of management indicator that will be used to verify the audit finding should be specified.

10.1.3. OBSERVATIONS

It describes all types of observations and recommendations to the Environmental Regulations or Environmental Measures, which the audit team deems appropriate to make.

In the case of recommendations, these are programmed as new environmental measures for the future EMP to be implemented.

10.1.4. COMPLIANCE VERIFICATION

These are boxes where the compliance or non-compliance with the Environmental Regulations and Environmental Measures is marked, determining whether they constitute Compliance or Non-Compliance.

- **COMPLIANCE (C):** When the operations and facilities comply with the provisions established in the law, regulations, ordinances, standards and measures of the Environmental Management Plan.
- **NON-COMPLIANCE (NC):** When measures have not been implemented to mitigate environmental impacts, or these do not comply with the permissible limits, the facilities do not comply with the technical specifications established by environmental regulations.
  To prioritize the degree of noncompliance, we divided non-compliance into two categories:
- **MINOR NON-COMPLIANCE (NC -):** It is considered when the following conditions are determined for the first time
  a) Non-compliance with the permissible limits or quality criteria by parameter and sampled source and that has not produced evident alteration to the environment.
  b) Delay or failure to submit administrative documents for environmental control and monitoring within the established terms.
  c) Failure to comply with the technical obligations described in the Environmental Studies, Management Plan or others required by the Competent Environmental Authority that may have produced or are producing a risk to the environment without this having produced an evident alteration to the environment;
  d) The importation, commercialization and use of hazardous chemical substances by natural or legal persons that do not appear in the corresponding registry.
  e) Failure to comply with the preventive measures for cleaner production issued by the Authority
  National Environmental
  f) Improper handling of products and/or elements considered hazardous, in accordance with applicable environmental regulations.
  g) The use, commercialization, possession and/or importation of products prohibited or restricted according to the corresponding list and technical standards.
  h) The performance of any activity related to the integrated management of wastes and/or hazardous chemical substances without authorization and/or without complying with the administrative and technical conditions established in the applicable environmental regulations.
  i) Partial non-compliance with the remediation, restoration and/or remediation program approved by the Authority
  Environmental Competent
  j) Partial non-compliance with the implementation of the emerging plan and/or approved action plan.
  k) The management of hazardous and/or special wastes in any of its phases, without complying with the technical standard issued for that purpose and/or without prior authorization from the
  Competent Environmental Authority
  l) The performance of activities additional to those described in the documents submitted for the issuance of the environmental license.
  m) The management of hazardous chemical substances, in any of its phases, without complying with the technical standard issued for this purpose by the

Environmental Authority and/or without prior authorization from the Competent Environmental Authority.

n) Failure to comply with specific activities detailed in the enabling documents and environmental regulations that allow for follow-up, monitoring and control required by the competent environmental authority for environmental management.
o) The generation, storage, transportation, elimination and final disposal of special wastes without complying with the technical standards issued for this purpose and/or without prior authorization from the competent environmental authority.
p) The formulation, manufacture and/or packaging of hazardous chemical substances by natural or legal persons that do not comply with the corresponding environmental permit and with current regulations.

- **MAJOR NON-COMPLIACE (NC+):** The qualification criteria are as follows:
  1. Repetition during the evaluated period of a Minor Non-compliance for the same non-compliance determined by the established control and follow-up mechanisms. More than thirty percent of non-compliances determined in sampling during an audited period of permissible limits of the same source and parameter.
  2. Determination of the following findings identified and notified by the Competent Environmental Authority:
     a) Consecutive and reiterative non-compliance with the permissible limits by parameter and sampled source
     b) Alteration of natural environmental conditions that require long-term remediation, caused by technical non-compliance with applicable environmental regulations.
     c) Failure to fully comply with the remediation and restoration program approved by the Environmental Authority.
     Competent
     d) Total non-compliance with the execution of the emerging plan and/or the approved action plan.
     e) Abandonment of infrastructure, equipment or closure of activities without the approval of the Authority. Environmental Competent
     f) Non-compliance in the execution of the activities contained in the contingency plans established in the applicable environmental legislation.
     g) The performance of activities additional to or different from those described in the documents submitted for the issuance of the environmental license.
     h) The introduction into the country of non-hazardous solid wastes for final disposal without the corresponding environmental permit.
     i) The introduction into the country of special wastes, for final disposal purposes, without complying with the technical standard issued for this purpose and/or without prior authorization from the Authority.
     National Environmental
     j) The transboundary movement of non-hazardous solid waste, hazardous and/or special wastes, whether by import, export or transit, including unauthorized traffic, without complying with the technical standards issued for this purpose and/or without prior authorization from the National Environmental Authority.
     k) The final or temporary disposal of debris, residues and/or wastes of any nature or kind in water bodies, including the coastal marine zone.
  3. Enforcement of the express prohibitions contained in this provision
  4. The determination of environmental damage by means of a final resolution

In case of findings that do not fall within the above described, they will be qualified as Major Non-compliance and Minor Non-compliance by the Competent Environmental Authority or audit team, based on the following criteria:

a) Magnitude of the event
b) Impact on human health
c) Alteration of flora and fauna and/or natural resources.
d) Type of ecosystem altered
e) Time and costs required for remediation

10.2. MATRIX FOR IDENTIFICATION OF ENVIRONMENTAL IMPACTS

Table 121: Impact Identification Matrix - Determination of Findings

N0	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT					
1	No waste separation or classification is performed	**PARAGRAPH I: GENERATION Article 60. Generator -** Every generator of non-hazardous solid residues and/or wastes shall: a) Be responsible for their management until they are delivered to the collection service and deposited in authorized sites determined by the competent authority. b) Take measures to reduce, minimize and/or eliminate waste generation at source by optimizing the processes that generate waste. c) Carry out separation and classification at the source as established in the specific regulations. d) Temporarily store waste under technical conditions established in the regulations issued by the National Environmental Authority. e) Large generators such as industry, commerce and services must have adequate and technically constructed facilities for the temporary storage of non-hazardous solid waste, with easy accessibility for their transfer.	**X**		Lack of separation at the source of the solid wastes	 
	There is no specific technical site and no suitable storage containers for waste					
	There is no specific location				Inappropriate containers	

	for the temporary storage of solid waste	f) Large generators such as industry, commerce and services must keep a monthly record of the type and quantity or weight of waste generated. g) Large generators such as industry, commerce and services must deliver the non-hazardous solid waste already classified to environmental managers authorized by the National Environmental Authority or Accredited Responsible Enforcement Authority for approval, to guarantee its use and/or correct final disposal, as the case may be. h) Place the containers at the collection site, according to the established schedule.			for solid waste	
	No waste separation or classification was done at the source	**PARAGRAPH II** **SEPARATION AT SOURCE** **Article 62 - Separation at the source -** The generator of non-hazardous solid waste is obliged to separate it at the source, classifying it according to the Integrated Waste Management Plan, as established in the applicable environmental regulations.	**X**		There is no separation at the source and waste is verified outside its storage area.	

N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT					
5	There are no adequate containers for waste separation, nor a specific place for the temporary storage of waste.	**Art. 63. Temporary urban storage:** The parameters for the temporary storage of non-hazardous solid waste already classified are established, without prejudice to others established by the National Environmental Authority, according to the following: a) Non-hazardous solid waste should be temporarily disposed of in closed containers or garbage cans (with lids), identified, classified, in order and, if possible, with a plastic cover inside. b) Containers for the temporary storage of non-hazardous solid waste must comply at least with: be covered and adequately located, have adequate capacity according to the volume generated, be built with resistant materials and have identification according to the type of waste. c) Temporary storage of non-hazardous waste will be carried out under the conditions established in INEN's technical standards.	**X**		Lack of Containers suitable for waste disposal	  

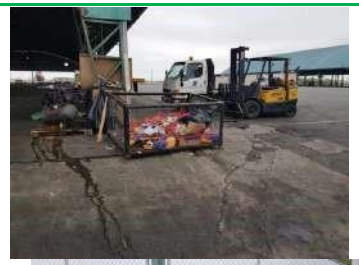
N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT					
6	No registration as a generator of hazardous and/or special waste.	**<u>Art. 88.</u> Responsibilities:** Since the generator is the owner and responsible for the management of hazardous and/or special wastes until their final disposal, it is his responsibility: a) To respond individually, jointly and severally with the natural or legal persons that carry out for it the management of the waste of its ownership, regarding the compliance with the applicable environmental regulations before the delivery of the same and in case of incidents involving improper handling, contamination and/or environmental damage. The liability is joint and several and cannot be waived; b) Obtain mandatory registration as a generator of hazardous and/or special waste before the National Environmental Authority or the responsible Environmental Enforcement Authorities, for which the National Environmental Authority shall establish the respective approval procedures by means of a Ministerial Resolution and in accordance with the provisions of this Chapter. The registration shall be issued per point of generation of hazardous and/or special		X	Inadequate handling of hazardous and/or special waste. There is no warehouse for storing hazardous and/or special waste.	
7	Operators should be requested to register as hazardous and special waste generators.					
8	There is no characterization of the hazardous					

	and/or special waste	wastes. Only one registration shall be issued for the exclusive case of a productive activity that covers several points where the generation of hazardous and/or special wastes is minimal, in accordance with the procedure established in the respective legal regulation. c) Take measures to reduce or minimize the generation of hazardous and/or special waste, for which purpose they shall submit to the Competent Environmental Authority the Hazardous Waste Minimization Plan within 90 days, once the respective registration has been issued; d) Store hazardous and/or special wastes in safe technical conditions and in areas that meet the requirements established in these regulations, INEN standards and/or applicable national and international standards, avoiding contact with water and soil resources and verifying their compatibility; e) Have adequate and technically constructed facilities for the storage of hazardous and/or special wastes, with accessibility to the vehicles that will carry out the transfer of such wastes;				
9	Hazardous and/or special waste is not delivered to qualified environmental managers.					
10	There is no record of hazardous and/or special waste movements.					

		f) Identify and/or characterize the hazardous and/or special wastes generated, according to the applicable technical standard; g) To deliver hazardous and/or special wastes for their proper management, only to natural or legal persons that have an environmental permit issued by the National Environmental Authority or by the responsible Environmental Enforcement Authority; h) Maintain a record of incoming and outgoing movements of hazardous and/or special wastes in its storage area, including the date of the movements, the name of the waste, its origin, quantity transferred and stored, destination, responsible parties and signatures of responsibility;				
11	Hazardous solid wastes are not stored according to regulations.	**Art. 91. Storage of hazardous and/or special wastes:** Hazardous and/or special wastes must remain packaged, stored and labelled, applying for this purpose the pertinent technical standards established by the National Environmental Authority and the National Authority for Standardization, or in their absence, internationally accepted technical standards applicable in the country. The containers used for storage should be used only for this purpose, taking into account the hazardous and incompatibility characteristics of hazardous and/or special wastes with certain materials.		X	Lack of storage site for hazardous and/or special wastes	
12	Out-of-date contingency plan	**Art. 199. Contingency plans:** Contingency plans shall be implemented, maintained, and periodically evaluated through drills. The drills shall be documented and their records shall be available to the	X		The operations area does not have a map of evacuation	

		Competent Environmental Authority. The lack of records shall constitute evidence of non-compliance with this provision. The execution of the contingency plans must be immediate. In case of delay, it shall be considered as an aggravating circumstance at the time of resolving the administrative procedure.			routes, meeting points, or signs to act in case of emergency. No drills have been carried out.	
13	Lack of monitoring of Water Quality	**PARAGRAPH I: WATER** **Art. 209 Water quality -** The evaluation and control of water quality shall be carried out by means of analytical procedures, sampling and monitoring of discharges, spills and receiving bodies; such guidelines are detailed in Annex I. Any anthropic activity shall carry out the necessary preventive actions to avoid altering and ensure the quality and quantity of water in the water basins, the alteration of the physical-chemical and biological composition of water sources due to discharges and liquid spills or disposal of waste in general or other negative actions on its components, shall entail the corresponding sanctions in each case.	**X**		Water Analysis	Water analysis reports
14	Water quality impact of the Santa Rosa Estuary					

N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF THE SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT				**GOOD**	
	NON-COMPLIANCE (FINDING)	**MINISTERIAL RESOLUTION 026 Procedures for Registration of Hazardous Waste Generators, Hazardous Waste Management after Environmental Licensing and for the Transportation of Hazardous Materials**				
15	No registration as a generator of hazardous and/or special waste.	**Art.1.** Every natural or legal, public or private person that generates hazardous waste must register with the Ministry of environment according to the procedure for the registration of hazardous waste generators.		**X**	Poor management of hazardous and/or special waste	
	NON-COMPLIANCE (FINDING)	**EXECUTIVE DECREE 1215 ENVIRONMENTAL REGULATIONS FOR HYDROCARBON OPERATIONS IN ECUADOR**				
16	No spill control kit available	**ART. 27. Operation and maintenance of equipment and facilities:** Spill control equipment and materials shall be available, as well as firefighting equipment, and there shall be preventive and corrective maintenance programs. During operation and maintenance, the necessary equipment and materials, as well as the trained personnel specified in the Contingency Plan, will be available for immediate response to any	**X**		Presence of oil spills in some areas. No equipment or material is available for control of spills.	

		contingency of the Environmental Management Plan, and the respective training and drills will be carried out periodically.				 
	NON-COMPLIANCE (FINDING)	**EXECUTIVE DECREE 2393 OCCUPATIONAL SAFETY AND HEALTH REGULATIONS AND IMPROVEMENT OF THE WORKSITE ENVIRONMENT**				
17	Deteriorated foundations and floors cause risk to employees and facilities	**Chapter II BUILDINGS AND PREMISES Art. 21. STRUCTURAL SAFETY** 2. The foundations, floors and other elements of the buildings shall offer sufficient resistance to safely sustain the loads to which they will be subjected.	**X**		Deteriorated Foundations and floors	

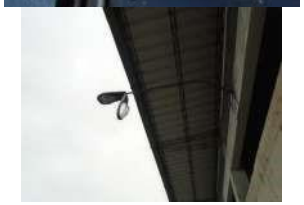
						

N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATION)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT					
18	Risk of accidents	**Article 30. OPENINGS IN FLOORS.** 1. Openings in floors, shall always be protected with handrails and toeboards.	**X**		Lack of protection in floor openings	  

N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATION)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 **RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT**					
19	Lack of cleaning at the worksite	**Art. 34. CLEANING OF PREMISES.** 1. The work premises and adjoining rooms shall be kept in a good state of cleanliness at all times. 3. All premises should be thoroughly cleaned outside working hours, with sufficient time in advance so that they can be ventilated for at least half an hour before starting work. 4. When the work is continuous, precautions shall be taken to avoid the unpleasant or harmful effects of dust or debris, as well as the hindrances that the cleaning itself may cause in the work. 5. Cleaning operations shall be carried out with greater care in the vicinity of places occupied by machines, apparatus or devices, the use of which offers greater danger. The pavement shall not be waterlogged and shall be kept free of oil, grease and other slippery materials. 6. Equipment, machines, installations, tools and instruments must always be kept in a good state of cleanliness. 7. Raw material or manufacturing wastes shall be disposed of either directly through piping or by accumulating them in suitable containers that shall be non-combustible and closed with a lid if the residues are bothersome or easily combustible. 9. Detergents should preferably be used as cleaning or degreasing liquids.			Garbage present in the worksite	 

20	First aid kits are not available in warehouse and yard areas.	**Art. 46. FIRST AID SERVICES -** All work centres shall have an emergency first aid kit for the provision of first aid to employees during the working day. If the centre has 25 or more simultaneous employees, it shall also have an infirmary. The employer shall ensure the proper functioning of these services, and shall provide the necessary training so that at least one employee on each shift has knowledge of first aid.	**X**		No first aid kit first aid	
20	Lack of safety sign maintenance	**Chapter VI** **SAFETY SIGNS - GENERAL STANDARDS** 4. The components of the safety signs shall be kept in a good state of use and conservation.	**X**		Deteriorated signs	

N0	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATION)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 **RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF THE SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT**					
	NON-COMPLIANCE (FINDING)	**RESOLUTION No. 360** **PORT OCCUPATIONAL HEALTH AND SAFETY REGULATIONS (STEVEDORING, DOCK WORK)**				
	Lack of order and cleanliness	**PARAGRAPH I** **Maintenance of Order and Cleanliness** Art. 3. The places where the loaders have to work on the docks on board, on the pontoons or on the means of access to the vessels, which due to rain, grease, oil, etc., are slippery, shall be cleaned or made practicable by sprinkling a suitable material, such as sand or sawdust. are slippery, shall, as far as possible, be cleaned or made practicable by sprinkling a suitable material, such as sand or sawdust.	X		Presence of spills	
	Lack of security in electrical installations	**PARAGRAPH V** **Electrical installations** Art. 17. The design, construction, arrangement, protection and maintenance of all installations and of all electrical circuits used in port works shall be such as to prevent any danger, in accordance with the requirements of national legislation and of the competent authority. Art. 22. The electrical installations exposed to the elements shall be effective protection object against moisture and corrosion	X		Faulty electrical installations	 

N0			nc -	NC+		MEANS OF VERIFICATION

	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)			OBSERVED EVIDENCE	
	MINISTERIAL RESOLUTION 061 RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT					
						  

N°			nc -	NC+		MEANS OF VERIFICATION

	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)			OBSERVED EVIDENCE	
	MINISTERIAL RESOLUTION 061 **RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT**					
24	Lack of maintenance and immediate access to fire extinguishers	**PARAGRAPH VIII** **Fire protection** Art. 35. Without prejudice to the general and special provisions on fire prevention in force, the places where dock employees work shall be provided with adequate and sufficient fire extinguishing material and a sufficiently high pressure water supply. The extinguishing equipment must be maintained and inspected at appropriate intervals.	**X**		Lack of maintenance to the fire protection system	  

N0			nc -	NC+		MEANS OF VERIFICATION

	NON-COMPLIANCE AD (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATION)			OBSERVED EVIDENCE	
	MINISTERIAL RESOLUTION 061 **RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT**					
25	Lack of first aid devices	**PARAGRAPH I** **First aid and rescue** The necessary personnel and material shall be available for the administration of first aid during working hours and in the same places where loading and unloading works are carried out in the ports**.** **Art. 240.** First-aid kits: One or more first-aid kits shall be available in appropriate places and in proximity to where the work is carried out, and these shall be protected against contamination by dust, humidity, etc. The first aid kits shall contain the necessary material to administer first aid to the loaders. **Art. 241.** The first-aid kits shall contain simple and clear instructions regarding assistance in cases of emergency. **Art. 244.** Stretchers: Stretchers shall be immediately available. These shall be so constructed that a person can be safely lifted out of a hold and transported without having to be moved from the stretcher. Each stretcher shall carry two clean blankets. **Art. 246.** Rescue of drowned persons: Appropriate rescue material for drowned persons shall be promptly available. The rescue equipment shall consist of a sufficient number of rescue buoys, provided with ropes of sufficient length, hooks, spars and ladders of sufficient length.	**X**		There is no first aid device	

		Art. 250. Aid Station: When at least 100 loaders are regularly engaged in loading and unloading operations, one or more well-equipped aid stations shall be installed in easily accessible places for the treatment of the lightly injured and as a resting place for the sick and seriously injured. The aid station shall be manned by a person in charge, qualified to administer first aid and available at all times during working hours. **Art. 253.** Training of First Aid Personnel: Dock employees shall be encouraged to acquire knowledge of first aid. **Art. 254.** First aid personnel shall be instructed in manual artificial respiration methods and rescue operations. When artificial respiration devices are available, they shall be used only by persons familiar with their use.				

<table>
<tr><th rowspan="2">N°</th><th>NON-COMPLIANCE (FINDING)</th><th>ARTICLE AND PARAGRAPH (OF THE REGULATIONS)</th><th>nc -</th><th>NC+</th><th>OBSERVED EVIDENCE</th><th>MEANS OF VERIFICATION</th></tr>
<tr><td colspan="6">MINISTERIAL RESOLUTION 061
RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF THE SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT</td></tr>
<tr><td></td><td>NON-COMPLIANCE (FINDING)</td><td colspan="5">ECUADORIAN TECHNICAL STANDARD INEN ISO 3864: 2013
GRAPHIC SYMBOLS. SAFETY COLORS AND SAFETY SIGNS.
PART 1: DESIGN PRINCIPLES FOR SAFETY SIGNS AND SAFETY INDICATIONS</td></tr>
<tr><td>26</td><td>Lack of signage and in some areas no signage at all. complies with standard conditions</td><td>This standard establishes safety identification colours and design principles for safety signs and safety indications to be used in workplaces and public areas for accident prevention, fire protection, health hazard information and emergency evacuation.
<table>
<tr><th>FIGURA GEOMÉTRICA</th><th>SIGNIFICADO</th><th>COLOR DE SEGURIDAD</th><th>COLOR DE CONTRASTE AL COLOR DE SEGURIDAD</th><th>COLOR DEL SÍMBOLO GRÁFICO</th><th>EJEMPLOS DE USO</th></tr>
<tr><td>CÍRCULO CON UNA BARRA DIAGONAL</td><td>PROHIBICIÓN</td><td>ROJO</td><td>BLANCO*</td><td>NEGRO</td><td>- NO FUMAR
- NO BEBER AGUA
- NO TOCAR</td></tr>
<tr><td>CÍRCULO</td><td>ACCIÓN OBLIGATORIA</td><td>AZUL</td><td>BLANCO*</td><td>BLANCO*</td><td>- USAR PROTECCIÓN PARA LOS OJOS
- USAR ROPA DE PROTECCIÓN
- LAVARSE LAS MANOS</td></tr>
<tr><td>TRIÁNGULO EQUILÁTERO CON ESQUINAS EXTERIORES REDONDEADAS</td><td>PRECAUCIÓN</td><td>AMARILLO</td><td>NEGRO</td><td>NEGRO</td><td>- PRECAUCIÓN: SUPERFICIE CALIENTE
- PRECAUCIÓN: RIESGO BIOLÓGICO
- PRECAUCIÓN: ELECTRICIDAD</td></tr>
<tr><td>CUADRADO</td><td>CONDICIÓN SEGURA</td><td>VERDE</td><td>BLANCO*</td><td>BLANCO*</td><td>- PRIMEROS AUXILIOS
- SALIDA DE EMERGENCIA
- PUNTO DE ENCUENTRO DURANTE UNA EVACUACIÓN</td></tr>
</table></td><td>X</td><td></td><td>Lack of signs under the standard</td><td> 
 
  </td></tr>
</table>

N°	NON-COMPLIANCE (FINDING)	ARTICLE AND PARAGRAPH (OF THE REGULATIONS)	nc -	NC+	OBSERVED EVIDENCE	MEANS OF VERIFICATION
	MINISTERIAL RESOLUTION 061 **RESTATEMENT OF BOOK VI OF THE CONSOLIDATED TEXT OF THE SECONDARY LEGISLATION OF THE MINISTRY OF ENVIRONMENT**					
						  

CUADRADO	EQUIPO CONTRA INCENDIOS	ROJO	BLANCO*	BLANCO*	- PUNTO DE LLAMADO PARA ALARMA DE INCENDIO - RECOLECCIÓN DE EQUIPO CONTRA INCENDIOS - EXTINTOR DE INCENDIOS

* El color blanco incluye el color para material fosforescente bajo condiciones de luz del día con propiedades definidas en la norma ISO 3864-4.

10.3. ACTION PLAN

Table 122: Action Plan

NON-COMPLIANCE	PROPOSED ACTION	MEAN OF VERIFICATION	RESPONSIBLE	TERM
Waste classification is not performed at source Waste is not separated or classified at the source	Provide that all personnel, visitors, and other occupants of the Puerto Bolívar Port Terminal perform the solid waste classification.	• Integrated Waste Management and Handling Plan • Photographs	Manager	1 month
There is no specific technical site or storage containers suitable for waste There are no adequate containers for waste separation, nor a specific site for the temporary storage of waste.	Acquire containers for waste classification	• Vessel purchase record • Photographs	Manager	2 months
There is no specific place for the temporary storage of solid waste. Hazardous solid waste is not stored according to regulations	A specific area should be set aside for the storage (warehouses) of common waste and hazardous and/or special wastes	• Warehouse Layout and Scheme Report • Photographs	Manager	3 months
No registration as a generator of hazardous and/or special waste.	The Port terminal must be registered as a generator of hazardous and/or special waste.	• Registration as a hazardous and/or special solid waste generator	Manager	3 months

There is no registration as hazardous and/or special waste generator				
Require operators to register as generators of hazardous and/or special waste	Deliver an official letter of obligation to operators that generate hazardous and/or special wastes that obtain their registration as generators before the Ministry of the Environment.	• Registration of operators as generators of hazardous and/or special wastes	Manager	3 months
There is no characterization of hazardous and/or special wastes There is no record of hazardous and/or special waste movements	Keeping a record of hazardous and/or special waste	• Waste movement record	Manager	1 month
No delivery of hazardous and/or special wastes to qualified environmental managers	The delivery of hazardous and/or special wastes to authorized environmental managers must be managed.	• Delivery manifests for hazardous and/or special wastes	Manager	2 months
The contingency plan is outdated.	Update the contingency plan of the Port Terminal and conduct drills	• Written Contingency Plan • Drill Report • Photographs	Manager	3 months
Lack of water quality monitoring Water quality impairment in Santa Rosa Estuary	Carry out a program for water quality control of the Santa Rosa Estuary	• Analysis reports of Water Quality	Manager	3 months

There is no kit for the control of spills	In areas where activities involving the use of fuels or liquid products are carried out, spill control kits must be available.	• Spill control kit purchase records • Photographs	Manager	1 month
Deteriorated foundations and floors cause risks to employees and facilities	Deteriorated walls, floors and ceilings should be repaired.	• Photographs	Manager	3 months
Risk of accidents	Protections must be placed in required areas	• Photographs	Manager	1 month
Lack of cleanliness in the worksite Lack of order and cleanliness	Clean and tidy up all areas and facilities of the Port Terminal	• Photographs	Manager	1 month
First-aid kits are not available in the areas of warehouses and yards	Install first aid kits in warehouse and yard areas as required.	• Record of purchase of first aid kit, medicines and supplies • Photographs	Manager	1 month
Lack of safety sign maintenance	Deteriorated safety signs should be replaced	• Safety sign purchase record • Photographs	Manager	2 Months
Lack of security of the electronic installations	The connections must be repaired and facilities that do not comply with standard requirements	• Photographs	Manager	1 month
Lack of maintenance and direct access to fire extinguishers	An inventory should be made of the fire extinguishers and firefighting equipment installed in the Port Terminal, indicating type, capacity, location,	• Inventory • Photographs	Manager	1 month

	recharge date, among others. The location of some extinguishers should be corrected, as they do not comply with standard and are hindered			
Lack of first aid devices	The port terminal must install first aid devices such as first aid kits, stretchers, evacuation routes, emergency exits, and emergency exit points, among others.	• Device purchase registration • Photographs	Manager	2 Months
Lack of safety signs and in some areas do not comply with standard conditions	Safety signs must be increased in accordance with INEN standards to prevent risks, restrict access, mandatory signs, warning signs, fire signs, among others.	• Safety sign purchase records • Photographs	Manager	2 months

11. RISK ANALYSIS

With the purpose of analysing the possible threats to which the development of the project ***"Construction and Operation of the Puerto Bolívar Port Terminal"*** is exposed, as well as the threats that may be generated, the following risk analysis is carried out in order to take actions for the prevention of contingencies. The current increase in the frequency and destructive force of different events, whether geological or hydrometeorological, at a planetary level, conditions a growing interest in understanding these phenomena, not only by academics but also by politicians and society as a whole.

The possibilities of technological and health disasters also condition the need to improve the political, social, economic and environmental approach to risk management and the need for these studies for the different cantons and provinces, especially for the coastal and mountainous areas, which are subject to various hazards, including landslides due to slope instability in mountainous areas, flooding due to heavy rains and the overflowing of rivers that cross the coastal plains and the penetrations of the sea.

Studies related to the analysis of hazards, vulnerability and risks then become instruments for risk management and decision making by government bodies at different levels in disaster prevention and make it possible to develop an effective action model that places greater emphasis on preventive and mitigation aspects.
It is not only a matter of responding to phenomena, but also of anticipating them by identifying hazards and their risks, the way to manage them, i.e. to transform and modify them in order to reduce the conditions of vulnerability that ultimately cause the main damage.

These studies require an interinstitutional and multidisciplinary system and multiple coordination at territorial, sectoral, environmental, social, etc. levels to ensure the identification, measurement, quantification, analysis and understanding of risk.

The concepts of the topics to be analysed in this chapter are detailed below:

- **THREATS:** natural or anthropic origin. Natural hazards consist of the generation of phenomena such as floods, landslides, mass movements, earthquakes, among others. While the threats of atrophic or human origin are those that include actions such as spills, labour accidents, terrorism, strikes, inadequate practices, among others.
- **VULNERABILITY:** is the resistance offered by the structure of a project, a building or any work to the action of a threat.
- **RISK:** is the result of interrelating the critical values of a hazard and the corresponding vulnerability of the element subject to that hazard.

Risk = Hazard * Vulnerability

11.1. PROJECT RISKS TO THE ENVIRONMENT (ENDOGENOUS)

The project "***Construction and Operation of the Puerto Bolívar Port Terminal"*** may cause risks to the environment.

For Risk Determination and Analysis, a modification of the methodology proposed by William T. Fine for Risk Analysis has been used.

This methodology is based on evaluating three criteria, consequence (C), exposure (E) and probability (P), and multiplying the scores obtained for each of them; in this way the degree of danger (GP) of a risk is obtained.

To evaluate the consequence, the results that would be generated by the materialization of the studied risk must be analysed. In this case, the evaluation parameters are modified

to adapt to the project, establishing the distance reached by the negative impact as a factor for the assessment of the consequence. The table used for the assessment of this parameter is presented below:

Table 123: Degree of severity of consequences

DEGREES OF SEVERITY OF CONSEQUENCES	VALUE
Affecting the entire water system	100
Affecting the water bodies that comprise the channel	50
Affecting the entire length of the channel	25
Affecting the water body at 1 km	15
Affecting the water body at 500 m	5
Specific impact	1

Source: *William T. Fine Methodology for Risk Analysis.*
Prepared by*: Ecosfera Cía. Ltda., 2017*

For exposure, the frequency of occurrence of a situation capable of triggering an accident in the analysed activity is assessed. For this purpose, the following table is used to establish the possible scores:

Table 124: Risk exposure factor

EXPOSURE FACTOR	VALUE
Continuously (many times a day)	10
Frequently (once a day)	6
Occasionally	3
Irregularly (once a month)	2
Rarely (known to occur)	1
Remotely possible (not known to have occurred)	0,5

Source: *William T. Fine Methodology for Risk Analysis.*
Prepared by*: Ecosfera Cía. Ltda., 2017*

To evaluate the probability of accident occurrence, the time that can lead to an accident is taken into account and the possibility of it ending in an accident is studied. For this purpose, the following evaluation table is used:

Table 125: Probability of occurrence of the accident

PROBABILITY OF OCCURRENCE OF THE ACCIDENT	VALUE

It is the most possible and expected outcome, if the risk situation occurs.	100
It is completely possible; it would not be strange at all 50% possible.	6
It would be a rare consequence or coincidence	3
It would be a remotely possible coincidence; it has been known to occur.	1
Extremely remote but conceivable; it has not happened in years.	0,5
Practically impossible (possibility in 1'000.000)	0,1

Source: *William T. Fine Methodology for Risk Analysis.*
Prepared by*: Ecosfera Cía. Ltda., 2017*

Finally, the value obtained for the Degree of Danger (GP), based on the multiplication of consequence, exposure and probability, is compared with William Fine's index value table to obtain a qualitative assessment of the risks analysed.

GP = C * E * P

Where:
GP: Degree of Danger
C: Consequences
E: Exposure
P: Probability

Table 126: Probability of occurrence of the accident

WILLIAM FINE INDEX VALUE	INTERPRETATION
0 < GP < 18	LOW
18 < GP ≤ 85	MEDIUM
85 < GP ≤ 200	HIGH
GP ≤ 200	CRITICAL

Source: *William T. Fine Methodology for Risk Analysis.*
Prepared by*: Ecosfera Cía. Ltda., 2017*

The detected risks of the project to the environment for the analysed activity are as follows:

Table 127: Endogenous Risks of the Project

RISK	ACTION TO BE TAKEN

Fuel Spills	• Purchase of anti-spill kit • Spill control procedures
Explosions	• Control of electrical installations • Control of storage tanks and containers for the storage of fuels and products
Fires	• Control of electrical installations • Control of fuel and chemical storage tanks and containers • Review of fire extinguishers and firefighting equipment
Mechanical failures	• Continuous maintenance • Personnel training
Operational failures	• Personnel training • Use of Personal Protective Equipment • Written work procedures

Source: *Own elaboration*
Prepared by*: Ecosfera Cía. Ltda.*
Date*: July 22, 2017*

11.1.1. ENDOGENOUS RISK ANALYSIS

Table 128: Results of the analysis of the project towards the environment

	ENVIRONMENTAL FACTOR				
RISK	**DEGREE OF DANGER**				
	(C)	**(E)**	**(P)**	**Valuation index**	**Interpretation**
Fuel Spills	50	2	3	300	Critical
Explosions	15	0,5	0,5	3,75	Low
Fires	1	1	1	1	Low
Mechanical failures	1	1	3	3	Low
Operational failures	50	2	3	300	Critical

Source: *Own elaboration*
Prepared by*: Ecosfera Cía. Ltda.*
Date*: July 22, 2017*

11.2. ENVIRONMENTAL RISKS TO THE PROJECT (EXOGENOUS)

The highest risk situations involve a combination of hydrological, geological, biological and chemical events.

Considering that much of the lower Jubones River Basin is susceptible to flooding, severe rainfall events could cause the estuary to overflow and cause temporary interruption of access roads to the sanitary sewer system.

This situation must be controlled by keeping the stream bed clean and having alternate access routes to the sanitary sewer system.

The probability of historical seismicity is an extremely important factor, taking into account that Ecuador is located within the Pacific Ring of Fire and subject to the movements of the South American and Nazca tectonic plates. Since the 1960s, the level of seismic risk in the area of influence of the project is considered low; however, it is advisable to maintain prevention systems that could affect the normal operation of the Puerto Bolívar Port Terminal.

Taking into account the great extension of the territory, diversity of its topography, different zones and climates, etc., it is subject to be exposed to a series of risks, among which we note:

Table 129: Natural Hazards Intensity

RISK	INTENSITY
Earthquake	Medium
Overflow	High
Flooding due to heavy rains	High
Slope landslides	Low
Sea penetration	Medium

Source: *Own elaboration*
Prepared by*: Ecosfera Cía. Ltda.*
Date*: July 22, 2017*

11.2.1. RISKS OF EARTHQUAKES

The evaluation of historical seismicity is of utmost importance as it constitutes a parameter used in the study of seismic hazard. In terms of seismic risk, Ecuador is located on the so-called "Pacific Ring of Fire", which is an active sector of movements of the Teutonic plates of Nazca and South America.

Historically, since 1541, about 80 seismic movements have been reported in the country, of intensity greater than grade 6 on the Mercalli scale, produced due to the presence of the active fault system, Dolores-Guayaquil Megashear.

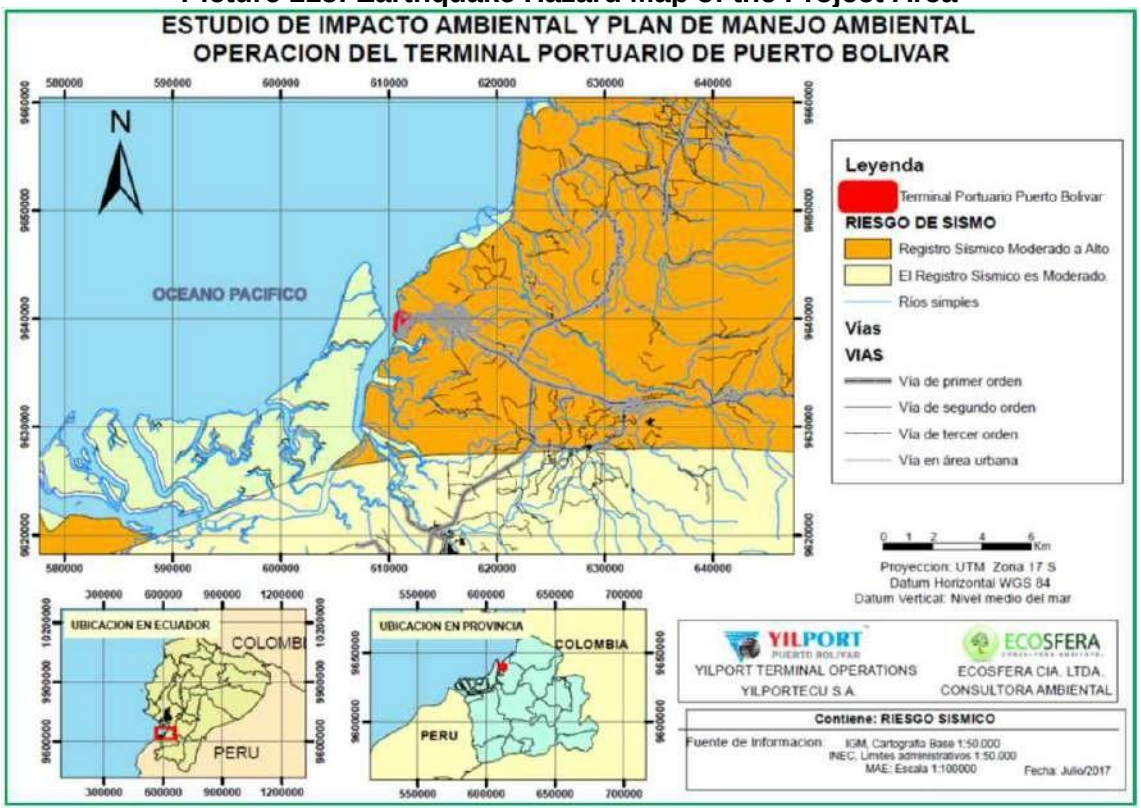
Most of the energy released during the last century corresponds to an earthquake that occurred on December 12, 1953, whose epicentre was located in the Gulf of Guayaquil and had a magnitude of 7.8 on the Richter scale. For this reason, the region is considered a seismically vulnerable zone, since a large amount of energy accumulated in the active faults can be released in a single earthquake.

For these reasons of past earthquakes and of high tendency in their future generation (according to the above mentioned), civil facilities must be built with anti-seismic construction standards.

According to data from the Secretary of Risks in the province of El Oro, earthquakes of slight magnitude have been recorded, especially in the north of the province, specifically in Machala, where no such events have taken place.

According to the Seismic Map of the project area, specifically the city of Machala is located in a Moderate to High Seismic Risk zone.

Picture 115: Earthquake Hazard Map of the Project Area



Source: *www.geoportalmae.gob.ec, INEC*
Prepared by*: Ecosfera Cía. Ltda.*
Location*: Puerto Bolívar Port Terminal, Canton Machala - Province of El Oro*
Date*: July 22, 2017*

11.2.2.2. RISK DUE TO TSUNAMIS

The threat of a tsunami on the Ecuadorian coast is permanent and real, due to the presence of the subduction zone and the complex system of faults, which has given rise to large earthquakes both at continental and submarine level. Earthquakes with location or epicentre on the continental shelf are the greatest threat to Ecuador, since they can produce local tsunamis and affect the nearest coasts.

11.2.2.1. HISTORICAL TSUNAMIS WITH EFFECTS ON ECUADORIAN COASTS

Local tsunamis for the Ecuadorian coasts and with important information found in the literature (source: Espinoza, 1992; CERECIS Catalogue) are detailed below:

1) Tsunami occurred on December 31, 1906, generated 138 km west of Tortuga, Esmeraldas province, the seismic magnitude established according to the Richter scale was Ms 8.8.
2) Tsunami occurred on October 2, 1933, generated off the Santa Elena Peninsula, Santa Elena province, the Richter seismic magnitude established was 6.9.
3) Tsunami occurred on December 12, 1953, generated off the coast of Tumbes (Ecuador-Peru border), the established seismic magnitude was over 8.6, the

waves were not destructive, because they presented oscillations of approximately 20 cm.

4) Tsunami occurred on January 19, 1958, generated in the border region of Ecuador - Colombia, the seismic magnitude of this event was calculated at Ms 7.8 Ritcher.
5) Tsunami occurred December 12, 1979, generated by an earthquake of magnitude Ms 7.9 Ritcher, offshore, north of the coastal edges of the San Lorenzo area, Ecuador - Colombia border sector.

11.2.2.2. Characterization of the Tsunamigenic threat in the province of El Oro

Machala is an area prone to flooding, as there are neighbourhoods and localities very close to the estuaries that make up the Jambeli Archipelago. In the surroundings of Puerto Bolívar, there are palatial houses with a distance between the ground and the sea level of 80 cm; similarly, Machala has extended enough, so that neighbourhoods and towns are just a few meters from the sea.

Estimated wave heights could reach 2 m and wave arrival times could be estimated at 75 minutes or more. This sector is protected by the Jambeli Archipelago, but the most exposed part is the Puerto Bolívar seaport.

11.2.3. RISK DUE TO FLOODING

The areas susceptible to flooding due to overflowing of river currents are located in the low areas of the plains where heavy rains originating in the mountainous regions to the east, the silting of the rivers and the important modifications made in the area to the natural drainage due to the construction of irrigation canals, river dams, etc., cause the waters to overflow from their channels in these low areas with scarce slopes, causing frequent and catastrophic flooding.

Another contributing factor is the presence of severe hydrometeorological phenomena, such as ENSO (El Niño Southern Oscillation), which affects the area every few years, such as the phenomena associated with El Niño in 1981-82 and 1997, increasing the risk of flooding. These floods combined with extreme rainfall in the plains areas can cause significant damage to agriculture and population settlements in these plains.

The effects of the El Niño Phenomenon of 1982-1983 (February-April 1982) and later those of 1997-1998 (September 1997 to May 1998) caused enormous damage in the cantons of the province of El Oro. The greatest damage was caused by the loss of agricultural crops and shrimp due to flooding, damage to roads, health centres and schools, and water contamination.

During El Niño seasons, the impact of excess rainfall is especially critical, but even in average annual rainy seasons, devastating effects are occurring in the different communities of the cantons of the province of El Oro in Ecuador. Most of the disasters generated by floods have had their most severe effects in rural areas, where crops have been lost due to flooding and water contamination.

The total area affected by this cause in the territory is 74,525 ha, directly and indirectly (data from the Cañar River flood control study).
In terms of risk, in the urban sector there are houses located in low-lying areas that face the natural threat of flooding, and there are also houses in the central area that are located at levels below the roadway.

The urban part of the cantonal capital, due to the tributaries of water, such as rivers and estuaries that cross and surround the sector of the cantonal capital, and that when there

are strong and severe rainfalls that cause overflows of the mentioned rivers, they produce havoc that mainly floods a large part of the cantonal capital.

11.2.3.1. RURAL AREA

At the rural level, the greatest threat to human settlements is flooding, due to the large number of bodies of water in the canton, which in strong winters or during the El Niño Phenomenon take on considerable volume and flow, and the fact that most of the houses in this sector are located next to them.

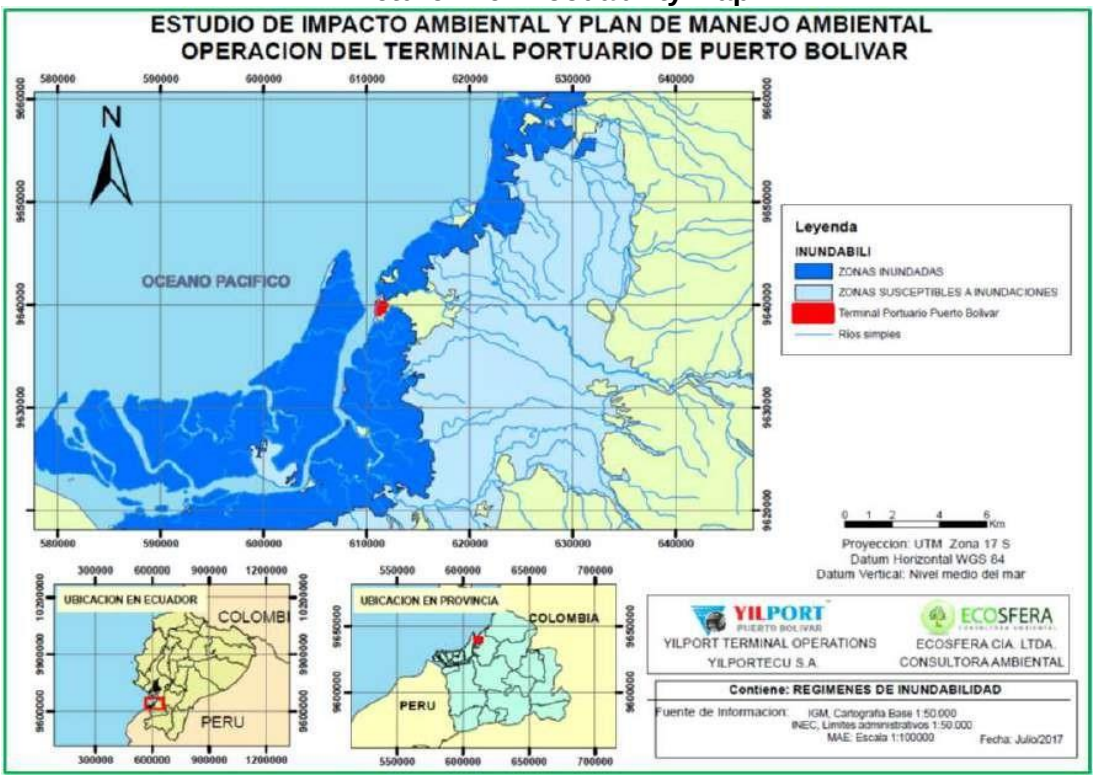
It should be noted that the entire territory of Machala Canton is within the flood zones of the Ecuadorian coast as indicated in the national risk maps.

11.2.3.2.2. FLOOD ZONES

In Ecuador there are regions where floods are concentrated. During the last 12 years, the highest frequency of floods occurred in the coastal provinces.

In the province of El Oro, between 20 and 40 flood events were recorded. A large part of the surface area of Machala canton, about 50%, is susceptible to flooding, as shown in the Flood Map, with the city of Machala and Puerto Bolívar being areas susceptible to flooding.

Picture 116. Floodability Map



Source: *www.geoportalmae.gob.ec, INEC*
Prepared by*: Ecosfera Cía. Ltda.*
Location*: Puerto Bolívar Port Terminal, Canton Machala - Province of El Oro.*
Date*: July 22, 2017*

Picture 117: Flood Risk

Source: *www.geoportalmae.gob.ec, INEC*
Prepared by*: Ecosfera Cía. Ltda.*
Location*: Puerto Bolívar Port Terminal, Canton Machala - Province of El Oro*
Date*: July 22, 2017*

Specifically, in the project, the main natural hazard is the risk of flooding, as mentioned above, due to the phenomenon of the Nino and because there is no drainage of the watersheds contributing to the project areas.

In Jambeli parish, due to its topography, most of the territory is prone to flooding, with high and medium susceptibility in the parish.

The analysis of Exogenous Risks according to the methodology detailed above is explained in the table below:

ANALYSIS OF EXOGENOUS RISKS

Table 130: Results of the analysis of the environment towards the project

ENVIRONMENTAL FACTOR					
RISK	DEGREE OF DANGER				
	(C)	(E)	(P)	Valuation index	Interpretation
Earthquake	1000	1	0.5	50	Medium
Overflow	50	3	1	150	High
Floods	15	3	10	450	Critical
Slope landslides	1	0,5	1	0,5	Low
Sea penetration	5	1	1	5	Low

Source: *Own elaboration*
Prepared by*: Ecosfera Cía. Ltda.*
Date*: July 25, 2017*

11.3. PROJECT RISK ANALYSIS AND EVALUATION

A simplified risk assessment method will be used for the risk assessment, which allows quantifying the existing risks and rationally prioritizing their priority. The following is an Analysis and Assessment of the project: ***"Construction and Operation of the Puerto Bolívar Port Terminal".***

11.3.1. PREVENTIVE MANAGEMENT

In order to establish an adequate preventive management and determine the measures required for risk prevention, it is necessary to identify the factors that generate risks and evaluate them to determine their importance.

Identifying risks is essential, both for the people who are exposed to them and for those who must act to eliminate them.

Risk identification and assessment is therefore a technical task, in which different aspects must be considered; moreover, there are various forms of risk assessment. Systematizing these criteria, this risk analysis will consider:

- Safety conditions
- Environmental conditions (around the employee or occupational hygiene)
- Workload
- Work organization

Preventive safety management is designed to develop a preventive work in Health and Safety, based on the following criteria:

- Avoiding risks
- Assess risks that cannot be avoided Combat risks at their source.

- Adapt the work to the person, in particular with regard to the design of the workstation, as well as the choice of equipment and work and production methods.
- Take into account technical developments.
- Substitute what is dangerous for what entails little or no risk
- Plan prevention, seeking a coherent whole that integrates technique, work organization, work conditions, social relations and environmental factors.

11.3.2. IDENTIFICATION OF RISKS

The Risk Identification has been carried out based on the Project Description, with an analysis of the different activities, observations data were collected, using an INSHTE[1] checklist.

Risk diagnosis is a process that involves studies to identify conditions, risks, evaluation of incidents and their risk reduction alternatives.

Based on this study and the factors noise, gases, suspended particles, effluents, waste, among others. Recommendations were issued in accordance with different standards such as health, environment, and safety. The urgency of the application and its solution will depend on the magnitude and probability of the risk detected.

The following checklists were applied:

- Workplaces
- Machines
- Hand tools
- Handling of objects
- Electrical installation
- Fire and explosions
- Chemicals
- Ventilation and air conditioning
- Noise
- Lighting
- Physical load

Through these, compliance and non-compliance were established, which when evaluated based on the pertinent Ecuadorian legislation, more explicitly, the Occupational Safety and Hygiene Regulation, the Occupational Health and Safety Regulation and other laws.

[1] National Institute of Occupational Health and Safety in Spain

Table 131. Identification of Project Risks

ASPECTS	FACTORS	ADMINISTRATIVE ACTIVITIES	USE OF DOCKS BY SHIPS	TRANSFER OF CONTAINERS, GENERAL CARGO AD BANANAS	CONTAINER STORAGE	WEIGHTING	CONSOLIDATION/DE-CONSOLIDATION OF CONTAINERS	OPERATIONS FOR CAPACITY OR INSPECTIO	RECEIPT AND DELIVERY OF CONTAINERS AND	CONSTRUCTION OF DOCK #6
Safety Conditions	1. Work place	B	B	B	B	B	B	B	B	B
	2. Machines	N/A	N/A	B	B	B	B	B	N/A	B
	3. Hand Tools	N/A	B	B	B	N/A	B	B	N/A	B
	4. Handling of Objects	B	B	B	B	B	B	B	B	B
	5. Electric Installations	B	B	D	D	B	B	D	D	B
	6. Fires and Explosions (prevention)	B	B	B	D	B	B	B	D	B
	7. Chemical Substances	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	8. Chemical Contaminants	N/A	B	B	B	B	B	B	B	B
Environmental Conditions	9. Ventilation and air conditioning	B	N/A	N/A	B	N/A	N/A	N/A	N/A	N/A
	10. Control of Noise	N/A	B	B	B	B	B	B	B	D
Workload	11. Physical Load	B	B	B	D	B	B	B	D	D
Work Organization	12. Factors of Organization	B	B	B	D	B	B	B	D	B

MD=Very Deficient D=Deficient B = Good

11.3.3. RISK ANALYSIS - LEVELS OF RISK

For the Risk Level Analysis, it is necessary to identify the process where the hazard analysis and risk assessment is performed. The activities associated with the process must be identified, as well as the associated workstations and equipment.

The development of the activities to be carried out in the Project: ***"Construction and Operation of the Puerto Bolívar Port Terminal"***, involves inherent risks associated with the tasks, processes, machinery, tools, materials that have a loss potential in case they are not properly performed or used.

The safety of the people involved in the project, of the facilities, infrastructure and equipment that interact directly in the project, is fundamental.

Therefore, it is important to perform a risk analysis as evidenced in the activities to be developed in the operation of the Port Terminal.

Picture 118: Risk Levels

Source: *National Institute of Occupational Safety and Hygiene in Spain*
Prepared by*: Ecosfera Cía. Ltda., 2017*
Date: *July 20, 2017*

Table 132: Project Risk Assessment

RISK ASSESSMENT												
CONSTRUCTION AND OPERATION OF THE PUERTO BOLIVAR PORT TERMINAL												
		PROBABILITY			CONSEQUENCE			RISK				
RISK TYPE	PERCEIVED RISK	Low	Medium	High	Slightly harmful	Harmful	Extremely harmful	Trivial	Tolerable	Moderate	Important	Intolerable
NATURAL	Flooding			X		X					X	
	Droughts	X			X			X				
	Erosion	X			X			X				
	Earthquakes		X				X				X	
	Landslides	X				X			X			
MECHANICAL	Entrapment by or between objects		X				X				X	
	Entrapment due to overturning of machines or vehicles		X				X				X	
	Collisions with vehicles	X				X			X			
	Collisions with stationary objects		X			X				X		
	Collisions against moving objects		X				X				X	
	Direct and indirect electrical contacts	X				X			X			

	Blows/cuts by objects or tools		X			X				X		
PHYSICAL	Falling objects		X			X				X		
	Fall of persons to a different level		X				X				X	
	Falling of people at the same level		X							X		
	Exposure to extreme environmental temperatures		X			X				X		
	Overexertion		X			X				X		
	Noise and Vibration			X		X					X	
	Fires		X				X				X	
CHEMICAL	Exposure to noxious or toxic substances	X				X			X			
BIOLOGICAL	Accidents caused by living beings	X			X			X				
ERGONOMIC	Position and Displacement		X			X				X		
	Cargo Handling		X				X				X	
PSYCHOSOCIAL	Relations and Communications			X		X					X	
	Working Time			X		X					X	

SYMBOLOGY		
B: LOW	**LD:** SLIGHTLY HARMFUL	**T:** TRIVIAL
M: MEDIUM	**D:** HARMFUL	**TO:** TOLERABLE
A: HIGH	**ED:** EXTREMELY HARMFUL	**MO:** MODERATE
		I: IMPORTANT
		IN: INTOLERABLE

Source: *National Institute of Occupational Safety and Hygiene in Spain*
Prepared by*: Ecosfera Cía. Ltda., 2017*
Date: *July 20, 2017*

With the Risk Analysis carried out, it has been determined that the most significant risks of the project: ***"Construction and Operation of the Puerto Bolívar Port Terminal"*** are the following:

- Floods
- Earthquakes
- Entrapment by or between objects
- Entrapment due to overturning of machines or vehicles
- Collisions with stationary or moving objects
- Fall of persons to the same and different levels
- Noise and Vibration
- Fire Risk
- Cargo Handling
- Relations and Communications
- Working Time

Controls and actions must be implemented in the development of the Port Terminal's activities in order to guarantee the safety, health and welfare of its human and material resources, and at the same time ensure the protection of the population and the surrounding environment.

12. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) contemplates the application of selected corrective measures to prevent and mitigate the environmental impacts that may be generated by the development of the Project: ***"Construction and Operation of the Puerto Bolívar Port Terminal".***

Ministerial Resolution No. 061 RESTATEMENT OF BOOK VI of the Consolidated text of Secondary Legislation establishes in its Art. 3 that the Environmental Management Plan is the document that establishes in detail and in chronological order the actions required to prevent, mitigate, control, correct and compensate the possible negative environmental impacts or accentuate the positive impacts caused in the development of a proposed action. In general, the Environmental Management Plan consists of several sub-plans, depending on the characteristics of the activity or project.

12.1. OBJECTIVES

- To ensure that the activities carried out in the project comply with current environmental regulations.
- To prevent, minimize, control and monitor the environmental impacts identified in the project.
- To provide an environmental management tool for project stakeholders to implement activities that benefit the environment.

12.2. RESPONSIBILITY FOR THE IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

YILPORTECU S.A., as concessionaire of the Port Terminal, is responsible for compliance with the Environmental Management Plan.

It is important to point out that this document is mandatory for the personnel working in the different stages of the project, which is why they must allocate the necessary resources and ensure that the activities proposed in the Environmental Management Plan are carried out within the established dates.

12.3. STRUCTURE OF THE ENVIRONMENTAL MANAGEMENT PLAN

For the development of this EMP, we propose to develop plans focused on the execution of specific actions to reduce the adverse effects of land development on environmental factors. The Environmental Management Plan contemplates the basic plans established in the TULSMA and in Ministerial Resolution 061, these plans are:

- Impact Prevention and Mitigation Plan
- Waste Management Plan
- Communication, Training and Environmental Education Plan
- Community Relations Plan
- Contingency Plan
- Occupational Health and Safety Plan
- Monitoring and Follow-up Plan
- Area Abandonment and Handover Plan

Each program comprises the following parameters:

- Code
- Name of Measure
- Objectives
- Place of application
- Responsible
- Environmental aspect

- Impact identified
- Proposed measures
- Indicators
- Means of verification
- Term (months)

12.3.1. IMPACT PREVENTION AND MITIGATION PLAN

PREVENTION AND MITIGATION PLAN NOISE, PARTICULATE MATTER AND GAS EMISSION CONTROL PROGRAM					
PURPOSE: Minimize, prevent and control the possible alteration of air quality due to the generation of noise, particulate matter and gaseous emissions. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PPM-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
AIR	Generation of noise, vibration and gaseous emissions Affecting the population and occupational health and safety	In order to control and mitigate possible impacts on air quality and health and safety of employees and the surrounding population, the following measures must be complied with: • Perform preventive and corrective maintenance of equipment and machinery in order to keep them in good working order. • Employees shall wear PPE (hearing protection) to mitigate noise generated by port operations. • The transit of equipment, machinery and vehicles will be done through authorized routes and roads established by the administration. In addition, a speed limit of 20 km/h must be established.	Number of teams and machinery that have received maintenance/ Number of teams and machinery used*100 = 100% Provisions complied with/ established provisions*100 = 100%	Registration sheets for maintenance of machinery and equipment Photographic records	Monthly One month (1)

		• Transportation of materials in trucks or dump trucks must be completely covered with protective tarpaulins when construction activities are carried out. • The transported material must not protrude beyond the height of the load compartment or the height of the sides of the bucket. • Apply water by irrigation to loose material and/or unpaved roads, using a tanker truck with a flute or similar equipment, to avoid dust generation. • The tanker shall not travel in the irrigation zone at speeds higher than 5 km/hour. • Each dump truck must carry shovels and brushes to collect material that may eventually fall onto public roads. • Sweep and keep the streets around the construction site clean at all times, complying with and complying with the city's sanitation regulations. • All equipment used during the construction phase must be designed to comply with the 70 decibel limit (maximum sound pressure level) in the limits of • perimeter of the facilities, if practical and feasible. • Noise levels within the work areas during the construction stage will be governed by the Ecuadorian		

		Legislation: Consolidated Text of Legislation. • Environmental Secondary • Employees exposed to excessive noise levels shall have hearing protection. • All cargo and/or private vehicles transiting through the Port terminal facilities shall avoid using horns, horns, whistles or horns.			

PREVENTION AND MITIGATION PLAN
IMPACT PREVENTION AND CONTROL PROGRAM

PURPOSE: To have standards for the correct development of activities in order to prevent and mitigate possible impacts. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PPM-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
AIR	Generation of noise, vibration and gaseous emissions Affecting the population and occupational health and safety	• To dictate precise provisions to its employees to: prevent the consumption of alcoholic beverages and drugs at work sources or work fronts. • No burning or incineration of any kind will be allowed. • All equipment, machinery and/or equipment maintenance activities must be carried out specifically in the areas designated for this purpose. In the event that the machinery is difficult to move, this activity must be carried out in waterproofed areas. • The materials left over from the basic work (rubble) or those generated by other structures (if any) will be placed in areas approved or designated for this purpose. • Storage areas for construction aggregates or other materials that can be carried by wind action should be hydrated with water or covered with plastic film and/or textiles.	Provisions complied with/ established provisions*100 = 100%	Written standards of provisions to be complied with Photographs	Monthly One month (1)

		• Adequately signalling work fronts when specific work is performed outside of normal activities. • The orderly location of construction materials should be planned at the site, and sites for the accumulation and storage of the different materials should be indicated. • In the event that the construction process is paralyzed, the builder will maintain security personnel to prevent theft and losses affecting the construction site, in addition to placing safety signs and protections for the safety of the population in the surrounding area.			

12.3.2. WASTE MANAGEMENT PLAN, PMD

WASTE MANAGEMENT PLAN COMMON WASTE MANAGEMENT PROGRAM					
PURPOSE: Proper waste management **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PMD-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOIL WATER LANDSCAPE SOCIAL	Solid waste generation Landscape transformation Social conflicts	Within the Port Terminal, in each area there must be an adequate identification and disposal of solid waste generated by the project. The management of common waste resulting from terminal operation activities will be carried out in accordance with INEN NTE 2841: 2014-03. Waste should be separated at the source using containers that facilitate its identification, for subsequent separation and final disposal. Separation guarantees the quality of usable waste and facilitates its classification; therefore, the containers that contain it must be clearly differentiated. The collection procedures must be carried out in a safe manner, avoiding as much as possible the spillage of waste and must not cause the separation previously made to be lost,	Number of containers installed/ number of containers required *100 = ≥9%	Photographic records Container purchase record	Monthly One month (1)

		Therefore, waste must be packaged in such a way as to avoid contact with the environment and the people in charge of collection. Coloured containers must be labelled in a visible place, according to the colour code, as described below:  Common waste will be collected in each area by specific personnel and then transferred to a general container to be collected by the municipal collection service of the city of Machala and then transferred to the city's sanitary landfill.			

OCCUPATIONAL HEALTH AND SAFETY PLAN HAZARDOUS AND SPECIAL WASTE MANAGEMENT PROGRAM					
PURPOSE: To establish specific procedures for the handling, transfer, storage and final disposal of Hazardous Waste generated in the work of the project **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PMD-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOIL WATER SOCIAL	Hazardous waste generation and soil and water contamination	Within the Port Terminal, hazardous and/or special waste must be classified in a special manner. In general, this category includes solid waste from inputs used in the machinery, such as rags soaked with oil and used fuel, plastic containers and oil filters, tires, among others, as established in the environmental regulations. The areas where this waste is generated should be identified and containers should be placed according to the colour code described above, as indicated below:	Amount of waste generated/ Amount of waste managed*100 = 100%	Photographic record	Monthly Three months (3)

		  These wastes will be transferred to a special storage facility for the Temporary Storage of Hazardous Materials, which will comply with INEN NTE 2266 Transport, storage and handling of Hazardous Materials. As part of the management, a monthly log must be kept of the generation of hazardous and special waste, including the characteristics of the waste, volume, origin and final disposal. All hazardous liquid wastes generated should be collected in hermetically sealed containers duly labelled and taken to the temporary hazardous waste storage area for subsequent delivery to a qualified manager. It is of utmost importance that the Port Terminal, as well as its Operators, obtain the Hazardous Waste Generator Registration before the National Environmental Authority, in accordance with provisions of Ministerial Resolutions 026, 061 and 142. The certificates provided by the managers must be kept in a specific file that will be created and implemented for this type of waste.	Registration as a hazardous waste generator obtained = 1 Copy of the registrations as hazardous waste generator of the applicable port operators	Monthly generation log of Waste Dangerous Manifest delivery Registration as hazardous waste generator	

12.3.3. COMMUNICATION AND TRAINING PLAN, PCC

COMMUNICATION AND TRAINING PLAN TRAINING PROGRAM					
PURPOSE: • Implement education actions on industrial safety and occupational health issues that allow the development of project activities in a safe and responsible manner in compliance with applicable regulations. • Promote environmental awareness among employees and stakeholders, which translates into the protection and conservation of natural resources through responsible actions in the work they carry out in the project. • To adequately implement the Environmental Management Plan. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PCC-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Ignorance of the measures of the PMA and occupational safety and health standards. Occupational hazards due to lack of safety equipment, accidents and contingencies during the performance of the project activities.	**INTRODUCTORY TALK** They will be given to new employees who start working on the project, to the operators of machinery and technical equipment to be integrated into the project. The introductory talk will last no longer than 30 minutes and the topics to be covered are described in the following table: **QUARTERLY TALKS** They will be addressed to all personnel involved in project activities.	Number of employees trained/number of employees hired*100 = ≥90%	Photographic records Attendance records for talks and training	Quarterly Three months (3)

	Affecting the Health and Safety of the employees	Talks will not last more than 60 minutes and will make use of didactic material (videos, diagrams, brochures). The main topics to be taught will be: - Environmental Management Plan - Environmental Legislation - Use of Protective Equipment Staff - Order and Cleanliness - Waste Management - Occupational Health and Safety - Risk of Accidents Records will be kept for each lecture and training session, which will include topics covered, trainer's data, date and number of hours given, and participants' signatures.			

COMMUNICATION AND TRAINING PLAN FIRE PREVENTION AND FIRST AID TRAINING PROGRAM					
PURPOSE: To have procedures for fire prevention and control. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PCC-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
HEALTH AND SECURITY SOCIAL	Occupational hazards due to lack of safety equipment, accidents and contingencies during the implementation of the project's activities. Risk of Fires Affecting the Health and Safety of the employees	All personnel should be trained in the use of fire extinguishers, fire prevention and first aid. It is necessary to establish a coordination schedule with the Fire Department of the City of Machala to carry out fire drill events and practice the use of portable devices. The basic topics to be covered are the basic rules comprising: - Classes of Fire - Types of Fire Extinguishers - Use and handling of fire extinguishers - How to avoid a fire - Ways to extinguish a fire - Steps for correct use of fire extinguishers - Safe process for breaking cabinet glass - Fire hydrant utilization process	Number of employees trained/ number of employees hired*100 = ≥90%	Photographic records Attendance records for talks and training sessions	Quarterly Three months (3)

12.3 4. COMMUNITY RELATIONS PLAN, PRC

COMMUNITY RELATIONS PLAN COMMUNITY RELATIONS PROGRAM					
PURPOSE: Build positive relationships with the communities, social organizations and local governments located in the direct area of influence of the project **LOCATION OF IMPLEMENTATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PRC-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Alteration of the harmony of the Project Social conflicts	YILPORTECU project manager S.A. will manage the "Community Relationships" of the project, in which meetings will be held with the project's main stakeholders: - Local authorities - Social organizations and communities in the project's areas of influence. - Operators and companies linked to the project Approaches should be made to the main authorities of the sector in order to inform the inhabitants of their concerns and establish communication links between the project - community - authorities.	N° of meetings held / N° of meetings planned per year	Records of Attendance at meetings Photographic record Meeting minutes	Semi-annual Three months (3)

COMMUNITY RELATIONS PLAN SOCIAL PARTICIPATION PROGRAM					
PURPOSE: To inform the population of the area of direct influence of the project about the activities to be developed in the Puerto Bolívar Port Terminal **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PRC-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Lack of information to the community adjacent to the project Social conflicts	The Environmental Consultant ECOSFERA CÍA LTDA. and the company YILPORTECU S.A., will coordinate with the Environmental Authority (Secretary of Environmental Management of the Autonomous Provincial Government of El Oro) the mechanisms of diffusion and social participation to the involved social actors and neighbouring community about the project, according to what is established in the Executive Decree 1040 and Ministerial Resolution 103.	Process of Social participation executed = 1	Records of the mechanism of social participation Photographic records PPS Report approved by the Environmental Authority	Once One month (1)

12.3.5. CONTINGENCY PLAN, PDC

CONTINGENCY PLAN EMERGENCY AND CONTINGENCY RESPONSE PROGRAM					
PURPOSE: • Prevent the occurrence of unplanned but foreseeable events, and define immediate response actions to control such events in a timely and effective manner. • Establish emergency prevention measures in order to protect the lives of people, the natural resources affected and the property of the company and third parties. • Define the procedures to be followed in case of emergencies in order to minimize the adverse effects derived from them. • Promote in all personnel the development of skills and capabilities to prevent and deal with emergency situations. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PDC-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
BIOTIC SOCIAL ECONOMIC	Risk of vehicular accidents Risk of Occupational accidents Affecting the Health and Safety of employees and population of the area of influence	YILPORTECU S.A. shall establish a security mechanism in response to any emergency that may arise during the activities of the Port Terminal. Bolívar. This mechanism must establish responsibilities for immediate response to possible events (natural disasters, work-related accidents, fires, etc.) that may occur at the terminal. A responsible person should be designated at the work front and who will	Contingency Plan elaborated = 1 100% effectiveness of response to emergencies Scheduled drills/	Contingency Plan Reports and notifications of occupational accidents Register of accidents and incidents Simulation report	Semi-annual Three months (3)

	Risk of Fires Spills of hydrocarbons and other hazardous substances	be in charge of the application of the **CONTINGENCY PLAN**, who will be in charge of directing actions in case of an emergency. This in turn may designate responsibilities to other employees. All employees, operators, administrative personnel, suppliers and others should be familiar with the following instructions to be followed in case of emergency: 1. Notify the person in charge of contingencies and emergencies. 2. The person in charge should determine the degree and type of emergency: fire, accident (communicate alert or alarm). 3. Communicate the emergency to ECU 911. 4. Keep bystanders away, if necessary form a human cordon. 5. Prohibit the entry of people to the site where the event occurred, for this purpose, safety signs or barriers such as danger tape, cones, etc. will be placed. 6. Make personnel aware of places where there is a risk of fire, falls, etc., by placing the necessary informative or preventive safety signs in key places to avoid accidents at work. 7. Familiarize personnel with safety information, placing in visible places the ECU 911 telephone number.	drills performed*100 = 100%		

		All personnel should be trained in first aid. In addition, it is necessary to keep an updated registry of aid and relief institutions with addresses and telephone numbers (Red Cross, Fire Department, National Police, Emergency, GOE, Risk Management, Hospitals and Clinics, Regional Electricity Corporation, Risk Secretary, among others). Within the Port Terminal, Evacuation Routes and meeting points will be established and properly signposted. Once the event or emergency is over, activities will resume normally once the order is given by the General Manager of the Port Terminal. In addition, the person in charge must make a complete report of the event with an investigation of the event in each of its phases. Based on this report, an evaluation of the emergency will be made, assessing its seriousness and the results of the actions taken. The Contingency Plan must be updated a minimum of twice a year and drills must be carried out to ensure their effectiveness.			

12.3.6. OCCUPATIONAL HEALTH AND SAFETY PLAN, PSS

OCCUPATIONAL HEALTH AND SAFETY PLAN INDUSTRIAL SAFETY PROGRAM					
PURPOSE: To have a legal technical instrument on Industrial Safety and Occupational Health, as established by current regulations. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PSS-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Risk of Accidents Impact on occupational health and safety Risk of damage from machinery and installations	The company YILPORTECU S.A. must have the Internal Regulations on Occupational Safety and Health aligned to provisions of the Ministry of Labour in compliance with the Executive Decree 2393 and other legal bodies that govern in Ecuador for the Puerto Bolívar Port Terminal. Health and Safety policies shall be applied in all activities, so that work is carried out free of risks and accidents, and if there are any, these are communicated for their evaluation and subsequent adoption of mechanisms to minimize them in the future. **HEALTH AND SAFETY POLICY** The company's Health and Safety policy applies to all its operations and projects. In order for the institution to achieve its goal of protecting the health and safety of its employees,	Internal Regulations on Health and Safety = 1	Internal Regulations on Occupational Health and Safety approved by the Ministry of Labour	Once Three months (3)

		it shall communicate its policy to all employees and their dependents and use it as the basis for its health and safety program. The policy states the institution's desire to achieve an accident-free workplace by complying with all regulatory requirements, communicating potential hazards to its employees and other interested parties, and providing appropriate training and equipment to its employees. The policy also defines the institution's expectations with respect to its employees and contractors, making them responsible for protecting their own and their colleagues' health and safety. **<u>SAFETY TRAINING</u>** YILPORTECU S.A., will ensure that all employees comply with a comprehensive Safety Training Program that includes the following main aspects • Institution's environmental safety policies and standards. • Responsibilities of employees with respect to work clothes. • Job-specific hazards • Safety precautions • Job Responsibilities	Number of employees who know policies/ number of employees hired*100 = 100% Number of employees who received safety training/number of employees hired*100 = 100%	Records of Health and Safety policy socialized with the employees Safety training records	

		• Regulatory requirements • Regulatory compliance policies of the institution. **SAFETY MEETINGS** The Industrial Safety Officer will develop a regular series of safety meetings to verify compliance with environmental and operational safety procedures. Attendance will be taken at these meetings. **INCIDENT AND ACCIDENT REPORTS** The Industrial Safety Officer shall report safety incidents and accidents and shall complete an accident report as soon as possible. The industrial safety officer should create a reporting system for the following: • Occupational injuries or illnesses • Injuries that can be treated on site (medical aid) • Property losses (fire, explosion, spills, vehicular accidents). **INCIDENT AND ACCIDENTS REPORTING AND INVESTIGATION** Employees shall immediately notify the Industrial Safety Technician of safety incidents and	Safety meetings held/safety meetings scheduled*100 = ≥90% Number of accidents reported/ number of accidents produced*100 = 100% Accident investigation reports	Minutes of meetings of security Occupational incident and accident reporting and investigation	

		in turn, the Technician shall create a reporting system for the following: • Fatalities. • Occupational injuries or illnesses. • Injuries that can be treated on site (medical aid). • Property loss or damage (fire, explosion, spills, vehicle accidents). • Any incident			

OCCUPATIONAL HEALTH AND SAFETY PLAN **FIRST AID KIT INSTALLATION PROGRAM**					
PURPOSE: To have medicines available to alleviate the symptoms that most commonly occur at work and to be able to give primary attention quickly in case of incidents during the execution of the work. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PSS-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
HEALTH AND SAFETY SOCIAL	Affecting the Occupational Health and Safety	The first aid kit is a basic resource for everyone, as it contains the essential elements to provide satisfactory care to victims of an accident or sudden illness, and in many cases can be decisive in saving lives. It is suggested to install several medicine cabinets in different areas with all the necessary medicines and supplies. The first aid kit should have a basic list of medicines (with the name of the medicines and how to use them).	Number of kits installed/ Number of kits scheduled to be installed*100 = ≥90%	Invoices for the purchase of first aid kit and drugs Photographs	Once Three months (1)

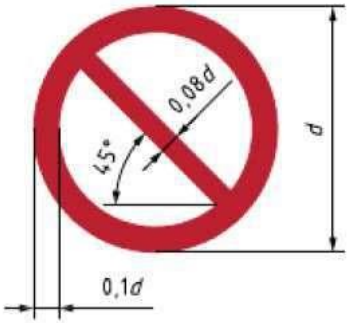
OCCUPATIONAL HEALTH AND SAFETY PLAN PERSONAL PROTECTIVE EQUIPMENT PROGRAM					
PURPOSE: • Prevent possible occupational accidents and illnesses to personnel during activities • Prevent and/or reduce the incidence of occupational diseases and occupational accidents during the operation phase of the project. • Implement the use of Personal Protective Equipment (PPE) during all activities, thus protecting employees. • Protect the physical safety of employees through the establishment of mandatory procedures. • Comply with the applicable guidelines stipulated in the Occupational Safety and Health Regulations **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** Promoter					**PSS-03**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Occupational hazards due to lack of security equipment Affecting the Occupational Health and Safety	All personnel working at the Puerto Bolívar Port Terminal who are exposed to risks must have safety equipment. YILPORT ECU S.A. shall require employees to use PPE during project activities. The use of personal protective equipment is mandatory. Without prejudice to their effectiveness, PPE will allow, as far as possible, the work to be carried out without unnecessary discomfort for the person performing the work and without diminishing his or her performance. The employer shall be obliged to: • Provide their employees with the mandatory means to protect them from the occupational risks inherent to their jobs.	Number of employees wearing PPE/ number of employees hired*10 0 = ≥90%	Invoices certifying the purchase of the EPP Photographic record of the employees using the EPP Minutes certifying the delivery and receipt of PPE	Once Three months (3)

		• Provide its employees with the necessary accessories for the correct maintenance of personal protection equipment. • Timely renew the means of personal protection, or its components, according to their respective characteristics and needs. • Instruct their employees on the correct use and conservation of personal protection equipment, undergoing the necessary training and making them aware of their applications and limitations. • Determine the workplaces and workstations where the use of personal protective equipment is mandatory. • Enforce the use and maintenance of PPE and monitor its efficient use and care. The employee is obliged to: • Use the means of personal protection in their work, according to their work needs. • Make correct use of them, not introducing any type of reform or modification in them. • Communicate to the OHS Technician the deficiencies observed in the condition or operation of the means of protection, the lack thereof or the suggestions for functional improvement.			

		In all maintenance work where there is a risk of falling objects or blows, it must be mandatory to wear an impact helmet for protection. Personal protective equipment shall consist of the following items: • Work clothes • Reflective vests • Helmets • Steel toe boots • Gloves • Masks • Safety glasses • Hearing protectors • Safety harness for work at height And other PPE that the safety technician determines necessary. Personal protective equipment must be made of soft, comfortable and hypoallergenic materials, appropriate for the activities carried out in the construction industry. The characteristics they must comply with are: • Providing maximum comfort • Its weight must be the minimum compatible with protection efficiency. • It should not restrict the employee's movements.			

		• Must be durable • It must be built in accordance with construction standards. • Must have an attractive appearance			

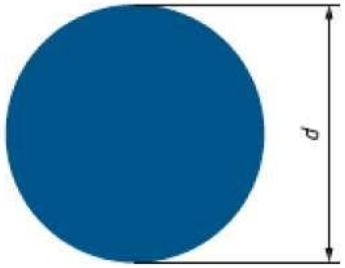
OCCUPATIONAL SAFETY AND HEALTH SAFETY SIGNS PROGRAM					
PURPOSE: • Define and execute a program for the implementation of safety signs and demarcation of areas to delimit and identify risk areas or zones aimed at reducing the potential occurrence of occupational accidents. • Prevent the occurrence of accidents and work incidents due to possible deficiencies in the signalling scheme. • Maintain in perfect condition the safety signs of work areas, evacuation routes, risk areas, warnings and indications. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PSS-04**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**MEASUREMENT OF VERIFICATION**	**Frequency TERM**
SOCIAL	Risks of Occupational accidents Risks to the physical integrity of employees and population Affecting the Population and Occupational Health and Safety	The design of the safety signs (colours, symbols, measurements, etc.) shall be in accordance with INEN ISO - 3864-1:2013. **DESIGN FOR SAFETY SIGNS** Safety colours, contrasting colours and geometric shapes should only be used in the following combinations to obtain the five types of safety signs: • **PROHIBITION SIGNS** The centre line of the diagonal bar shall pass through the centre point of the prohibition sign and shall cover the graphic symbol.	Number of signs installed/ number of signs scheduled to be installed*100 = ≥90%	Photographic record Purchase invoices for safety signs	Once Three months (3)



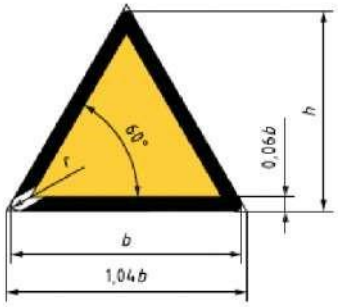
The colours of the sign shall be:
Background colour: white
Circular band and diagonal bar: red
Graphic symbol: black

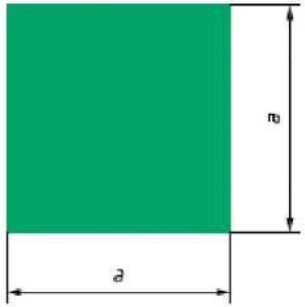
- **<u>MANDATORY ACTION SIGNS</u>**

They shall comply with the design requirements presented in the following figure:



The colours of the sign shall be:
Background colour: blue
Graphic symbol: white

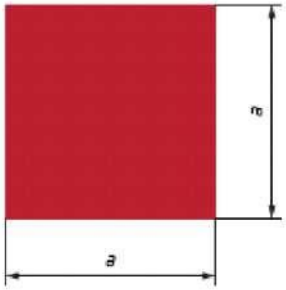
		The blue safety colour shall cover at least the 50% of the sign area. • **CAUTION SIGNS** If *b*= 70 mm, then *r*= 2 mm. The colours of the sign shall be:  **Background colour:** yellow **Triangular band:** black **Graphic symbol:** black The yellow colour shall cover at least 50% of the sign area. • **SAFE CONDITION SIGNS** The colours of the sign shall be:			



Background colour: green
Graphic symbol: white
The green safety colour shall cover at least 50% of the sign area.

- **EQUIPMENT SIGNS AGAINST FIRE**

The colours of the sign should be



Background colour: red
Graphic symbol: white

OCCUPATIONAL HEALTH AND SAFETY PLAN FIRE EXTINGUISHER INSTALLATION PROGRAM					
PURPOSE: To have an extinguishing agent as a first hand mechanism to extinguish a fire. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PSS-05**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
SOCIAL	Risks of Occupational accidents Risks to the physical integrity of employees and population Affecting the Population and Occupational Health and Safety Risk of damage to machinery and infrastructure.	Within the project areas, extinguishing agents must be installed according to the characteristics of the areas and the recommendations of the Safety technician. Fire extinguishers should be installed in easily accessible and clearly identified locations, free of any obstacles, and should always be in maximum working condition. The Technician in charge of Occupational Health and Safety of YILPORTECU S.A. shall check, install and recharge fire extinguishers inside the Port Terminal. For this purpose, an inspection sheet should be made, where the extinguisher number, location, type of extinguishing agent, date of last recharge, person in charge and condition of the extinguisher should be recorded.	Number of fire extinguishers installed / Number of fire extinguishers programmed to be installed*100 = 100%	Invoices for the purchase of fire extinguishers Photographic record Invoices for recharge of fire extinguishers Fire extinguisher inspection sheets	Monthly One month (1)

		In addition, personnel must be trained in the handling and use of fire extinguishers, as well as being kept informed of the measures that must be taken to prevent the occurrence of fires. The safety signs, which should be placed in the area where the extinguishers are located, is as follows:  SQUARE: on the wall, on top of the equipment high enough to be seen over surrounding obstacles and from a distance.   0.05 m wide STRIP on the floor, around the equipment, leaving 0.20 m free on each side and 0.50 m free at the front.			

12.3.7. MONITORING AND FOLLOW-UP PLAN, PMS

<table>
<tr><th colspan="6">MONITORING AND FOLLOW-UP PLAN
ENVIRONMENTAL QUALITY CONTROL PROGRAM</th></tr>
<tr><td colspan="5">PURPOSE: To monitor ambient air quality parameters in order to identify possible negative impacts due to atmospheric emissions and high sound pressure levels.
PLACE OF APPLICATION: Puerto Bolívar Port Terminal
RESPONSIBLE: YILPORTECU S.A.</td><td>PMS-01</td></tr>
<tr><th>ENVIRONMENTAL ASPECT</th><th>IDENTIFIED IMPACT</th><th>PROPOSED MEASURES</th><th>INDICATORS</th><th>VERIFICATION MEASURE</th><th>Frequency TERM</th></tr>
<tr>
<td>AIR QUALITY</td>
<td>Impact on air quality</td>
<td><u>AIR QUALITY MONITORING</u>
Biannual monitoring of ambient air quality and noise levels in the area of operation must be carried out to determine if negative environmental impacts have been generated.

The monitoring points are detailed below:
<table>
<tr><td>Point</td><td>Place</td><td>Coordinates (UTM-Datum WGS 84)</td></tr>
<tr><td>1</td><td>APPB Docks</td><td>X: 610951
Y: 9639819</td></tr>
</table>
The monitoring shall be carried out with calibrated equipment and following the monitoring methodology established in Annex 4 of Book VI of the Consolidated Text of Secondary Legislation of the Ministry of Environment issued by Ministerial Resolution 097 - A.</td>
<td>Number of monitoring performed/ number of monitoring scheduled*100 = 100%</td>
<td>Monitoring schedule

Report of Air Quality Monitoring

Report of Noise Monitoring

Photographic records</td>
<td>Semi-annual

Six months (6)</td>
</tr>
</table>

NOISE MONITORING

Noise monitoring must be performed by a laboratory accredited by the Ecuadorian Accreditation Service – SAE in the following points:

Point	Place	Coordinates (UTM-WGS 84)
1	Dock # 1	X: 610941 Y: 9639369
2	Administrative Area APPB	X: 611136 Y: 9639401
3	Dock # 5	X:611014 Y: 9640135
4	Puerto Bolívar Cabotage Dock	X: 610892 Y:9639050

Monitoring must be performed with calibrated equipment and following the monitoring methodology established in Annex 5 of Book VI of the Consolidated Text of Secondary Legislation of the Ministry of the Environment issued by Ministerial Resolution 097 - A.

Registration and analysis

A system must be established to record all monitoring carried out.

In addition to evaluating the results obtained and establishing new control measures in the event that the results do not comply with the permissible limits established by current environmental regulations.

<table>
<tr><th colspan="6">MONITORING AND FOLLOW-UP PLAN
ENVIRONMENTAL QUALITY CONTROL PROGRAM</th></tr>
<tr><td colspan="5">PURPOSE: To monitor water quality parameters in order to identify possible negative impacts
PLACE OF APPLICATION: Puerto Bolívar Port Terminal R
ESPONSIBLE: YILPORTECU S.A.</td><td>PMS-02</td></tr>
<tr><th>ENVIRONMENTAL ASPECT</th><th>IDENTIFIED IMPACT</th><th>PROPOSED MEASURES</th><th>INDICATORS</th><th>VERIFICATION MEASURE</th><th>Frequency TERM</th></tr>
<tr>
<td>WATER QUALITY</td>
<td>Affecting water and sediment quality</td>
<td><u>WATER QUALITY MONITORING</u>
The control points established in the environmental baseline will be monitored and compared with the permissible limits in Table 2. Admissible Quality Criteria for the preservation of aquatic and wild life in fresh, marine and estuarine waters of Annex 1 of Book VI of the Consolidated Text of Secondary Legislation of the Ministry of Environment, issued by Ministerial Resolution 097 - A.

The monitoring points are located in Santa Rosa Estuary at the points described below:

<table>
<tr><td>Point</td><td>Place</td><td>Coordinates (UTM-WGS 84)</td></tr>
<tr><td>1</td><td>In front of the Port (Depth 0.60 m)</td><td>X: 610680
Y: 9639902</td></tr>
<tr><td>2</td><td>In front of Liceo Naval (Depth 0.60 m)</td><td>X: 610682
Y: 9640521</td></tr>
</table>
Monitoring parameters:</td>
<td>Number of monitoring performed/ number of monitoring programmed *100 = 100%</td>
<td>Report of Water quality

Chain of custody for the collection of samples

Photographic records</td>
<td>Semi-annual

Six months (6)</td>
</tr>
</table>

		The parameters to be monitored are the following:			

		• Arsenic • Cadmium • Total Chromium • Copper • Iron • Mercury • Fecal Coliforms • Surfactants-Detergents • Oils and Fats • Biochemical Oxygen Demand • Chemical Oxygen Demand • Total Petroleum Hydrocarbons • Dissolved Oxygen in situ • Ammonia • Total Suspended Solids. • Organophosphorus Pesticides • Organochlorine Pesticides • Organonitrogenous Pesticides • Carbamates All water quality analyses will be performed in SAE-accredited laboratories. **Sampling** Water sampling will be simple and timely. A sampling log sheet should be completed that includes the following information: – Responsible – Date – Time and place – Number of samples taken			

		– Sample preservation method used. – Name of the laboratory that will analyse the samples and name of the person responsible for the analysis and delivery of results. – Name and signature of the person responsible for its transport – Notes or observations. – Date and signature of receipt of samples in the laboratory. In addition, the use of adequate containers for sample collection will be verified. For most of the parameters, samples can be collected in hermetically sealed plastic containers, however, the quantification of DQO (Chemical Oxygen Demand) and TPH (Total Hydrocarbons), requires the use of dark glass containers.			

MONITORING AND FOLLOW-UP PLAN ENVIRONMENTAL MONITORING AND FOLLOW-UP PROGRAM					
PURPOSE: To monitor compliance with the Environmental Management Plan by overseeing the activities carried out in the project. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PMS-02**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
FOLLOW UP AND MONITORING OF ENVIRONMENTAL COMPONENTS (AIR, NOISE, SOIL, WATER) SOCIAL	Impact on air quality, water and soil Risk of accidents Affecting the Occupational Health and Safety Solid waste generation atmospheric emissions generation Damage to machinery and equipment Social Conflicts	In order to monitor compliance with the Environmental Management Plan proposed for the Puerto Bolívar Port Terminal, it will be necessary to verify compliance with each of the measures on a monthly basis. A monitoring matrix will be applied to identify each measure and its level of compliance, as well as the means of verification indicating compliance. This plan will make it possible to obtain records that facilitate correcting and optimizing the efficiency of the measures implemented for the identified impacts involved, as well as to control the application of environmental measures and programs. For this purpose, YIPORTECU S.A. must hire a qualified consulting firm to supervise the Environmental Management Plan, which will be in charge of monitoring and controlling the environmental action applied by the executing company.	Actions completed/ Actions of the PMA*100 = ≥90%.	Monthly compliance reports of the PMA Contract with the supervisory company	Monthly Three Months (3)

12.3 8. AREA ABANDONMENT AND HANDOVER PLAN, PAE

AREA ABANDONMENT AND HANDOVER PLAN **AREA ABANDONMENT AND HANDOVER CLOSING PROGRAM**					
PURPOSE: To establish future conditioning or restoration measures in order to reduce health and environmental risks. **PLACE OF APPLICATION:** Puerto Bolívar Port Terminal **RESPONSIBLE:** YILPORTECU S.A.					**PAE-01**
ENVIRONMENTAL ASPECT	**IDENTIFIED IMPACT**	**PROPOSED MEASURES**	**INDICATORS**	**VERIFICATION MEASURE**	**Frequency TERM**
Protection of the environmental components (flora, fauna, soil, air, water)	Impacts on flora, fauna, natural areas productive capacity, soil, water and socio-economic factors Soil contamination	When the Puerto Bolívar Port Terminal decides to terminate its operation, it will carry out an Abandonment Plan according to its conditions. In summary, the Abandonment Plan should consider two main stages: 1. The first stage will be associated with the completion of all use activities and will contain the following components: – Disassembly of machinery, installations and structures – Debris Removal – Treatment of waste based on its classification During disassembly, measures should be taken to avoid the generation/propagation of noise and dust, and to properly dispose of liquid and solid wastes that may be generated during disassembly;	100% Compliance with the Abandonment Plan	Report of the Abandonment Photographic record	Once At the termination of the Project

		and the prevention of accidents. 2. The next stage is related to the recovery of sites that were intervened and includes the following activities: – Soil levelling and reconformation – A schedule of activities to be implemented at the site must be drawn up prior to the start of abandonment activities to allow for a new use of the area. Abandonment Plan and maintain coordination with the competent authorities for the correct execution of the planned activities. **STAGES IN THE DEVELOPMENT OF THE ABANDONMENT AND CLOSURE PLAN** • **Environmental Inspection** In the execution of the Environmental Inspection, the following should be identified: – Signs of soil contamination by solid waste; – State of the infrastructure; – Land use and topography – Determine demolition and decommissioning requirements , and conduct an environmental sensitivity assessment and pollutant source identification.			

13. ESTIMATED SCHEDULE OF THE ENVIRONMENTAL MANAGEMENT PLAN

Table 133: Environmental Management Plan Estimated Schedule

ENVIRONMENTAL MANAGEMENT PLAN ESTIMATED SCHEDULE													
PLANS	**EXECUTION TIME**												**BUDGET**
	MONTH 1	**MONTH 2**	**MONTH 3**	**MONTH 4**	**MONTH 5**	**MONTH 6**	**MONTH 7**	**MONTH 8**	**MONTH 9**	**MONTH 10**	**MONTH 11**	**MONTH 12**	
MITIGATION AND PREVENTION PLAN													
NOISE CONTROL PROGRAM, PARTICULATE AND GAS MATERIAL EMISSION													$50.000
PROGRAM OF IMPACT PREVENTION AND CONTROL													$2.500
WASTE MANAGEMENT PLAN													
COMMON WASTE MANAGEMENT PROGRAM													$3.000
HAZARDOUS WASTE MANAGEMENT PROGRAM													$5.000
COMMUNICATION AND ENVIRONMENTAL EDUCATION PLAN													
PROGRAM OF COMMUNICATION, TRAINING AND ENVIRONMENTAL EDUCATION													$2.000
PROGRAM OF													$3.500

TRAINING IN FIRE PREVENTION AND FIRST AID													
COMMUNITY RELATIONS PLAN													
COMMUNITY RELATIONSHIP PROGRAM													$2.000
CONTINGENCY PLAN													
RESPONSE PROGRAM TO EMERGENCIES AND CONTINGENCIES													$10.000
OCCUPATIONAL HEALTH AND SAFETY PLAN													
INDUSTRIAL SAFETY PROGRAM													$5.000
PROGRAM OF INSTALLATION OF FIRST-AID KITS													$3.500
PERSONAL PROTECTION EQUIPMENT PROGRAM													$20.000
PROGRAM FOR THE													$8.000

IMPLEMENTATION OF SAFETY SIGNS													
PROGRAM FOR THE INSTALLATION OF FIRE EXTINGUISHERS													$9.000
MONITORING AND FOLLOW-UP PLAN													
AIR QUALITY CONTROL PROGRAM													$2.000
WATER QUALITY CONTROL PROGRAM													$ .000
ENVIRONMENTAL AUDIT AND MONITORING PROGRAM													$30.000
AREA ABANDONMENT AND HANDOVER PLAN													
ABANDONMENT AND CLOSURE PROGRAM													$6.000
TOTAL							**One hundred sixty-three thousand five hundred**						**$163.500**

Source: *Own elaboration*
Prepared by: *Ecosfera Cía Ltda.*

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- Ministerial Resolution 097 A dated July 30, 2015

    - Annex 1: Environmental Quality Standard and Effluent Discharge.
    - Annex 2: Environmental Quality Standard for the Soil Resource and Remediation Criteria for Contaminated Soil
    - Annex 3: Air Emission Standard from Stationary Sources
    - Annex 5: Maximum Noise Emission Levels and Measurement Methodology for Stationary and Mobile Sources, and Maximum Noise Emission Levels from Mobile Sources

15. ANNEXES

- **ANNEX 1:** Intersection Certificate of
- **ANNEX 2:** Terms of Reference
- **ANNEX 3:** Company's Tax ID Number
- **ANNEX 4:** Administrative Resolution of Concession Awarding
- **ANNEX 5:** Project plan
- **ANNEX 6:** Air Quality Monitoring Report - Ambient Gases
- **ANNEX 7:** Noise Monitoring Report
- **ANNEZ 8:** Thematic Maps of the project
  - Project Implementation
  - Weather Stations
  - Types of Weather
  - Isotherms
  - Isohyets
  - Geologic Period
  - Geological
  - Geomorphology - Macro relief
  - Geomorphology - Meso-relief
  - General Geomorphology
  - Description Geomorphology
  - Soil Taxonomy
  - Soil Texture
  - Land Use Conflict
  - Watersheds
  - Hydrography
  - Road
  - Vegetable Coverage
  - Life Zones
  - Air Quality Monitoring Points
  - Noise Monitoring Points
  - Flora Monitoring Points
  - Wildlife Monitoring Points

APPENDIX 1

ECUADOR
MINISTRY OF THE ENVIRONMENT
CALLE MADRID 1159 Y ANDALUCÍA, QUITO, ECUADOR
ZIP BOX: 170109
TELEPHONE: (593 2) 3987 600
E-MAIL: www.ambiente.gob.ec

MAE-SUIA-RA-DPAEO-2017-208188

Machala, Monday, July 3, 2017

Bidder
Rafael Bernardo SAPIÑA GARCIA
General Manager
YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A.
In your office

CERTIFICATE OF INTERSECTION WITH THE NATIONAL PROTECTED AREA SYSTEM (SNAP IN SPANISH), STATE FOREST HERITAGE (PFE IN SPANISH), PROTECTIVE FOREST AND VEGETATION (BVP IN SPANISH), FOR THE PROJECT:
"CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A., LOCATED IN THE PROVINCE(S) OF (EL ORO)"

1. RECITALS

In order to obtain the Intersection Certificate with the National Protected Area System (SNAP in Spanish), State Forest Heritage (PFE in Spanish),Protective Forest and Vegetation (BVP in Spanish), YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A. as Bidder of the Project, work or activity, request this Ministry of State to issue the Intersection Certificate for the Project: CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A., located in the province(s) of (EL ORO)

2. ANALYSIS OF THE DOCUMENTATION SUBMITTED

The bidder submits the information of the project, work or activity in UTM coordinates in the DATUM reference system; WGS-84 South Zone 17, which is automatically superimposed by the Single Environmental Information System (SUIA in Spanish) with the official geographic coverage of the National Protected Area System (SNAP in Spanish),State Forest Heritage (PFE), Protective Forest and Vegetation(BVP) of the Ministry of the Environment.

From the automatic analysis of the information through the SUIA System, it is obtained from the Project, work or activity CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A,, located in the province(s) of (EL ORO), **DOES NOT INTERSECT** with the National Protected Area System (SNAP), State Forest Heritage (PFE), Protective Forests and Vegetation (BVP)

3. AUTOMATIC INTERSECTION CERTIFICATE

Based on the Ministerial Resolution No. 389 dated December 8, 2014, which establishes that the National Director of Environmental Pollution Prevention shall enter into Intersection Certificates nationwide.

4. CATALOGUE OF PROJECTS, WORKS OR ACTIVITIES:

From the information forwarded by YILPORT TERMINAL OPERATIONS (YILPORTECU) S.A. as Bidder of the project, work or activity; and in accordance with the Catalogue of Projects, Works or Activities issued by Ministerial Agreement No. 061 dated May 4, 2015, published in the Official Registration No. 316 dated Monday, May 4, 2015, it is determined:

41.05.04 CONSTRUCTION AND/OR OPERATION OF COMMERCIAL PORTS, corresponds to: **ENVIRONMENTAL** LICENCE**.**

5. PROJECT CODE: MAE-RA-2017-309603

The Environmental Regularization process of your project must continue in PROVINCIAL DECENTRALIZED AUTONOMOUS GOVERNMENT OF EL ORO, located in the Territorial Jurisdiction of the Province

Yours truly,

(illegible signature)
Vielka Cristina Altuna Álvarez, Environmental Engineer
National Director of Environmental Pollution Prevention, Responsible

I, Rafael Bernardo SAPIÑA GARCÍA, with Identity Card PAC333385, declare under oath that all information entered corresponds to reality and I acknowledge the responsibility generated by the misrepresentation or concealment when providing false or wrong data, pursuant to the provisions set forth in Article 255 of the Criminal Comprehensive Organic Code, which states: Forgery or concealment of environmental information: The person who issues or provides false information or conceals supporting information for the issue and granting of environmental permits, environmental impact studies, audits and environmental diagnosis, forestry permits or licenses, resulting in the commission of an error by the environmental authority, shall be punished with a penalty from one to three years imprisonment.

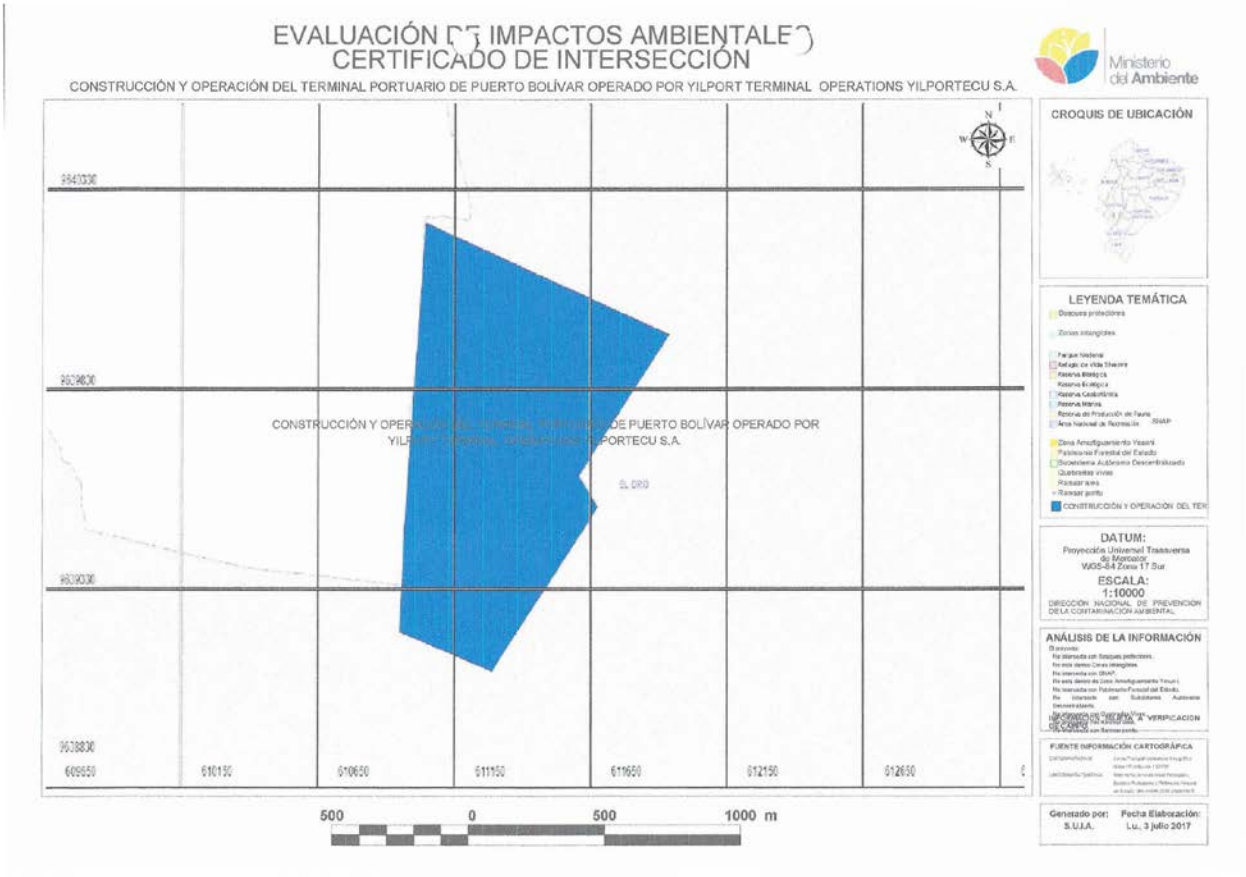
Yours truly,

Rafael Bernardo Sapiña García
PAC333385

MINISTRY OF THE ENVIRONMENT

ENVIRONMENTAL IMPACT ASSESSMENT
CERTIFICATE OF INTERSECTION

CONSTRUCTION AND OPERATION OF PUERTO BOLÍVAR PORT TERMINAL OPERATED BY YILPORT TERMINAL OPERATIONS YILPORTECU S.A.



SKETCH OF LOCATION

THEMATIC LEGEND
Protective forests
Intangible zones
National Park
Wildlife Refuge
Biological Reserve
Ecological Reserve
Geobotanical Reserve
Marine Reserve
Faunal Production Reserve
National Recreation Area SNAP (National Protected Area System)
Buffer Zone of Yasuni

State Forest Heritage
Decentralized Autonomous Subsystem
Live streams
Ramsar area
Ramsar spot
LAND CONSTRUCTION AND OPERATION

DATUM:
Universal Transverse Mercator Projection
WGS-84 South Zone 17

SCALE: 1:10000
NATIONAL BUREAU OF ENVIRONMENTAL POLLUTION PREVENTION

ANALYSIS OF THE INFORMATION
The project:
Does not intersect with protective forests
Does not intersect with SNAP (National Protected Area System)
Is not within the Buffer Zone of Yasuni
Does not intersect with the State Forest Heritage
Does not intersect with the Decentralized Autonomous Subsystem
Does not intersect with Live Streams
Does not intersect with Ramsar area
Does not intersect with Ramsar spot

INFORMATION SUBJECT TO FIELD VERIFICATION

SOURCE OF CARTOGRAPHIC INFORMATION

BASE CARTOGRAPHY	(illegible) (illegible)
THEMATHIC CARTOGRAPHY	National Protected Area System Protective Forests and State Forest Heritage MINISTRY OF THE ENVIRONMENT

GENERATED BY: S.U.I.A.
Date of preparation: Lu., July 3, 2017

APPENDIX 2

MINISTRY OF THE ENVIRONMENT

UNDERSECRETARY OF ENVIRONMENTAL QUALITY (SCA)

STANDARD TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT ASSESSMENT: OTHER SECTORS

w

MINISTRY OF THE ENVIRONMENT

STANDARD TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT ASSESSMENT – OTHER SECTORS

OVERVIEW

Terms of Reference (TOR) are preliminary documents that determine the content, scope, focus, methods and techniques to apply in preparing environmental studies. Terms of reference for completing the environmental study will be available online at Single Environmental Information System (Sistema Único de Información Ambiental – SUIA) for promoters of the project, work or activity; the Competent Environmental Authority will focus the studies based on the activity being regularized.

The process of regularizing activities is effectuated at the level of definitive studies, i.e., viability and/or relevant permits that may be required in advance by the Sector Authority (e.g. Ministry of Electricity and Renewable Energy/ARCONEL[1], SENAGUA)[2].

The following TOR defined apply to **environmental studies** of projects, works or activities:

- Agricultural
- Construction
- Industries
- Services

The proponent shall continue the environmental regularization process for the Environmental License as provided under current environmental law.

Sections that must be included in the Environmental Impact Assessment (EIA) generally are:

- Executive Summary
- Datasheet
- Acronyms and Abbreviations
- Introduction
- Legal and Institutional Framework
- Definition of Study Areas
- Environmental Analysis - Baseline
- Project, Work or Activity Description
- Alternatives Analysis
- Determination of the Area of Influence
- Forest Inventory
- Impact Identification and Assessment
- Risk Analysis
- Environmental Management Plan (EMP)
- EMP Estimated Timeline
- Appendixes
  Glossary of Terms Reference
  Bibliography

Generally, the environmental impact assessment (EIA) must identify and address:

- Applicable environmental regulations, standards and requirements provided at international, national, regional and/or local levels, including those designed to meet resource management objectives and/or the land use plans that may be in effect and in the surroundings of the jurisdiction(s) where the project is expected to be developed that could have a potential impact.

[1] TN: Electricity Regulation and Control Agency (Agencia de Regulación y Control de Electricidad – ARCONEL)
[2] TN: National Water Department of the Republic of Ecuador (Secretaría Nacional del Agua de la República del Ecuador – SENAGUA Ecuador)

- Failing such legislation, a set of reference points must be identified that can be used in the analysis and the basis for their selection.

- Concerns of the public and stakeholders relating to the impacts in and around the project and alternatives for stakeholders within the scope of the potential impact.

- Project promoters must document the specific steps taken to commit to the public and other stakeholders so that they acquire the commitment as soon as possible prior to preparing the Environmental Impact Assessment (EIA).

- Include in the public involved: local governments, people living and working in project surroundings, those whose interests in the resources may be affected, e.g., indigenous peoples and those safeguarding protected areas, agricultural land and water resources.

- All plans related to the proposed activity, for example, restoration and rehabilitation plans, closure plans, mitigation plans and others within the general environmental management plan.

- All project phases, from technical viability studies to preparing the terrain for closure operations as well as plans to expand the capacity of current or adjacent sites.

- Alternative approaches to comply with the purpose and need for the proposed project during the construction phase, including search for an alternative site, site configuration, design, construction to identify, avoid, reduce or mitigate negative impacts or to improve positive environmental or socioeconomic impacts.

- The Environmental Impact Assessment (EIA) must evaluate the impacts of a range of representative and technically viable and reasonable alternatives (at least 2) as well as the project proposal. Project alternatives must include a “No Action” alternative indicating what would happen in the absence of the proposed project, in addition to the range of alternatives indicated above.

- Cleaner production practices and best practices must be considered as an alternative.

- Direct, indirect and cumulative impacts and assessments

- Uncertainty and how it is addressed through the monitoring and contingency plans that may be necessary to reduce the risk of future adverse effects.

- Specific commitments, including the person responsible for each, what will be done, when and how they will be monitored, reported and audited to confirm that commitments are met.

General Objectives

- Comply with the provisions of applicable Environmental Regulations.
- Prepare the Environmental Impact Assessment and Environmental Management Plan described in currently effective environmental legislation and other laws applicable to the project.

Specific Objectives

- Establish methodologies to determine current socio-environmental conditions of the place where the project will be carried out.
- Develop the environmental analysis of the project, work or activity study area.
- Incorporate methodological criteria to characterize the Biotic Component.
- Include the Biotic Component design methodology with technical and literature support to be used in gathering the information (qualitative and quantitative inventories), sampling points, location, size, number and sampling effort, etc.
- Identify possible socio-environmental impacts on environmental components that could arise because of project development.
- Determine the areas of direct and indirect influence as well as sensitive areas that could be affected by possible environmental impacts of the project, work or activity proposed.
- Perform the alternatives analysis of new infrastructure to be emplaced.

- Identify risks for both environment-to-project and project-to-environment (endogenous and exogenous).
- Formulate an Environmental Management Plan for the project in order to avoid, minimize or compensate possible environmental impacts identified in the project.

DEVELOPMENT OF THE TERMS OF REFERENCE

The Environmental Impact Assessment will include the following points that must be completed by an accredited, certified and registered environmental consultant as provided in legislation.

- Executive Summary
- Datasheet
- Acronyms and Abbreviations
- Introducción
- Legal and Institutional Framework
- Definition of the study area
- Baseline Environmental Analysis
- Project, Work or Activity Description
- Alternatives Analysis
- Determining the Area of Influence
- Forest Inventory
- Impact Identification and Assessment
- Risk Analysis
- Environmental Management Plan (EMP)
- EMP Estimated Timeline
- Appendixes
  Glossary of Terms
  Reference Bibliography

EXECUTIVE SUMMARY

The Executive Summary is a synthesis or summary that favors broad understanding of the results obtained in the study and that contains the most relevant, easily used information for reviewers of works, projects or activities as well as critical problems, description of negative and positive impacts, principal environmental management measures and strategies, and sources of information used.

The content of the Executive Summary must be entered into the specific text field of the Single Environmental Information System (SUIA in Spanish) with no more than 2000 characters (approximately 2 pages).

1. DATASHEET

Information from the datasheet will take the data entered during project registration, so it is suggested that the activity promoter pay attention to the validity and truthfulness of the information entered so that the process continues problem-free during the ensuing steps of the regularization process.

The updated list of environmental consultants certified by the Ministry of the Environment will be displayed to confirm the environmental consultant in the SUIA system, and the consultant responsible for the project will be selected.

Complete the fields established in the system corresponding to the consultant team that participated in preparing the study. Also, upload into the system the team participating with the firm responsible.

Based on the following table, provide the list of the team that participated in preparing the study:

Names and Surnames	Professional Training	Component of the study participated in (physical, biotic, socioeconomic and cultural, etc.)

2. ACRONYMS AND ABBREVIATIONS

All acronyms and abbreviations in the study must be clearly defined and described in this section. This will avoid the reader having to look up words and acronyms or abbreviations in the text. It shall be a document attachment of no more than 2 pages.

3. INTRODUCTION

This section shall explain the conceptual framework of the study as well as a description of the overall content and its different sections, the methodology used to collect primary and secondary information, sampling procedure and its relationship with environmental studies performed for previous phases, if any.

A maximum of 2500 characters of text (approximately 1 page) may be included in the SUIA field.

4. INSTITUTIONAL AND LEGAL FRAMEWORK

The applicable legal framework will be automatically displayed in the SUIA system depending on the project, work or activity, which must be accepted by the proponent in its respective terms and conditions.

Notwithstanding indications on developing the study, the project shall take into account works or activities to be performed, the particular environment and characteristics, and the measures to be adopted, which will involve analysis of applicable environmental legislation, standards and requirements established at international, national, regional, and/or local levels as well as those designed to meet the resource management objectives, among others.

5. DEFINITION OF THE STUDY AREA

The study area includes the area set out in the intersection certificate wherein the project, work or activity will be emplaced; however, it must be understood that the information analysis and collection shall include specific activities to be emplaced, administrative political units and hydrographic systems.

Thus, the project promoter must be meticulous with the geographic coordinates entered and the geographic scope for collecting baseline information so that the process may continue without problems in ensuing steps of the regularization process and later monitoring and control as well as the possible inclusion of complementary activities, as provided in Article 19 of Book VI of the Unified Text of Secondary Legislation from the Ministry of the Environment, which was issued under Ministerial Resolution No. 061 published in Official Register No. 316 dated May 04, 2015 and/or applicable legislation.

The SUIA system field allows a maximum 4000 characters (approximately 1 page) where the analysis of elements for collecting baseline information is considered; i.e. the area of the intersection certificate versus the project activities and infrastructure to be emplaced, administrative political units and hydrographic systems.

6. ENVIRONMENTAL ANALYSIS – STUDY AREA BASELINE

The environmental characterization must include the description of the physical, biotic, and socioeconomic and cultural media under minimum methodological criteria that are described in this document.

Each component's determination will depend on the type of project, work or activity. If any do not apply, the grounds for not characterizing any of them will be justified technically in a well-reasoned manner.

The promoter of the activity will attach the characterization of the study and the analysis of the study area to the system and enter the monitoring information on the different components collected in the field into the SUIA system (primary information).

The study document attached to the system must include references and literature sources of secondary information used in the analysis and diagnosis carried out and the literature citations and references for the methodologies employed in collecting primary information.

The system will digitize only (primary) information collected in the field. If the project, based on its characteristics, does not merit collection of primary information, there must be technical justification for the component(s).

6.1 PHYSICAL ENVIRONMENT

Characterization of the physical environment must include the following:

- **Methodology:** The methodology employed in collecting primary and secondary information must be described along with the technical criteria for selecting the number and location of sampling sites and number of samples; physiochemical parameters to be analyzed (on- and off-site); detailed methodology for collecting, transporting and preserving samples; accredited laboratories that perform the sample analysis; equipment and personnel necessary to survey the physical aspect; analytic and instrument techniques used by the laboratory. The methodology shall take into account the terms of the standards attached to Book VI of the Unified Text of Secondary Legislation of the Ministry of the Environment and where appropriate, the standards issued by the Ecuadoran Standardization Service.
- Environmental components that must be characterized include: Geology and Geomorphology, Soil, Climate and Weather, Air Quality, Noise, Hydrology, Flora, Fauna, Social Environment, and Cultural Heritage.

Following is a proposed analysis:

Environment	Scope	Observations
PHYSICAL	**Water Resource** * Overall hydrography * Surface and subterranean hydrology * General status and current hydrographic handling (hydroelectric projects) * Water bodies: width, depth, speed, flow * Multi-annual and seasonal average, maximum, minimum flows (hydroelectric projects and those using the resource) * Water quality * Estimate of ecological flow (hydroelectric projects or those using the resource) * Flood pattern * Main uses of water that will be affected	All details established by the regulations of the competent sector authority will be taken into account. Tidal power generation projects will take monitoring of interest in regard to the ocean resource into account as provided in the applicable technical standard. For ex post studies, discharge monitoring must be added to the above-indicated details as well as results of compliance with maximum allowable limits set out in applicable law and regulation.
	Climate • Climate classification • Climate parameters of interest: precipitation, temperature, heliophany, wind speed and direction, evapotranspiration, others.	Isolinear and other maps may be included to illustrate the spatial distribution of principal climate parameters.

Environment	Scope	Observations
	Soil Resource • Geology • Geomorphology • Soil stability (Geotechnics) • Sources of material (Quarries) • Current land use, potential land use • Areas that are under some special territorial zoning regime	All details established by the regulations of the competent sector authority will be taken into account.
	Air Resource • Quality (general estimate) • Noise • Non-ionizing radiation (in case of high voltage power lines)	For ex post studies, gas emission monitoring must be added to the above-indicated details as well as results of compliance with maximum allowable limits set out in applicable law and regulation

Results: The results must be shown using graphics, tables, maps, etc., analyzing the results of sampling for each physical component and comparing laboratory analysis results and analysis of the maximum allowable limits established under applicable environmental regulations for water, air and soil quality.

- **Conclusions:** Individual conclusions on their physical environment must be presented.
- **Appendixes:** All appendixes must be presented which show all the above-mentioned and all that may be necessary to establish the baseline, for example: sampling point location maps, laboratory analysis, certificates accrediting the parameters and laboratories engaged for sample analysis, climate yearbooks used, maps of results (slopes, geomorphology, watershed, etc.), maps of areas of influence, maps of sensitive areas, chains of sample custody, etc.
- In addition, literature citations must be included with their sources in the bibliography chapter.

Notwithstanding preparation of the study document, the following fields will be completed in the SUIA system:

Project Study Area characterization and analysis

- Precipitation
- Temperature
- Humidity
- Wind speed and Evapotranspiration

The minimum, average, maximum and source must be indicated for each one using no more than 250 characters.

Water Bodies

- Category (Lentic or Lotic)
- Name
- Sample location: Coordinates (UTM, WGS 84): At least 2 points
- Width
- Depth
- Speed
- Flow
- Use

Physical Mechanical Soil Characteristics

- Code
- Sample location: Coordinates (UTM, WGS 84)

- Relative Humidity
- Liquid limit
- Plastic limit
- Plasticity index
- Clay
- Silt
- Sand
- Gravel
- Specific gravity

Chemical characteristics of the soil

- Sample location: Coordinates (UTM, WGS 84)
- Consideration of land use
- Parameters according to applicable environmental regulations and characteristics of the activity
- Accredited Laboratory

Waste identification

- Hazardous and/or special waste
- Solid waste

Water Quality

- Name of water body
- Sample location: Coordinates (UTM, WGS 84)
- Consideration of water use
- Parameters according to applicable environmental regulations and characteristics of the activity
- Accredited laboratory

Note: For ex post studies, also consider discharge monitoring and allowable limits.

Air Quality

- Sample code
- Sample location: Coordinates (UTM, WGS 84)
- Parameters according to applicable environmental regulations
- Accredited laboratory

Note: For ex post studies, also consider emission monitoring and allowable limits according to the regulations.

Sound pressure level

- Sample code
- Sample location: Coordinates (UTM, WGS 84)
- Parameters according to applicable environmental regulations
- Accredited laboratory

Non-ionizing Radiation (In the case of High Voltage Transmission Lines)

- Sample code
- Sample location: Coordinates (UTM, WGS 84)
- Description of sampling site
- Parameters and allowable limits according to environmental regulations

6.2 BIOTIC ENVIRONMENT

The following will be considered in characterizing the biotic environment, including flora and fauna.

Environment	Scope	Observations
BIOTIC	**Flora** • Ecosystem characteristics and representativeness • Existing vegetation formations • Flora and fauna location, extent and abundance • Endangered species **Fauna** • Zoogeographic floors • Fauna location, extent and abundance **Land Fauna** • Mastofauna (mammals) • Avifauna (birds) • Herpetofauna (reptiles and amphibians) • Entomofauna (insects) • Endangered species under the IUCN list and Ecuador's Red Book	Illustrate ecosystem and vegetation formations with corresponding thematic maps The information referring to ecosystems and vegetation coverage will automatically be generated based on the coordinates of the intersection certificate. Field samples will be required for the land flora and fauna description, especially if important and protected, endangered or endemic species are identified. Ecological aspects of each component of the biotic environment must be included. Sampling techniques such as trapping, direct visual observation and local interviews, among others will be used for the inventory.
	Hydrobiological Resources • Aquatic biology (ichthyofauna, aquatic macro-invertebrates)	Field samples are required, especially if important and protected endangered or endemic species are identified. Ecological aspects of each component of the biotic environment must be included. Sampling techniques such as trapping, direct visual observation and local interviews, among others, will be used for the inventory. Emphasis for hydroelectric or tidal power station projects and those that apply.
	Biodiversity and Endemism • In affected areas pertaining to: Intangible Zones, National Protected Area System (SNAP in Spanish), Protective Forest and Vegetation	

Environment	Scope	Observations
	and Fragile Ecosystems (paramos, wetlands and mangroves)	

In characterizing the biotic environment, attention must be paid to previous requirements and permits: Research Permit to collect and take samples for biotic studies; Permit to move wild specimens, and sample deposit certificate granted by Holding Centers authorized by the Ministry of the Environment, etc.

The information of this component will be attached in the SUIA system. In addition, the forms established in the system will be downloaded; an analysis of the scope of the research permit obtained will be described in the text field. Finally the deposit certificate for the samples will be attached, which may not exceed 15 MB.

Flora

Methodology: The methodology used must be described in detail, including the literature review (secondary information) and field visits (primary information). For the latter, qualitative and quantitative inventories will be taken. The following must be included for both samplings: sampling method (e.g. transect, parcel, other) and technical justification for the choice, sampling date, sampling site, sampling point, UTM WGS84 Zone 17S coordinates (for transects, the starting and ending coordinate must be included, and 4 coordinates for parcels), altitude, description of the area, and sampling effort. The latter point is important since it indicates the number of people and hours dedicated to collecting the information.

The following indices and parameters and their respective analyses must be included for quantitative sampling: basal area (AB), biomass (V=LxAB), relative density (DnR), relative dominance (DmR), importance value indices (IVI), richness and abundance analysis, Shannon-Wiener diversity index, Simpson diversity index, Chao index, flora species abundance curve, floristic structure and composition, and dominant floristic groups.

Results: Characterization of flora must contain a classification of vegetation units according to the proposal of the Ministry of the Environment (MAE in Spanish) ecosystem map and the 1999 Sierra classification, determining species habit (herbaceous, shrub, arboreal, etc.); vertical vegetation stratification (emergent, canopy, sub-canopy or understory) indicating percentages; vegetation coverage of the sampling unit determining horizontal stratification (very sparse, sparse, very clear, clear, slightly dense, dense, very dense) and coverage percentage.

The quantitative sampling results must include the determination of species richness, abundance, diversity and similarity, for which diversity indices such as Shannon-Wiener, Simpson, similarity indices and other parametric and non-parametric methods shall be employed.

The qualitative sampling results must contain the information for family, scientific name, common name, habit, origin, type of vegetation and type of sampling. Floristic composition will be determined using this sampling type (number of species, numbers of families and dominant families).

In regard to ecological aspects, the species conservation status (CITES, IUCN and Red Books), indicator, sensitive, endemic species; sensitive species, rare species; species of economic interest; endangered species, threatened species; floristic structure of important sites; floristic sensitivity and identification of sensitive zones must be indicated. The description of the resource use must be included, which could be medicinal, commercial, food or other.

Conclusions: Conclusions and recommendations must be included.

Appendixes: Maps must be attached with all the information that has been collected.

Fauna

Methodology: The methodology must be well detailed with technical and literature support. It must include sampling date, sampling site, sampling point, UTM WGS84 Zone 17S coordinates, altitude, description of the area and sampling effort. In addition, the sampling method chosen and its technical justification must be indicated. Indicate the family, scientific name, common name, number of individuals, number of species, percentage and diversity value.

Results: The richness and abundance parameters must be determined as well as statistical indices (diversity, similarity, etc.). Incorporate graphic representation for each parameter analyzed in the quantitative inventories of the Fauna Component. Include the discussion of the results obtained from analyzing the quantitative parameters of the Fauna Component, contrasting with existing literature information.

Include ecological aspects that were determined based on the quantitative sampling, species conservation status (CITES, IUCN and Red Books), bioindicator species, endemic species, sensitive species, rare species, species of economic interest and endangered or threatened species. Also include the use of the resource.

Conclusions: Include conclusions and recommendations.

Appendixes: Attach location maps for samples of all biotic components using a representative scale.

The SUIA system clarifies the areas of research applied and considered in the biotic environment characterization document – fauna based on the characteristics of the project and the study area (e.g. Mastofauna, ornithofauna, herpetofauna, entomofauna, ichthyofauna, etc.). Observations and actions of the case will be included.

In case collecting information for one or more of these research areas does not apply, it must be justified in the system text fields.

Enter the species in a threatened category (CITES) in the text field considering the following: frequency, scientific name, common name, uses and actions of the case.

Generally, the following will be considered for the Baseline in Protected Areas:

a) Collection of primary information based on sampling or direct observation and based on secondary information only as a complement.
b) Sampling site and route coordinates
c) Flora and fauna inventories:
Mastofauna: aquatic and marine mammals as required
Birds
Amphibians
Reptiles
Entomofauna: Coleoptera and Lepidoptera
Aquatic macroinvertebrates
Ecological aspects and biostatistical analyses
Sensitive species
Conservation status {CITES, Red Books, IUCN)
Bioindicator species of the ecosystem conservation status
Endemic species
Migratory species
Richness
Importance value indicator
Alpha and beta diversity

6.3 SOCIOECONOMIC AND CULTURAL ENVIRONMENT

Social Component Methodology:

The Environmental Impact Assessment or its equivalent shall describe the methodological process of collecting information for the social component. It shall include backup for the research tools used: datasheets, forms, registration techniques, methodological approach strategies, etc. Include the description of the research team and the respective technical justification.

Characterization of Socioeconomic and Cultural Aspects

The baseline characterization will be on the areas of influence, so the description of the social context must differentiate from the general Area of Indirect Influence (AII) to the specific Area of Direct Influence (AID).

For the socioeconomic–cultural description of the Area of Indirect Influence, secondary information will be used, especially the latest census data, Territorial Zoning Plans of administrative–political

units that are part of the AII and relevant documentary information collected during the field research process which includes documents provided by the proponent.

The socioeconomic–cultural description of the Area of Direct Influence will be based on primary information that will be generated during the field research process.

Thus, investigation techniques to apply shall be:

- Process of analyzing the contents of secondary information referring particularly to the Area of Indirect Influence
- Quantitative information techniques if necessary
- Qualitative research techniques that can generate significant information on the socioeconomic use of the Area of Direct Influence. The following will apply for this purpose:

    - Participant observation of the local scene
    - Semi-structured interviews with relevant social actors
    - Semi-structured interviews wtih instutional and organizational actors
    - Group discussions wiht consultant team specialists and project promoter
    - Surveys of relevant social actors

Records of participant observation, semi-structured interviews, surveys of relevant actors and any other technique applied will be incorporated into the EIA-EMP as Appendixes.

The list of qualified, relevant informants from the areas of influence that were interviewed based on the following matrix shall be included:

LIST OF QUALIFIED INFORMANTS				
DATE	**INTERVIEWEE NAME**	**POSITION**	**INSTITUTION / COMMUNITY ORGANIZATION**	**POLITICAL ADMINISTRATIVE JURISDICTION, ETC.**

The following aspects shall be considered for description of the Social Areas of Direct and Indirect Influence:

Demographic Profile: Composition of the population by age and sex, population growth rate, density, migration characteristics of the economically active population (EAP)

Food and Nutrition: food supply, nutritional problems, water and other natural resource use and access

Health: factors that have an effect on birth rate; infant, general and maternal mortality; morbidity; existing health services; traditional medicine practices

Education: literacy condition, level of instruction, school buildings, teachers and students in the last school year

Housing: number, types, predominant material

Stratification: (socioeconomic groups), organization (types of association, forms of relationship, leadership), and social participation as well as characterization of values and customs; status of legalization of properties and communities (communities, associations, etc.)

Physical Infrastructure: existing roads, community infrastructure, basic services (water, sewer), education, health, environmental sanitation

Productive Activities: Land holding and use, local production, jobs, productive projects and community development

Archeology: studies of archeological remains and conservation that are incorporated in the EIA shall be performed according to the National Cultural Heritage Institute (INPC in Spanish) as

provided by law. A certificate from the INPC shall be submitted to support the non-existence of archeological remains, if that is the case.

Transportation: access to and type of transportation in the project, work or activity area.

Socio-institutional field: This chapter focuses on describing and explaining the makeup of the existing socio-institutional field, its structure and operation. It shall include the description and analysis of the perception and posture of Representative Political Organizations, and possible conflicts that could arise due to personal or political positions about the presence of the promoter and development of the project.

The use made by communities in the project AID of water, soil, forests, flora and fauna, etc., shall be described in detail.

Perceptual Environment

Analysis shall be completed of:

Tourism: places of interest because of their landscape value, natural resources and the cultural and historic value.

In addition, the following table indicates points related to analysis of the perceptional environment that may be included:

Environment	Scope	Observations
Perceptual	Landscape and tourism • Areas with landscape value • Areas with tourist attractions • Areas with recreational value	Include a brief description

A maximum 5 MB file on the social component of the study shall be attached in the SUIA system.

6.4 IDENTIFICATION OF CONTAMINATED SITES OR SOURCES OF CONTAMINATION

Contaminated sites or sources of contamination shall be identified for ex post projects, works or activities and others that apply, and entered into the SUIA as shown in the following table:

Affected Area	UTM DATUM WGS 84 Coordinates		Sources of Contamination
Water, air and soil, biotic component and social component	**Enter Coordinates**		Select from the system
	X	**Y**	

This shall be attached to the system together with the study Appendix documents and corresponding thematic map(s).

Having identified environmental liabilities, after the regularization process, they shall be assessed and remediated in coordination with the relevant Environmental Authority and pursuant to the methodologies established by the Ministry of the Environment.

7. PROJECT, WORK OR ACTIVITY DESCRIPTION

This section shall contain information about: the work force required, access roads, project life cycle, techniques used, activities to be developed, raw materials, processes, machinery and equipment, required inputs, water catchment from bodies of water or a groundwater source as the case may be, emissions and discharges generated by the project during each of its construction, operation and closure or abandonment phases, and anything relating to the proposed project, work or activity.

Possible expansions or new infrastructure and/or activities anticipated for consideration in the regularization process of ex post projects, works or activities must be identified and included, as the case may be.

The technical document with the detailed project, work or activity description must be uploaded to the SUIA system and may be based on the aspects detailed below.

Technical Characteristics of the Project: Techniques that will be used for different phases of project construction, operation and closure must be indicated in order to determine possible impact on the environment. Parameters to be indicated include power, voltage, length, flow, types of turbines, etc. depending on the project, work or activity.

Access Roads: Routes or roads that will be used to access the Project area shall be indicated, including principal, secondary, unimproved, etc. roads. They shall be drawn on a map to an appropriate scale.

Project Life Cycle: The useful life of the project must be indicated for the different phases of project construction, operation and closure.

Required Work Force: The number of people who will work on the project must be indicated in this section along with their positions and/or specialties and the activity they will perform.

Activities: Indicate the activities included in the project, considering the construction, operation and closure phases, such as earth movement, maintenance activities.

Facilities: Indicate the facilities at the project during each phase (construction, operation or closure) and attach a map on a scale of 1:1,000 with the location of the facilities. It should also indicate the facility location, area, size, description and diagrams of the facility, plates or tables to support it: dump sites, camps, explosive storage magazines, mechanical workshops, warehouses, laboratory, etc. like the example shown in the following table.

Facilities	Description
Camps	Specify the characteristics and details for each case.
Warehouses	
Roads	
Fuel storage	
Temporary waste storage sites	
Power generation	
Other (specify)	

Machinery: Include machinery, equipment or tools required by the project for each phase and each step of project construction, operation and closure.

Indicate machinery or equipment the project will use and describe it as in the example shown in the following table.

Machinery or Equipment	Description
Backhoes / vehicles	Indicate the number, characteristics and details of interest
Compressors	
Pneumatic drills (jackhammers)	
Ovens	
Boilers	
Electric generator	
Water pumps	
Other (specify	

Material and inputs: Indicate the materials and inputs required by the project for each phase, indicating amounts and/or volumes required such as water, fuel, electricity, explosives, etc., and describe following the example of the following table.

Material and Inputs	Description
Dielectric oil for transformers	Indicate amount, characteristics and pertinent details.
Cleaning detergents	
Grease	
Cement for construction	
Explosives	
Fuel	
Water	
Other (specify)	

Liquid Discharges: Indicate possible liquid discharges of the project, like sewer water or process water (camps/industrial, etc.). Describe the treatment system for sewer water, which may be described similarly to the example shown in the following table.

Type of Liquid Discharge	Amount Generated (l/day or l/s)	Type of Treatment	Final Disposal Method
Sewer water			
Process water			

Waste: Indicate the waste generated by the project during the phases and each of the construction, operation and closure stages of the project. Indicate the type of waste generated, amount and final disposal site and whether it is domestic waste, non-hazardous and hazardous waste, proceeding as provided in Book VI of the Unified Text of Secondary Legislation of the Ministry of the Environment (issued with Ministry Agreement No. 061 published in Official Register No. 316 dated May 04, 2015) and technical standards attached to this book and applicable environmental regulations.

Attach the project description document in the SUIA system and enter the prioritized information in the system: phase, activity and infrastructure with geographic location in UTM datum WGS 84 coordinates and a brief description.

Enter the chemical substances to be used based on the search criterion established in the system catalog. If it is not available, specify and enter the name of the substance.

Enter the timeline for the project phases, dates anticipated for start and completion and actions. In addition, enter the information on materials, inputs, equipment and tools to be used and their quantities.

8. ALTERNATIVES ANALYSIS

The study must assess impacts of a range of representative alternatives that are technically viable and reasonable based upon which at least 2 alternatives shall be described, not including the alternative of “no project” which can be assessed as a “no action” alternative, indicating what would happen in the absence of the proposed project in addition to the range of alternatives already indicated.

Alternatives analysis is not required for ex post projects, works or activities except in the case of expansions, new activities and infrastructure.

At least two alternatives and parameters assessed must be considered in Protected Areas, which can determine the option of least environmental impact.

The following analysis must be considered in Protective Forests and/or State Forest Heritage.

- Vegetation coverage or land use

- Floristic composition and structure
- Floristic resource use

Attach the analysis document in the SUIA system (in appendixes if the system does consider the fields in this chapter). Enter the information from the alternatives analysis considering the technical aspects, ecological and socioeconomic systems for alternative project (activities and/or infrastructure) locations as comparative criteria. The table below provides an example document.

TECHNIQUE	ECOLOGICAL	SOCIOECONOMIC AND CULTURAL
Construction processes	Hydrographic and hydrologic characteristics	Land holding
Infrastructure safety	Bodies of water (surface / underground)	Population directly affected
Costs	Water use	Productive activities directly affected
	Geological, geomorphological and geotechnic characteristics	Levels of social conflict
	Land use	Compatibility with territorial zoning plans
	Volume of soil removed	Interference with historic, cultural and archeological heritage
	Area and type of vegetation to be removed (primary / secondary forest)	Infrastructure of basic services (sanitation, electric power, water supply)
	Fragile and/or protected ecosystems	Sensitive elements (schools, health centers, community infrastructure)
	Biodiversity (flora / fauna)	
	Endangered species	

Based on the comparative criteria considered for each alternative, provide a brief description of the characteristics of that alternative and define it considering first the option of least environmental impact.

9. DETERMINATION OF AREAS OF INFLUENCE AND SENSITIVE AREAS

The boundaries of the area of influence that will involve the project, work or activity management and will be constructed based at least on the following considerations and inputs:

- Analysis of the baseline of the reference area of the project, work or activity
- Project description and scope of activities
- Positive and/or negative impact identification and assessment
- Environmental Management Plan activities

9.1. AREA OF DIRECT INFLUENCE (AID)

Implement methodologies with their respective technical justification in defining the AID, which enable delimitation of the area where the socio-environmental impacts will be apparent during the work.

Both biotic and abiotic components involved must be assessed, incorporating the methodological criteria, directives and guidelines for the social component established in applicable environmental legislation issued by the Ministry of the Environment wherein the Area of Direct Social Influence (AISD) is defined.

As a proposal it is suggested that the following components be considered, notwithstanding other criteria of the person who prepared the expert analysis may consider appropriate, which may be applied flexibly and proportionally, adapting their forecasts to each concrete work, activity or project.

Environmental Component	AREA OF DIRECT INFLUENCE (AID)
Physical Component	
Geology and Geomorphology	In accordance with the methodology to be used by the environmental consultant to define the AID
Soil Quality	In accordance with the methodology to be used by the environmental consultant to define the AID
Air Quality	Areas that could be directly affected by combustion gas emissions, particulate and sedimentable material or others arising from the project, work or activity may be considered as criteria of this component in the methodology to be used by the environmental consultant to define the AID
Noise and Vibrations	Direct and sensitive receptors of noise and vibration emissions arising from the project, work or activity may be considered as criteria of this component in the methodology to be used by the environmental consultant to define the AID
Hydrology and Water Quality	The basin / sub-basin / micro-basin or hydrographic unit, body (bodies) of water present, flow, self-purification, consumption and non-consumption use of the water and sensitive receptors downstream, among others, may be considered as criteria of this component in the methodology to be used by the environmental consultant to define the AID
Biotic Component	
Flora and Vegetation	Natural boundaries of vegetation, protected areas, protective forests and vegetation, physiographic aspects of the terrain like streambeds, high ridge lines, plains, slopes and slope exposure, etc. may be considered as criteria of this component in the methodology to be used by the environmental consultant to define the AID
Fauna	Natural vegetation boundaries, protected areas, physiographic aspects of terrain like streambeds, high ridge lines, plains, slopes and slope exposure, etc. may be considered as faunistic criteria in the methodology to be used by the environmental consultant to define the AID
Social Component	
Levels of Social Integration	The Area of Social Direct Influence methodology must be carried out as provided in the directives and guidelines for the social component established by the Ministry of the Environment where the Area of Social Direct Influence (AISD) is defined. **Area of Social Direct Influence:** the social space arising from direct interactions of one or several 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 exists on at least two levels of social integration: individual units (farms, dwellings and their corresponding owners) and first and second order social organizations (communities, enclosures, neighborhoods and organizational associations).

Environmental Component	AREA OF DIRECT INFLUENCE (AID)
	The individual elements of the AISD are identified by focusing indemnification actions while communities, neighborhoods, and first and second order organizations that make up the AISD are identified by establishing compensation actions.

9.2. AREA OF INDIRECT INFLUENCE (MANAGEMENT AREA)

Once the area of direct influence is defined and delimited, the spatial area must be established where the promoter will generate positive and/or negative impacts on socio-environmental comportments brought about by their activity, based on the baseline analysis, scope of activities, project, work or activity impacts identified and Environmental Management Plan activities.

The management area that includes the area of direct influence and the boundary of the area of indirect influence may be adjusted with updates to the Environmental Management Plan that are made and based on the provisions of current environmental legislation in force.

Both biotic and abiotic components involved must be assessed in defining the boundary of the area of indirect influence, incorporating methodology criteria, directives and guidelines for the social component set out in applicable environmental regulations issued by the Ministry of the Environment for that purpose.

As a proposal, notwithstanding other criteria that the consultant preparing the expert analysis may consider appropriate, it is suggested that the following components be considered, which may be applied flexibly and proportionally, adapting the provisions to each concrete work, activity or project.

Environmental Component	AREA OF INDIRECT INFLUENCE (AII)
Physical component	
Geology and Geomorphology	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Soil Quality	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Air Quality	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Noise and Vibrations	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Hydrology and Water Quality	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan

Environmental Component	AREA OF INDIRECT INFLUENCE (AII)
Biotic Component	
Flora and Vegetation	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Fauna	In accordance with the methodology to be used by the environmental consultant to define the AII and criteria to establish the spatial area wherein the promoter will manage this component; based on the baseline analysis, scope of activities, impacts identified for the project, work or activity and activities of the Environmental Management Plan
Social Component	
Levels of Social Integration	Methodology for the Area of Indirect Social Influence must be completed in accordance with the directives and guidelines for the social component established in applicable environmental regulations issued by the Ministry of the Environment wherein the Area of Social Direct Influence (AISD) is defined. **Area of Social Indirect Influence**: social-institutional space resulting from the project relationship with territorial-political units where the project is developed: parish, canton and/or province. The reason for the relationship is the role of the project and/or activity in local territorial zoning. Although based on the political-administrative location of the project, other territorial units may exist that are relevant to project social-environmental management, such as the Indigenous Territorial Districts, Protected Areas, Municipal Commonwealths.

Pay particular attention to the following in Protected Areas to determine Areas of Influence:

- Hydrographic watersheds
- Representative vegetation units
- Risk zones
- Threatened species and CITES, CMS species

9.3. DEFINITION OF SENSITIVE AREAS

Appropriate methodologies will be used that can determine socially sensitive areas considering that social sensitivity is the reaction-response capacity of an element of the AID without loss of identity when faced with the disturbances caused by the project.

Sensitive elements of the environment, such as housing, community infrastructure, water sources for community use and the like must be considered. Once the sensitivity of the elements of the AID is determined, the corresponding table and map shall be generated.

Assess whether the use of forestry, marine, etc. natural resources found in the project area are the main economic and/or nutritional income for the population.

Pay particular attention to the following in Protected Areas to determine Sensitive Areas:

- Fragile ecosystems considered in the CRE
- Georeference the sensitive areas identified, such as:
  - Nesting areas
  - Mangrove ecosystem
  - Roosting sites
  - Wetlands
  - RAMSAR sites
  - Salt licks
  - Foraging areas

- Breeding grounds
- Aquatic or marine mammal sighting areas
- Migratory species routes

- In addition, consider that the system may be fed more technical information.

Add the document for determination of areas of influence and sensitive areas to the system, and literature citations and references for the methodologies employed must be included.

In addition, results of the distances defined for the areas of direct and indirect influence shall be entered into the SUIA system by component (physical, biotic, etc.) along with the description of results as well as requirements for information on the social component established in the system in regard to communities, population centers or other jurisdictions in relation to the infrastructure and/or activities that the project would affect.

10. FORESTRY INVENTORY AND ECONOMIC ASSESSMENT OF GOODS AND SERVICES

An Inventory of Forestry Resources must be completed as well as the piedmont calculations if native vegetation coverage was removed, as provided in Ministry Agreements No. 076 published in Official Register No. 766 dated August 14, 2012, and 134 published in Official Register No. 812 dated October 18, 2012.

It would generally consider the following:

a) General project data
b) Coordinates of sampling sites and the area of emplacement
c) Description of study area

METHODOLOGY:

e) Field phase: collection of primary information based on sampling or direct observations and based on secondary information only as a complement,
f) Office phase: data analysis
g) Results: average volume per hectare
h) Sensitive species: Conservation status (CITES, Red Books, UICN) Endemic species

RICHNESS

i) Importance value indicator
j) Tables of records, statistical tables (diameters, indexes)

Conclusions: total volume to be removed

That is, with development of the following information:

DATASHEET

- Project name:
- Administrative Political Location
- Intersection: Indicate if there is an intersection with the National *SYSTEM OF PROTECTED AREAS, Protective FORESTS* and *VEGETATION, STATE FOREST HERITAGE*, Cuyabeno Intangible Zone, Imuya, *CORE* of Yasuni National Park and Buffer Zone of Yasuni National Park Core
- Area the project will intervene in
- Forestry professional responsible for preparing the Forest Inventory

DEVELOPMENT

- WGS 84 System Coordinates of the areas required by the Project shall be included.

Description of Study Area

- Description of ecosystems in the study area
- Land use and coverage (% of land use according to the area affected)
- Land holding

Field Phase

- Materials and methods (detail indicators, equations, literature, photographic records and other backup documentation that is used to collect the information on the forestry inventory)
- Sampling percentage of the forestry inventory in the area affected by the project shall represent at least (n=1%) if the project is implemented in areas with primary and secondary native forest. In the case of areas with human intervention where primarily relict trees and pioneer vegetation is evident, a forest census must be completed. Justify the percentage.

DATA ANALYSIS

Tables of results
- Species diversity (DnR, DmR, IVI, Shannon Wiener, and Simpson indexes, Sorensen similarity index)
- Tables of calculations of BHD, AB, Height, total and commercial volume (If there are no growth tables by species, use 0.7 for latifoliate species and 0.5 for conifers)
- Define endemic, rare, and important species and conservation status of species recorded in the field according to the Red Book.
- Species of economic importance

Results del Forest Inventory
- Basal Area per hectare (≥ 10 cm BHD)
- Average volume per hectare per site sampled
- Average volume of wood foot per hectare and extrapolation for the total area of intervention

Statistical charts
- Diametric distribution (curve of diameters)

Forest fee payments must be based on Art. 1 of Ministry Agreement 041 ($3 dollars per cubic meter of standing timber or at the piedmont).

CONCLUSIONS

RECOMMENDATIONS

APPENDIXES

- Maps (areas to be affected)
- Map of forest inventory sampling
- Map of land use and vegetation coverage

11. IDENTIFICATION, EVALUATION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

11.1 EX ANTE PROJECTS, WORKS OR ACTIVITIES

Significant positive and negative environmental impacts that could be caused by the different phases of the project, work or activity, construction, operation-maintenance and closure or abandonment, etc. must be identified, characterized, predicted and assessed

Environmental impacts must be identified, predicted and assessed taking into account the environmental variables and elements affected by the following environmental components:

- Physical environment
- Biotic environment
- Socioeconomic and cultural environment

Analysis of environmental impacts shall cover the following phases:

a. Environmental Impact identification:

Begin with the analysis of the effects that the works and activities forecast during different phases of the project, work or activity (construction, operation-maintenance, closure or abandonment, etc.) could have on the environment.

Therefore, cause-effect matrixes may be used along with checklists or other methods that facilitate basic identification and characterization of the potential environmental impacts during each phase and key activities of the project cycle.

b. Prediction and quantification of environmental impacts:

Carry out in order to predict the size, intensity, extent, duration or other characteristics that could arise, considering the nature of the environmental impacts.

Impact factors (causes of the impacts from the project) and environmental impacts (alteration of the environment due to impact factors) shall be forecast and quantified.

Methods based on cause-effect matrixes, supported by cartographic models or geographic information systems, social research, surveys, panels of experts, etc. may be used, as necessary, according to the significance and nature of impacts and the availability of economic, technology and material resources. A basic recommendation is to select the method that allows adequate results to be obtained for making decisions, using the least amount of resources.

c. Impact assessment and determination of significance:

Carry these out in order to assess environmental impacts, comparing the assessment of their characteristics with the criteria that determine the significance of the environmental impacts.

Significance criteria of the impacts may be the following, among others:

- Compliance with current environmental policy, legislation and regulations in effect
- Compliance with allowable limits of emissions and dumping
- Compliance with established environmental quality limits
- Causing alterations in environmental components and variables that are irreversible, permanent or of long duration
- Causing impacts on singular environmental sites or values that society has decided to protect

Significant impacts shall be subject to mitigation measures in order to bring them to allowable levels and compensation measures in order to build an environment similar to what was affected at another site.

d. Summary of significant impacts of the project:

Significant impacts of the project shall be presented in an impact matrix wherein the basic occurrence and characteristics of the impact (size and intensity), among others, shall be visualized depending on the matrix used, all based on the activity that could generate it and alteration of the component and environmental variable.

e. Establishing the impact hierarchy

Once the impacts are identified and quantified, they must be ranked in a hierarchy in order to determine their significance, maintaining agreement with the information to be entered into the SUIA system.

Results analysis / conclusions and recommendations:

The results shall be analyzed detailing positive vs. negative impacts and taking into account the ranges that will be considered for the measures to be included in the Environmental Management Plan.

The conclusions and recommendations shall be included for the project activities and significant environmental impacts.

The document identifying, assessing and valuing impacts shall be attached to the system and must include literature citations and references for the methodologies used. In addition, enter conclusions in the text field using no more than 3000 characters.

Generally, the following must be addressed in the Environmental Impact Identification and Assessment in Protected Areas for the analysis to be performed on them:

Flora:

- Vegetation coverage or land use
- Floristic composition and structure
- Wildlife habitat for critical, endangered or vulnerable species
- Conservation areas and fragile and sensitive ecosystems
- Floristic resource use
- Other

Fauna

- Faunistic structure and composition
- Wildlife habitat for critical, endangered or vulnerable species
- Areas of ecological interest: feeding grounds, salt licks, watering holes, nesting sites, temporary resting sites and the like
- Introduction of exotic species and/or wild species migration
- Risk of affecting breeding periods of species identified within one of the conservation criteria
- Habitat fragmentation
- Hydrobiological water quality
- Risk of bioaccumulation in living organisms and/or proliferation of disease vectors
- Other

The following fields must be entered in the SUIA system, without prejudice to preparation of the study document:

Activity Stage / Phase
Component
Environmental aspects
Impacts identified
Results

11.2 EX POST PROJECTS, WORKS OR ACTIVITIES

In addition to environmental impact identification and assessment, in the case of ex post projects compliance with applicable environmental regulations must be analyzed and verified, considering the results of conformity and non-conformity as a priority, as well as what is observed as shown below:

Non-conformity (Finding)	Article and letter (of the law)	Minor non-conformity	Major non-conformity	Evidence Observed	Verification measures	Appendixes

12. RISK ANALYSIS

A brief description of possible risks that could arise from project activities shall be included in the Contingency Plan and the Environmental Management Plan (EMP).

The project – environment associated risks and environment – project associated risks shall be described,

Use the most appropriate methodology in the risk analysis depending on the type of risk, and include the corresponding literature citation and reference.

12.1 RISKS OF THE PROJECT TO THE ENVIRONMENT (ENDOGENOUS)

Among this type of risk and according to the location and characteristics of the project, work or activity, the following may be considered endogenous risks, among others:

- Spills
- Explosions
- Fires
- Mechanical failures (equipment)
- Operational failures (operator)

Methodologies applicable to this type of risk shall be used, a simplified method of which is provided as a guideline to quantify existing risks and rank their priority. The principles governing this assessment include:

- Severity of potential losses (light, moderate, serious, catastrophic, etc.)
- Frequency with which losses have or may be produced (very low, low, medium, high, etc.)
- Probability that a loss will occur (literature reference, historic records of accidents, etc.)

As a reference to categorize Risk, use of the following formula may be considered as a reference: **R=Severity x Frequency**; and the results may be presented in a series of ranges with their respective quantification.

Quantification of these risks must agree with the activities described the respective chapter of the study.

12.2 RISKS OF THE ENVIRONMENT TO THE PROJECT (EXOGENOUS)

The following, among others, may be considered exogenous risks and according to the project, work or activity location and characteristics:

Geological risks	Earthquakes
	Tremors
	Land slides
	Settling
	Soil erosion
Atmospheric risks	Flooding
	Hurricanes
	Droughts
	Storms
Biological risks	Plagues
	Epidemics
Social Risk	Sabotage
	Terrorism

Methodologies applicable to this type of risks shall be utilized where historic information may be used to determine the frequency with which the different environmental risks occur. As a guideline for assessment, the matrix prepared by Fundación Natura 1996 is presented where the probability assessment versus consequences is represented as follows:

- **Social**:

R= V*S
R= Risk
V = Vulnerability
S = Sensitivity

PROBABILITY SCORE: 0 = absence, 1 = Did not occur over the last 5 years, 2 = Did not occur over the last 2.5 years, 3 = Occurred in the last year.

PROBABILITY VULNERABILITY INDEX	0	1	2	3
For example: Strikes				

LEVEL OF RISK: high = > 0.5, medium 0.25 - 0.49, low= 0 - 0.24

All risks will be added by community and activity and score depending on the value obtained.

COMMUNITY	ACTIVITY	SENSITIVITY INDEX	VULNERABILITY INDEX					RISK	LEVEL OF RISK
			Example of Strike				Vulnerability index		
		0.9	Include classification based on probability				Add partial vulnerability indices	R = vulnerability index x sensitivity index	

Sensitivity index: Coefficient 0.9 corresponds to the most likely.

- **Biological –** Threats or risks must be assessed from the point of view of the Biotic Component related to project development and include a Biological Risk Matrix synthesizing the Type of Risk / Activities / Risk Score.

The risk analysis in the Protected Area shall consider the project's impact on the ecosystem.

As for the overall study, the risk analysis for protected areas must pay attention to the following:

Flora:
- Vegetation coverage or land use
- Floristic composition and structure
- Wildlife habitat for critical, endangered or vulnerable species
- Conservation areas and fragile and sensitive ecosystems
- Faunistic resource use
- Other

Fauna
- Faunistic structure and composition
- Wildlife habitat for critical, endangered or vulnerable species
- Areas of ecological interest: feeding grounds, salt licks, watering holes, nesting sites, temporary roosting sites and the like
- Introduction of exotic species and/or migratory wild species
- Risk of impact on breeding periods of species identified in one of the conservation criteria
- Habitat fragmentation
- Hydrobiological water quality
- Risk of bioaccumulation in living organisms and/or proliferation of disease vectors
- Other

Notwithstanding the previously indicated analysis that may be required, in Protective Forests and/or State forest heritage, the analysis of the project impact on the following must be considered as a priority:

- Vegetation coverage or land use
- Floristic composition and structure
- Floristic resource use

The risk analysis document shall be attached to the system and must include literature citations and references on the methodologies used.

Information on the results of the risks shall also be entered into the system: type (endogenous and exogenous), sub-type (geological, etc.), results and actions of the case.

13. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

13.1. EX ANTE PROJECTS, WORKS OR ACTIVITIES

Once the possible environmental impacts derived from the process of a work, project, economic or productive activity have been identified, analyzed and quantified, an Environmental Management Plan must be prepared, which shall consider at least the following aspects:

Analyze the possible actions to take for those activities that involve an undesirable impact as determined in the qualitative impact assessment.

Identify institutional responsibilities for addressing needs that are not the direct responsibility of the company and design coordination mechanisms.

Describe the processes, technologies, design, operation and others that were considered to reduce negative environmental impacts when necessary.

Description of positive impacts in order to maintain and reinforce them during the phases of the project, work or activity; the impacts mentioned shall be included in the different programs and sub-programs of the Environmental Management Plan.

Include a deadline for environmental control and information update: environmental studies and plans must be reviewed periodically. Both control strategies and updating must be dynamic.

Based on these considerations, the environmental impact assessment will propose at least the plans listed below with their respective programs, responsibilities, budgets, timelines, performance appraisals and management plan.

a) IMPACT PREVENTION AND MITIGATION PLAN

This corresponds to the actions tending to minimize negative environmental impacts during the different phases of project operations.

If there is an intersection with a Protected Area and/or Protective Forest/State forest heritage, this sub-plan shall include the following among the other aspects included in the study:

Flora and wildlife rescue Program and implementation of forest nurseries
Establish canopy bridges
Avoid unnecessarily clearing large, sensitive and threatened tree species
Establish wildlife passageways
Avoid the presence of exotic species
Avoid extracting wild flora and fauna
Avoid rerouting natural water flows
Bury power lines

b) WASTE MANAGEMENT PLAN

This includes concrete measures and strategies to be applied in projects, works or activities to prevent, treat, recycle / reuse and dispose of different hazardous and non-hazardous waste in compliance with the guidelines established in Book VI of the Unified Text of Secondary Legislation of the Ministry of the Environment, issued by Ministry Agreement 061 published in Official Register No. 316 dated May 04, 2015, and applicable technical environmental standards issued for that purpose by the Ministry of the Environment.

This plan shall include, depending on the specifics of the case, a hazardous waste management program and the actions to take in compliance with applicable environmental legislation (Book V! TUSMA, Ministerial Resolution No. 026 published in Official Register No. 334 dated May 12, 2008 "Procedures for registration of hazardous waste generators, hazardous waste management prior to environmental license being issued and for transport of hazardous materials" and Ministerial Resolution No. 142 published in Official Register No. 856 dated December 21, 2012 "National list of hazardous chemical substances, hazardous and special waste ").

c) ENVIRONMENTAL COMMUNICATION, TRAINING AND EDUCATION PLAN

Includes a training program on EMP elements and application for all company personnel in accordance with the duties they perform.

In the case of intersection with a Protected Area and/or Protective Forest / State forest heritage, this sub-plan shall include the following among the other aspects included in the study.

Protected Area: The training program must be oriented to social actors in the project area of influence and must be aligned with the communication, education and participation program of the annual operational management plan of the protected area and protective forest management plan (if any).
Protective Forest: The training program must be oriented to social actors of the project area of influence and must be aligned with the comprehensive management of the protective forest and vegetation with which it intersects.

d) COMMUNITY RELATIONS PLAN

This is a program of activities to be developed with the community (or communities) directly involved, the authority and the promoter of the project, work or activity.

It shall include measures to disseminate the study, principal information and communication strategies, eventual plans for indemnification, compensation projects and mitigation of socio-environmental impacts as well as a participatory environmental education program with the community. These agreements must allow a reduction in negative effects and optimization of positive actions.

It consists of a series of specific programs and activities to be developed with the communities and social actors of the areas of influence in order to reduce, mitigate and compensate any that the project may generate on the socioeconomic and cultural component, which will include:

Information and Communication Program: Includes ESIA dissemination measures, mechanisms of information on the activities to carry out, progress of the project and compliance with the agreements and other EMP measures.
Compensation and Indemnification Program: Based on the impact assessment performed, guidelines will be established to apply compensation measures in the communities located in the area of direct influence of the project, which are related to negative impacts generated and environmental goods and services that may be affected as well as compensation mechanisms and procedures for owners of properties to be taken over.
Local Work Force Hiring Program: The policies and procedures to use in engaging staff from the project Areas of Influence will be described.
Environmental Education Program: Directed at the communities and other social actors of the area of influence of the project, work or activity.
Mitigation measures and protection for sensitive elements located in the project area of influence and other mitigation measures for specific impacts on the socio-economic component that are identified in the environmental assessment shall be described.

Actions considered in the Community Relations Plan shall be specified technically: objectives, activities, resources, execution timelines, team responsible, monitoring methods, verification methods.

e) CONTINGENCY PLAN

Includes details of the actions as well as equipment, material and personnel lists and quantities to address eventual accidents and emergencies in the infrastructure or input handling during different phases of the project, work or activity operations based on the risk analysis. The definition and assignment of responsibilities shall be included for execution of its different phases (flow chart and organization chart), operational cooperation strategies and an annual training and drill program.

If the contingency does not contain the event, a comprehensive restoration plan must automatically be established that addresses remediation of the site affected, compensation and indemnification.

If it intersects with a Protected Area, this sub-plan shall include the following among the aspects involved:

Flora and wildlife rescue program and implementation of forest nurseries.

f) OCCUPATIONAL HEALTH AND SAFETY PLAN

This plan includes the standards established by the company internally to preserve employee health and safety, including strategies for its dissemination and all actions aimed at compliance with applicable laws.

g) AFFECTED AREA REHABILITATION PLAN

An analysis must be performed to determine a restoration and rehabilitation plan based on the socio-environmental impacts and/or effects of the project, work or activity.

If there is an intersection with a Protected Area, this sub-plan shall include the following among the other aspects included in the study:
Establish nurseries
Determine native species to replant or reforest
Manage natural regeneration
Determine areas to be replanted and/or re-forested

If there is an intersection with a Protective Forest/State forest heritage, this sub-plan must include the following among the other aspects included in the study:
Determine native species to replant or reforest
Manage natural regeneration
Determine areas to be replanted and/or re-forested

h) ABANDONMENT PLAN AND DELIVERY OF THE AREA

This includes designing activities to be completed upon conclusion of the operation, how to proceed with abandonment and delivery of the area of the project, work or activity.

i) MONITORING AND CONTROL PLAN

The Environmental Impact Assessment (ESIA) shall define systems for monitoring, assessment, environmental monitoring, public health monitoring of the area of influence, and community relations, which tend to properly control impacts identified in the ESIA and compliance with the Environmental Management Plan (EMP) as well as corrective activities proposed therein.

Community Monitoring shall be applied considering the particular characteristics of the activity to be developed. It may include community training activities on monitoring, accompaniment and results reporting mechanisms.

The sub-plan shall include, among other aspects included in the study, the following if there is an intersection with a Protected Area and/or Protective Forest/State forest heritage:

The Monitoring and Control Plan must be aligned with the Research and Monitoring Program of the annual operational management plan of the protected area or Protective Forest as the case may be.

The EMP sub-plans may be uploaded to the SUIA system as an Excel file. At least the following system requirements must be considered when entering information:

For EMP sub-plans, except the Contingency Plan and the Monitoring Plan:

Environmental Aspect	Impact Identified	Proposed Measure	Indicators	Verification Method	In-Charge	Frequency	Period	Actions
						Number of times the proposed measure repeats in a determined period	Daily, weekly, monthly, quarterly, semi-annually, annually	

For the Contingency Plan

Risk	Environmental Component	Proposed Measure	Indicators	Verification Method	In-Charge	Frequency	Period	Actions
						Number of times the proposed measure repeats in a determined period	Daily, weekly, monthly, quarterly, semi-annually, annually	

Consider the following for the Monitoring Plan

ENVIRONMENTAL COMPONENT (as applies)	PARAMETERS TO MONITOR	Coordinates (X Y) (required for Ex Post, but not Ex Ante)		SAMPLING FREQUENCY	REPORTING FREQUENCY
		X	Y		
Groundwater	Per the regulation			Number of times repeated per the proposed measure over a determined period	Monthly, quarterly, semi-annually, annually
Surface Water					
Marine Water					
Discharges					
Sewer and Gray Water					
Air Quality					
Noise					
Vibrations					
Non-ionizing Radiation					
Soil Quality					
Sediment					
Flora					
Fauna					
Social					
Other					

13.2 EX POST PROJECTS, WORKS OR ACTIVITIES

Ex Post projects, works or activities must prepare, in addition to the Environmental Management Plan, an action plan that enables correction of Non-Conformities (NC) encountered which will incorporate principally the following:

Non-conformity	Proposed Measures	Verification Methods	In-Charge	Term (Months)	
				Start Date	End Date
				dd/mm/yyyy	dd/mm/yyyy

14. PRICED TIMELINE OF THE ENVIRONMENTAL MANAGEMENT PLAN

A timeline must be provided with all costs associated with execution of the sub-plans and corresponding programs and that are part of the Environmental Management Plan.

A priced timeline of the management plan must be generated by phases, construction, and operation.

Information corresponding to the EMP activity or measure shall be entered into the SUIA system for each sub-plan, setting out the months included in the timeline and considering the frequency of the measure, as well as its budget.

Priced Timeline of the Environmental Management Plan							
	Month 1	Month 2	Month 3	Month 4	Month 5	Month X…	Budget
Mitigation and Impact Prevention Plan							
Scheduled Activities **(for each measure indicated in the sub-plans both proposed and other additional ones)**							
Waste Management Plan							
Scheduled Activities							
Communication and Training Plan							
Scheduled Activities							
Community Relations Plan							
Scheduled Activities							
Contingency Plan							
Scheduled Activities							
Monitoring and Control Plan							
Scheduled Activities							
Area Rehabilitation and Closure Plan							
Scheduled Activities							
TOTAL		WRITTEN OUT					$US

15. APPENDIXES

- Include the Glossary of Terms: It must contain the main definitions being used in the study.
- Include Literature References: Considering all the information generated in the study. It must be properly cited using the corresponding standard and duly linked to the part of the document being cited.
- This section shall also include all supporting documents for the information contained and backup documentation for the study (e.g. Research permit for collecting and taking samples for biotic studies; permit to move wild specimens; certificate of samples received issued by the Holding Centers that are authorized by the Ministry of the Environment; documentation or permits issued by INPC for archeological studies; results of soil, air, water, etc. analysis performed by certified laboratories according to the studies and analyses carried out for the project, work or activity; other backup documentation as required by environmental law and regulation).
- Basic and thematic map information in a digital format using the ArcGis Geographic Information System (Versions from 9.* to 10.2 *.mxd), including the respective database using UTM coordinates and the WGS84 ellipsoid reference system; the working scale for the basic information shall be 1:50000, 1:25000 or greater (IGM Topographic Sheets) and the printed scale shall depend on the size of the project, i.e., the minimum mappable unit (UMC in Spanish) which is the size of the minimum area that should appear on a thematic map for correct visualization:
  - Thematic information must provide detail on the source(s) of information with their respective official source, scale and year of the competent authority. It is recommended that updated information be used and National Geo-Information Council (Consejo Nacional de Geo Información – CONAGE) guidelines are followed in presenting marginal cartographic information.

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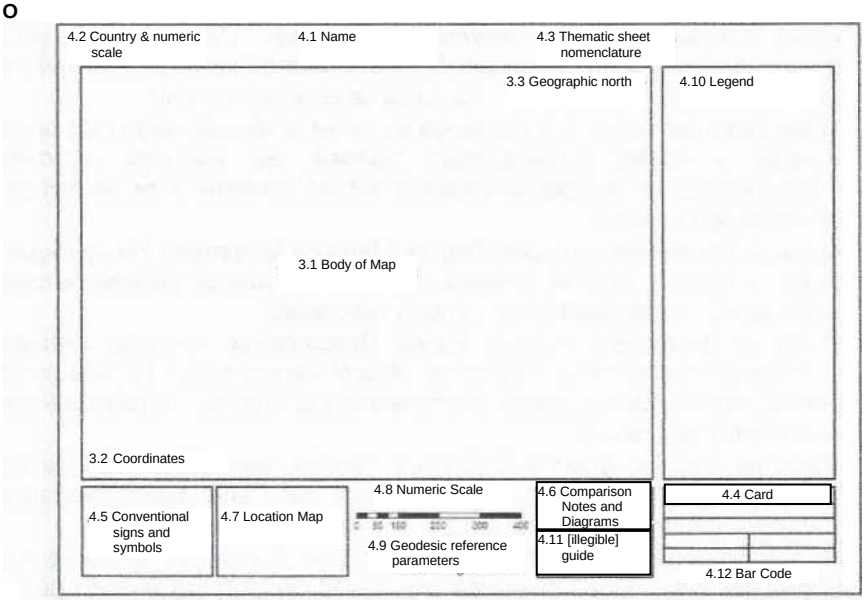


- All maps shall include the study area according to the provisions in current environmental legislation in force.
- Basic and Thematic Maps based on characteristics of the project, work, or activity and the like, may include the following:
- Political-Administrative Location Map: Must show territorial division at the level of the province, canton, parish and section depending on the size of the project.
- Base Map: Must show bodies of water (double rivers, single rivers, irrigation canals, streams, lakes), roads (first, second and third order), population centers, contour lines, heights, points

of interest (schools, health centers, housing, churches, recreation centers, cemeteries, bridges, airports, helipads, haciendas, hills, and the like).

- Project Implementation Map: This map shows infrastructure or emplacement of other existing works according to the project area and its different phases as well as including the polygon of the intersection certificate.
- Protected Area Map: This map contains the National System of Protected Areas, Protective Forests and Vegetation, State forest heritage, Intangible Zones, Buffer Zone and others of great interest.
- Geological Map: Lithology formation and geological period.
- Geomorphological Map: Macro and meso relief; also include the DEM, the digital elevation model.
- Physiography and soil Map: Physical mechanical characteristics of the soil, taxonomy, (order, suborder).
- Soil Sampling Map: This map must contain coverage of the taxonomy, georeferenced sampling points, the table of contents of which shows the laboratory analysis results.
- Water Sampling Map: This map must contain the water sampling codes, sampling type, sampling location using UTM coordinates, site description, on-site laboratory results of the sampling, etc.
- Noise Sampling Map: This map must contain noise sampling codes, location of sampling location using UTM coordinates, site description, sampling type, sampling results (decibels).
- Climate Map: include (isohyets, isotherms): Include weather stations and climate types. The isohyets and isotherm maps should include units of measure and symbology of the competent agent.
- Hydrogeological Map: This map contains the division based on units of measure and representative scale, which can be basins, sub-basins or micro-basins. In the table of attributes, it should contain water catchment points
- Hydrographic Basin Map
- Physical Sampling Map (Water, Soil, Noise and Air Quality): must contain georeferenced points with the respective field and laboratory results.
- Flora and Fauna Sampling Map (Mastofauna, Avifauna, Herpetofauna, Ichthyofauna, Land Invertebrates, Macroinvertebrates): This map must contain the georeferenced points, transects or parcels with their respective field and laboratory results.
- Land Use and Vegetation Coverage Map: This map must contain vegetation coverage showing the first level legend of the Intergovernmental Climate Change Panel (Panel Intergubernamental de Cambio Climático – IPCC) of the MAE.
- Community, Ethnicity, Federations Maps: Boundaries of the communities must be supported from an official source; social information surveys will be accepted for ethnicities.
- Owner Map: backed up by official sources of the Parish and/or Canton Independent Governments, etc.
- Maps of Areas of (Physical, Biotic, Social) Direct Influence and Management Area: This map must also contain the reference or study area, and the management area is similar to the area of indirect influence.
- Maps of Areas of (Physical, Biotic, Social) Sensitivity: based on the analysis performed, this map must indicate the degree of sensitivity of each component.
- Monitoring Point Map (Liquid Discharges and Atmospheric Emissions)
- Project Alternatives Map prepared based on the project alternatives analysis chapter.
- Map showing Control Points in case of spill: Include in the table of attributes control point identification or code, location based on UTM coordinates, response times, contingency material.
- Exogenous Risk Map (Environment on the Project must include variables like seismology, slopes, flooding, etc.) based on the risk analysis chapter.
- Endogenous Risk Map (Project on the Environment, such as spills, explosion, etc.) and the respective ranks (high, medium or low) based on the risk analysis chapter.
- Satellite and/or vertical aerial photography in color: Satellite information shall include the technical characteristics like type of satellite, number of bands, spatial and spectral resolution, cloudiness percent, RGB combination, year taken, reference system (georeferencing).
- The satellite image must be no older than five years from the current date, taking into account that the image must be high resolution (5m per pixel) and cloudiness no greater than 15%

(take into account that the study area should not be cloudy); moreover, Aster or Landsat panchromatic images will be accepted at 15 m resolution.

- Submit metadata of all cartographic information, both basic and thematic, based on the Ecuadoran Metadata Profile (PEM in Spanish) under ISO 19115:2003 and ISO 19115-2:2009 Standards with their respective XML files. This information may be located at the following link: http://sni.gob.ec/documentos-geograficos
- Other maps: merited by the project and its characteristics.

SOCIAL PARTICIPATION PROCESS

This process shall be conducted according to the provisions of Articles 44, 45 and 46 of Book VI of the Secondary Unified Environmental Law Text of the Ministry of the Environment issued by Ministry Agreement 061 published in Official Register No. 316 dated May 04, 2015, and applicable environmental manuals and standards issued for that purpose by the Ministry of the Environment. The purpose of this process is to inform the population potentially affected by the project and make them aware of the Impact Study and Environmental Management Plan in order to determine and incorporate their comments, opinions and observations, which shall be described in detail in the Social Participation Report.

A table shall be included which will specifically explain the observations and comments collected during the social participation process; components of the Environmental Study will be indicated that accommodate and respond to the matters proposed or the justification for not including them based on the criteria of technical and economic viability set out in D.E. 1040.

OBSERVATIONS MADE BY THE COMMUNITY		
Questions – remarks made by actors	Responses developed during the process	Describe the inclusion in the EIA or justification for not including it/them

APPENDIX 3

INTERNAL REVENUE SERVICE (SRI IN SPANISH)

TAXPAYER IDENTIFICATION NUMBER
CORPORATIONS

TAXPAYER IDENTIFICATION NUMBER (RUC IN SPANISH):	**0992982047001**
BUSINESS NAME:	**YILPORT TERMINAL OPERATIONS YILPORTECU S.A.**
TRADE NAME:	YILPORT TERMINAL OPERATIONS
TYPE OF TAXPAYER:	SPECIAL
LEGAL REPRESENTATIVE:	Carlos Alberte CRUZ HERNÁNDEZ
ACCOUNTANT:	Gladys Victoria REDROBAN ANDRADE

DATE OF COMMENCEMENT OF ACTIVITIES:	July 29, 2016
DATE OF INCORPORATION:	June 30, 2016
FILING DATE:	July 29, 2016
UPDATE DATE:	September 8, 2017

MAIN ECONOMIC ACTIVITY:

Exploitation activities of terminal facilities such as ports

DOMICILE FOR TAX PURPOSES:

Province: EL ORO Canton: MACHALA Parish: PUERTO BOLÍVAR Citadel: PUERTO BOLÍVAR Street: AV. BOLÍVAR MADERO VARGAS Number: W/N Building: P. BOLÍVAR PORT AUTHORITY Location reference: INSIDE THE PUERTO BOLÍVAR PORT AUTHORITY Cellphone: 0987734139 E-mail: rafael.sapina@yilport.com.tr

SPECIAL ADDRESS:

TAX OBLIGATIONS:

- ANNNEX ON SHAREHOLDERS, PARTICIPANTS, PARTNERS, MEMBERS OF THE BOARD OF DIRECTORS AND ADMINISTRATORS
- ANNEX ON DIVIDENDS, PROFITS OR BENEFITS (ADI IN SPANISH)
- DEPENDENCY RELATIONSHIP ANNEX
- SIMPLIFIED TRANSACTIONAL ANNEX
- CORPORATION INCOME TAX RETURN

- WITHHOLDING TAX RETURN AT SOURCE
- MONTHLY VAT STATEMENT

Are taxpayers' rights: Treatment and confidentiality rights. Assistance or collaboration rights. Economic rights. Information rights. Procedural rights; for further information visit www.sri.gob.ec.

Individuals which capital stock, annual income or annual costs and expenses exceed the limits established in the Regulations for the Implementation of the Law on Internal Tax Regime are obliged to have accounting books, becoming withholding agents, they cannot enter the Simplified Regime (RISE) and their VAT statements shall be filed on a monthly basis.

Remember that your VAT statements may be filed on a semester basis provided that you are not obliged to have accounting books, transfer goods or provide services only with 0% rate of VAT and/or your sales with a rate different than 0% are subject to 100% withholding of VAT.

 # OF REGISTERED ESTABLISHMENTS: From 001 to 001 **OPEN:** 1
JURISDICTION: \ZONA 7\ EL ORO **CLOSED:** 0

Taxpayer's signature

Internal Revenue Service
(illegible signature) / Seal

I declare that the information contained herein is true and accurate; therefore, I bear the legal responsibility arising therefrom (Article 9, Tax Code, Article 9 of the Law on the Taxpayer Identification Number (RUC) and Article 9 of the Regulations for the Implementation of the Law on the Taxpayer Identification Number (RUC))

User: JFGN010607 **Date of issue:** GUAYAQUIL/AV. FRANCISCO **Date and time:** 2017/09/08 16:48:13

INTERNAL REVENUE SERVICE (SRI IN SPANISH)

TAXPAYER IDENTIFICATION NUMBER
CORPORATIONS

TAXPAYER IDENTIFICATION NUMBER (RUC IN SPANISH): **0992982047001**

BUSINESS NAME: **YILPORT TERMINAL OPERATIONS YILPORTECU S.A.**

REGISTERED ESTABLISHMENTS:

ESTABLISHMENT NUMBER: 001 **STATUS** OPEN PARENT OFFICE

DATE OF COMMENCEMENT OF ACTIVITIES: July 29, 2016

ECONOMIC ACTIVITIES:

Exploitation activities of terminal facilities such as ports

ESTABLISHMENT ADDRESS:

Province: EL ORO Canton: MACHALA Parish: PUERTO BOLÍVAR Citadel: PUERTO BOLÍVAR Street: AV. BOLÍVAR MADERO VARGAS Number: W/N Reference: INSIDE THE PUERTO BOLÍVAR PORT AUTHORITY Building: P. BOLIVAR PORT AUTHORITY Cellphone: 0995083333 E-mail: rafael.sapina@yilport.com.tr

Taxpayer's signature

Internal Revenue Service
(illegible signature) / Seal

I declare that the information contained herein is true and accurate; therefore, I bear the legal responsibility arising therefrom (Article 9, Tax Code, Article 9 of the Law on the Taxpayer Identification Number (RUC) and Article 9 of the Regulations for the Implementation of the Law on the Taxpayer Identification Number (RUC))

User: JFGN010607 **Date of issue:** GUAYAQUIL/AV. FRANCISCO **Date and time:** 2017/09/08 16:48:13

ADMINISTRATIVE RESOLUTION No. 31-2016

VICTOR VICENTE GUZMAN BARBOTO, GENERAL MANAGER OF PUERTO BOLIVAR PORT AUTHORITY

WHEREAS:

The Constitution of the Republic of Ecuador, Article 66, Number 25 grants the rights of people to access public and private goods and services, and fair treatment under qualified, efficient and accurate terms, as well as to obtain proper and true information over their content and characteristics;

The Constitution of the Republic of Ecuador, Article 154 establishes that "State Ministers, besides their roles established by law, must: "1. perform control over public policies regarding their areas and issue every agreement and administrative resolution required during their administration…"

The Constitution of the Republic of Ecuador, Article 227 establishes Public Service constitutes a service to public ruled, among others, by accuracy, efficiency, hierarchy, decentralization, and coordination;

The Constitution of the Republic of Ecuador, Article 314 establishes the State will be in charge of providing public utilities for drinking and irrigation water, sanitation, electricity, telecommunications, road management, port and airport infrastructure and others as determined by Law.

The second section of afore mentioned article establishes the State will ensure public utilities and their provision comply with the principles of duty, generality, standardization, efficiency, responsibility, universality, accessibility, consistency, continuity and quality. The State will make sure costs and fares for public utilities are equitable and will establish their enforcement and regulation.

The Constitution of the Republic of Ecuador, Article 316, Section 2, establishes the State will exceptionally delegate its activities in strategic areas and public utilities to private sector or popular and solidarity-based economy enterprises, in cases established by Law.

The Organic Code for Production, Commerce and Investment (COPCI – *Código Orgánico de la Producción Comercio e Inversiones*), Article 100, establishes exceptional nature in afore mentioned article, according to the following text: "As exceptionally decreed by the President of the Republic whenever required and appropriate, in order to satisfy public, collective or general interest, whenever technical or economical capability is unavailable or when service demand may not be fulfilled by civil or joint enterprises, the State or institutions may delegate management of strategic areas and provision of utility services for electricity, road management, port or airport and railroad infrastructures, and others to private sector or popular and solidarity-based economy enterprises".

According to Executive Decree No. 810 published in the Official Registry No. 494 dated July 19, 2011, an Implementation Regulation for Exceptional Delegation of Public Transportation Service was issued. This Regulation establishes procedure to be followed so that the State, -by means of their

institutions and according to its competences-, may be able to provide and manage in an integrated manner, public transportation services from others provided through road infrastructures.

Article 2 in afore mentioned Regulation determines the authority to provide and manage public transportation service in an integrated way and exceptional manner, as previously declared by the President of the Republic, whenever the highest authority in the delegating entity, through a motivated resolution based on specialized technical studies, demonstrates relevant opportunity, convenience and technical-economic viability for such process, in compliance with Organic Code for Production, Commerce and Investment, Article 100, in the following cases: "1. Whenever in a justified manner, need or convenience to satisfy public, collective or general interest by infrastructure modernization and development for integrated provision and/or management of transportation and logistics services is demonstrated…"

Delegation process for public port service in Puerto Bolivar is subject to rules applicable to public-private associations, mainly included in the Organic Code for Production, Commerce and Investment, and Executive Decree No. 582 published in the Official Register 453 dated March 6, 2015.

PUERTO BOLIVAR PORT AUTHORITY received from YILPORT HOLDING NV a private-initiative proposal on March 9, 2015, in compliance with Public-Private Cooperation Regulation (*Régimen de Colaboración Público-Privada*) Article 6, included in Decree No. 582 published in the Official Register 453 dated March 6, 2015.

On March 24, 2015 General Management of Puerto Bolivar Port Authority sends Communication No. APPB-GG-0129 to YILPORT HOLDING NV in order to communicate that Private Initiative named PUERTO BOLIVAR MODERNIZATION PROJECT is of public interest to the Ecuadorian State.

In a report dated April 29, corresponding units of PUERTO BOLIVAR PORT AUTHORITY analyzed the private-initiative proposal and determined technical, economical and legal viability of this project proposed by YILPORT HOLDING NV in compliance with procedure established in Public-Private Cooperation Regulation Articles, 8, 9 and 10.

Mr. President of the Republic issued Executive Decree No. 674, dated May 12, 2015 to authorize, on an exceptional basis, delegation of public service in Puerto Bolivar Port by contractual modality to define granting authority in compliance with Organic Code for Production, Commerce and Investment, Article 100.

According to Document APPB-GG-0257 dated June 5, 2015, General Management assigned a Technical Committee to undertake a public tender.

On June 9, 2015, Mariuxi Galvez Vivar, engineer and President of this Technical Committee during preparation stage, sent documents of a **PUBLIC TENDER FOR DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL** to General Management for corresponding approval.

By **ADMINISTRATIVE RESOLUTION No. 66-2015**, dated **June 9, 2015**, afore mentioned Management determined:

"…Article 1. Authorizing relevant procedure for an International Public Tender for DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL in compliance with Organic Code for Production, Commerce and Investment, Article 100 and Executive Decree No. 810 published by the Official Register No. 494 on July 19, 2021.

Article 2. Approving documents and reference budget of SIX HUNDRED ELEVEN MILLION TWO HUNDRED TWENTY THOUSAND AMERICAN DOLLARS 00/100 (USD 611,200,000.00) and the term of 37 years for service delegation as of agreement date.

Article 3. Requiring Technical Committee Secretariat to publish this Resolution including documents, announcement, and any documentation generated during this hiring process in the official website created for this purpose.

Article 4. Acknowledging Sub-Secretary of Ports and Maritime and Fluvial Transportation about documentation and this Resolution to be registered…."

On June 9, 2015, APPB official webpage published an announcement to national and foreign legal entities, or associations and corporations formed by these, and legally capable of contract undersigning, to participate in Public Tender No. 001-2015-APP-APPB in order to select, in compliance with administrative, technical, economic and contractual bases approved by APPB General Manager through Resolution No. 66-2015 dated June 9, 2015, the best tender for **"DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL."**

On October 2, 2015, at 4:40 p.m., the only tender was delivered by Vianna Maino, attorney and representative of **YILPORT HOLDING NV** in APPB meeting room. This delivery was performed within the term established in Modifying Notice No. 5 dated September 16, 2015.

On October 2, 2015, at 5:00 p.m. during **BIDDING QUALIFICATION PHASE** in public hearing, the Eligible Envelope was opened. This envelope contained an Original envelope in Parts A and B, and 3 envelopes containing copies of the original also containing Parts A and B. After time established in the basis documented for this tender, a Selection Technical Committee, verified the checklist of requirements for Eligibility submitted and after a favorable qualification was awarded, they enabled the bidder to move to the second phase.

On October 13, 2015, at 10:00 a.m. during **TECHNICAL EVALUATION PHASE** in public hearing in APPB meeting room, the Technical Bidding Envelope containing an Original Envelope, 6 Envelopes with copies from the original and a box containing Layout Plans were opened. After time established in basis documentation for this tender, the Selection Technical Committee verified the checklist of Technical requirements submitted and including a favorable qualification for the bidding, they enabled the bidder to subsequent revision by corresponding Subcommittee.

A Technical Subcommittee, comprised by experts in equipment, infrastructure and port maintenance operations, submitted Technical Proposal Qualification Annex 14 including a 100/100 score, and added a series of comments, recommendations and conclusions that were to be considered by the Technical Committee when entering the Negotiation and Awarding Phase.

On November 24, 2015, at 10:00 a.m. during **ECONOMIC EVALUATION PHASE** in public hearing in APPB meeting room, the Economic Bidding Envelope containing an Original Envelope was opened after time established in basis documentation for this tender. Since no other bidder is available, no tabulations or comparative graphics are required to determine compliance with minimal weightings, thus the Technical Committee enabled the bidder for the following phase.

After bidding submitted by YILPORT HOLDING NV for **"DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL"** Tender has overcome each phase established in the document for mentioned tender, the Technical Selection Committee convenes the bidder to move to the last phase of Negotiation and Adjudication.

In an agreement Memorandum dated February 04, 2016 undersigned by Ministry of Transportation and Public Works – Walter Solis, engineer and General Manager of Puerto Bolivar Port Authority, and Robert Yildirim, President of Yilport Holding NV, a commitment to actions in compliance with Ecuadorian legislation in order to undertake final phase to process design, financing, equipment, additional work execution, operation and maintenance of Puerto Bolivar Port Terminal was established on the basis of background stated in such document and according to applicable regulations.

According to criteria and weightings established in Technical Baseline, which results and details included in **FINAL EVALUATION REPORT** dated November 30, 2015, and once **NEGOTIATION PHASE** including observations of technical revision may have been absolved or ratified, including relevant aspects for better proposal, the Selection Technical Commission for **"DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL"** Tender unanimously and in compliance with Negotiation and Adjudication, Clause 18, Section e) recommended the Manager of Puerto Bolivar Port Authority to issue an Adjudication Resolution to YILPORT HOLDING NV in their **NEGOTIATION AND ADJUDICATION REPORT** dated February 22, 2015.

In the exercise of its jurisdiction conferred by the Constitution of the Republic of Ecuador, the Organic Code for Production, Commerce and Investment, National Port Administration Law Articles 12 and 13, Section a) and Executive Decree No. 674, dated May 12, 2015:

RESOLVES

Article 1.- Granting **"DESIGN, FINANCING, EQUIPMENT, ADDITIONAL WORK EXECUTION AND MAINTENANCE SERVICE OF PUERTO BOLIVAR PORT TERMINAL" PUBLIC TENDER** to **YILPORT HOLDING NV** amounted the sum of **SEVEN**

HUNDRED MILLION DOLLARS (USD 750, 000, 000.00), financed by a foreign investor, with an execution term of 50 years from the date of contract signed.

Article 2.- General Management, endorsed by corresponding Departments and Units if required, will prepare a minute, including as a mandatory part, the conditions established in documentation for such purpose and points agreed in corresponding negotiation.

Article 3.- General Management along with legal representative of the Ecuadorian company that YILPORT HOLDING NV shall constitute according to documentation requirements, will undersign a contract within terms established in corresponding documentation.

Article 4.- Valid bid bond will remain under custody of the entity until contract is undersigned. For this purpose, Entity Treasurer, custodian of this bond, will proceed to return it when corresponding notification regarding contract duly legalized is received.

Article 5.- Adjudication Resolution will be notified to the private proponent at its electronic mail address established for such purpose: **vianna.maino@gmail.com.** This notification will be published in Puerto Bolivar Port Authority webpage, under an official site for the public tender, subject of this Resolution.

BE DULY NOTIFIED

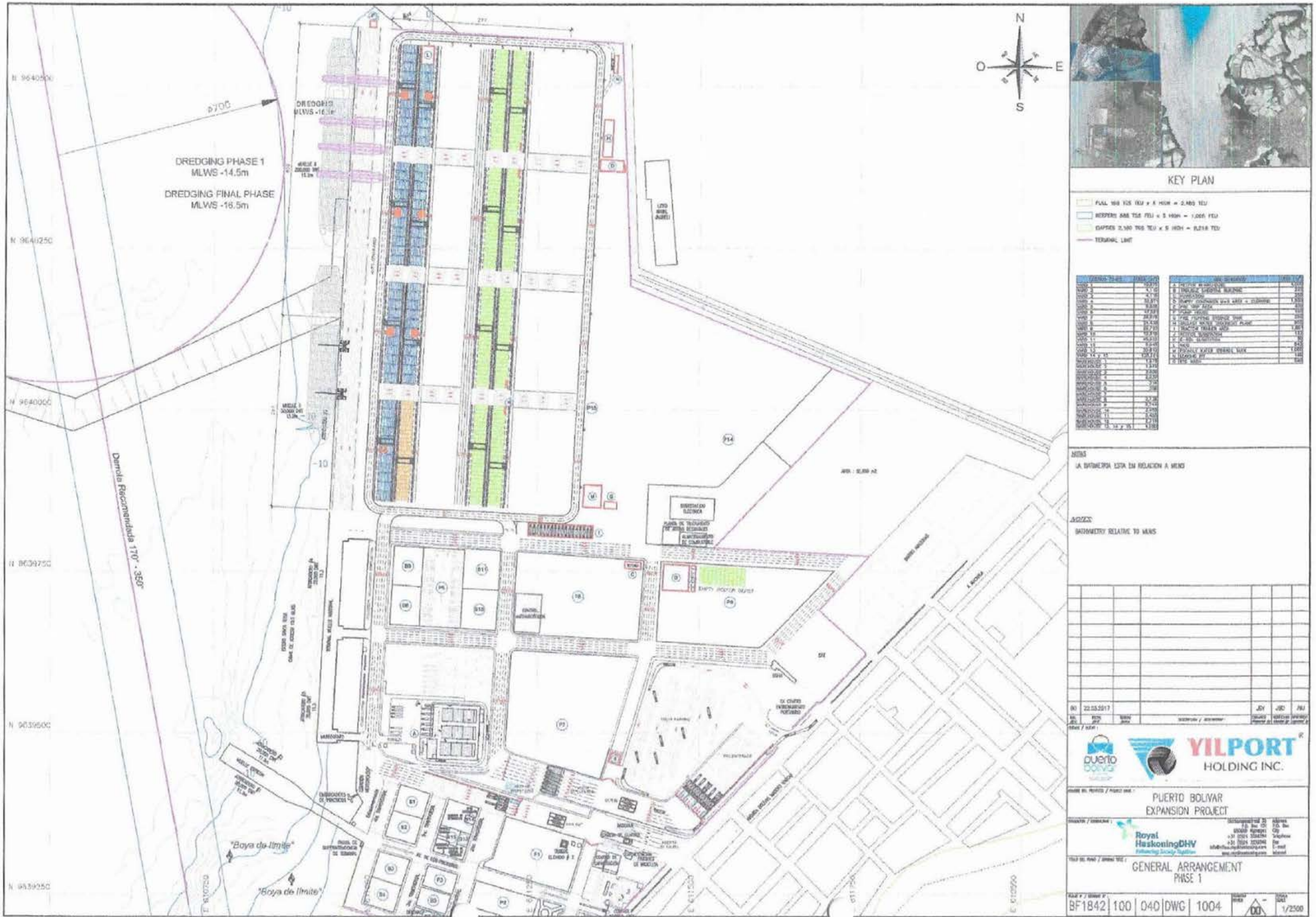
Done and signed in the office of Puerto Bolivar Port Authority General Management on the twenty-fourth day of February, two thousand sixteen.

VICTOR VICENTE GUZMAN BARBOTO
GENERAL MANAGER

This Resolution was drawn and signed by **VICTOR VICENTE GUZMAN BARBOTO**, General Manager of Puerto Bolivar Port Authority, on February 24, 2016. **I HEREBY CERTIFY**.

MGR. ELAIN RAMON MONTENEGRO
GENERAL SECRETARY

APPENDIX 5


N
S
O
E
DREDGING PHASE 1
MLWS -14.5m
DREDGING FINAL PHASE
MLWS -16.5m
Derrota Recomendada 170° - 350°
"Boya de límite"
"Boya de límite"
N 9640500
N 9640250
N 9640000
N 9639750
N 9639500
N 9639250
KEY PLAN
TERMINAL LIMIT
LA BATIMETRIA ESTA EN RELACION A MLWS
BATHYMETRY RELATIVE TO MLWS
22.03.2017
YILPORT
HOLDING INC.
PUERTO BOLIVAR
EXPANSION PROJECT
Royal HaskoningDHV
GENERAL ARRANGEMENT
PHASE 1
BF1842 100 040 DWG 1004
1/2500

APPENDIX 6

CLIENT IDENTIFICATION

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6 MANEUVERING ZONE AND ACCESS CHANNEL OF PUERTO BOLÍVAR
El Oro Province: Machala , Av Bolívar Madero Vargas S/N-. Puerto Bolívar
Engineer Harry Veintimilla
0992909970

Guayaquil. April 20, 2017

MONITORING PRESENTATION

Geographic coordinates: 0610951 -9639819
Work order: 01-0260-17
Technical Regulation: Ministerial Resolution 097-A
Sample procedure: PEE. EL.019

Technical coordinator: Jose Marcial, Engineer
Technician: Gabriel Sellán
Start date: April 20, 2017
Close date: April 20, 2017

EQUIPMENT USED

CODE	*NAME*	*BRAND*	*MODEL*	*SERIE*	*DATE CAI.*	*CERTIFICATES*
EL.EA.071	*SUPELCO BOMB*	*MICRO AIR SAMPLER*	*NOT SPECIFIED*	*NOT SPECIFIED*	*05-09-16*	*http://www.elicrom.com/trazabilidad/*
EL.PT.211	*THERMOHYGROMETER*	*ATM*	*1179211*	*NOT SPECIFIED*	*01-07-17*	
EL.PT.567	*ANEMOMETER*	*CONTROL COMPANY*	*3655*	*160252313*	*03-04-16*	
EL.PT.547	*BAROMETER*	*CONTROL COMPANY*	*1081*	*160253 706*	*03-01-16*	

STATION LAYOUT:

Address: Guayaquil City Mz 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007, Cell Phone 099337519, 099448710;
jmarcial@elicrom.com GUAYAQUIL- ECUADOR

DESCRIPTION OF SOURCE EVALUATED:

NAME:	*DREDGING OF DOCKS 1, 2, 3, 4, 5, 6 MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR*
ACTIVITY:	*CONTAINERS STORAGE, LOAD AND UNLOADING*
OPERATION SYSTEM:	*SHIFT: 3 (8 HOURS EACH)* *DAYS PER MONTH: 30 DAYS* *HOURS PER MONTH: 720 HOURS*

ENVIRONMENTAL CONDITIONS

The environmental conditions of the monitoring site were:

Stations	Measurement Site	Average Temperature (°C)	Relative Moisture (%HR)	Wind Speed (m/s)	Atmospheric pressure (mmHg)
1	DOCK # 5	31.6	69.3	1.5	753.6

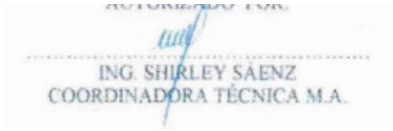
RESULTS

Parameter	Observed Concentration µg/m^3	Corrected Concentration µg/m^3	Maximum Allowed*	Evaluation
Carbon monoxide	2024.22	2086	10000	COMPLY
Nitrogenous dioxide	10.96	11.29	200	COMPLY
Sulfur dioxide	8.64	8.90	125	COMPLY
Ozone	22.86	23.56	100	COMPLY

* Air quality standard or immision level. Ministerial Resolution N° 097-A

"REPORT ATTACHMENT / CERTIFICATE NUMBER ME-0260-002-17"

AUTHORIZED BY:



ENGINEER SHIRLEY SAENZ
TECHNICAL COORDINATOR M.A.

ANNEX:

1. ***CHROMATOGRAPHY***
2. ***PHOTOGRAPH***
3. ***CERTIFICATE OF CALIBRATION***

Address: Guayaquil City Mz 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007, Cell Phone 099337519, 099448710;
jmarcial@elicrom.com GUAYAQUIL- ECUADOR

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
AIR MONITORING QUALITY
APRIL, 2017

SITE: DOCK # 5

Monitoring date: April 20, 2017
Equipment used: Supelco bomb

Performed by:

Engineer Jose Marcial

April, 2017

Address: Guayaquil City, 1st Solar street 10, Pbx: 2282007, Cell Phone 099337519, 099448710;
jmarcial@elicrom.com
GUAYAQUIL - ECUADOR

Clarity - Chromatography SW

AIR QUALITY ANALYSIS

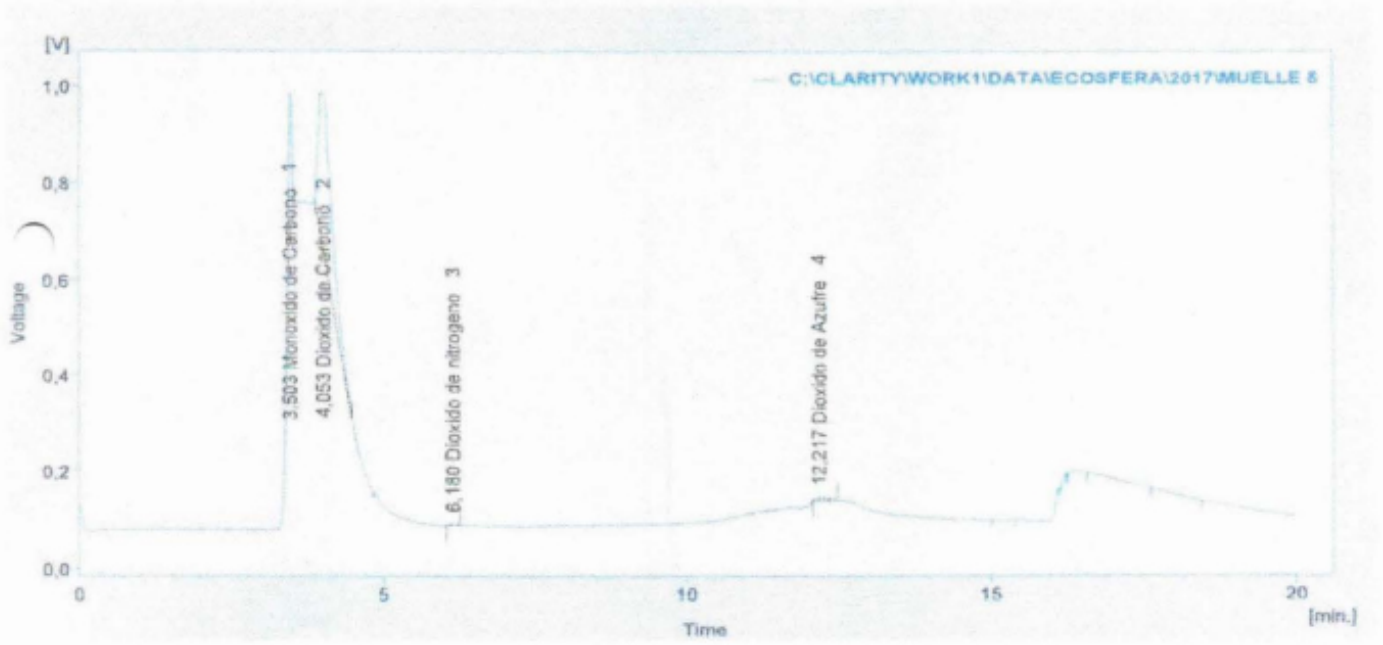
CONTACT PERSON: ENGINEER HARRY VEINTIMILLA

Printed Version Info:

Printed Version	: Modified	Printed Date	: 24/04/2017 8:37:40
Report Style	: Chromatogram	By	: None
Calibration File	: GASES AMBIENTE		

Sample Info:

Sample ID	: ECOSFERA CIA. LTDA.	Amount [µg/m3]	: 1
Sample	: MUELLE 5	ISTD Amount	: 0
Inj. Volume [ml]	: 1	Dilution	: 1



	Retention Time (min)	Response	RB	Amount (µg/m^3)	Amount (%)	Peak Type	Compound Name
1	3.503	1039.102	A	2024.224	2024.4	Ordnt	Carbon monoxide
2	4.053	4828.756	A	N/A	N/A	Error	Carbon dioxide
3	6.180	22.183	A	10.986		Ordnt	Nitrogenous dioxide
4	12.217	91.246	A	8.644		Ordnt	Sulfur dioxide
	Total			1.000	204383.7		

Clarity - Chromatography SW

OZONE ANALYSIS

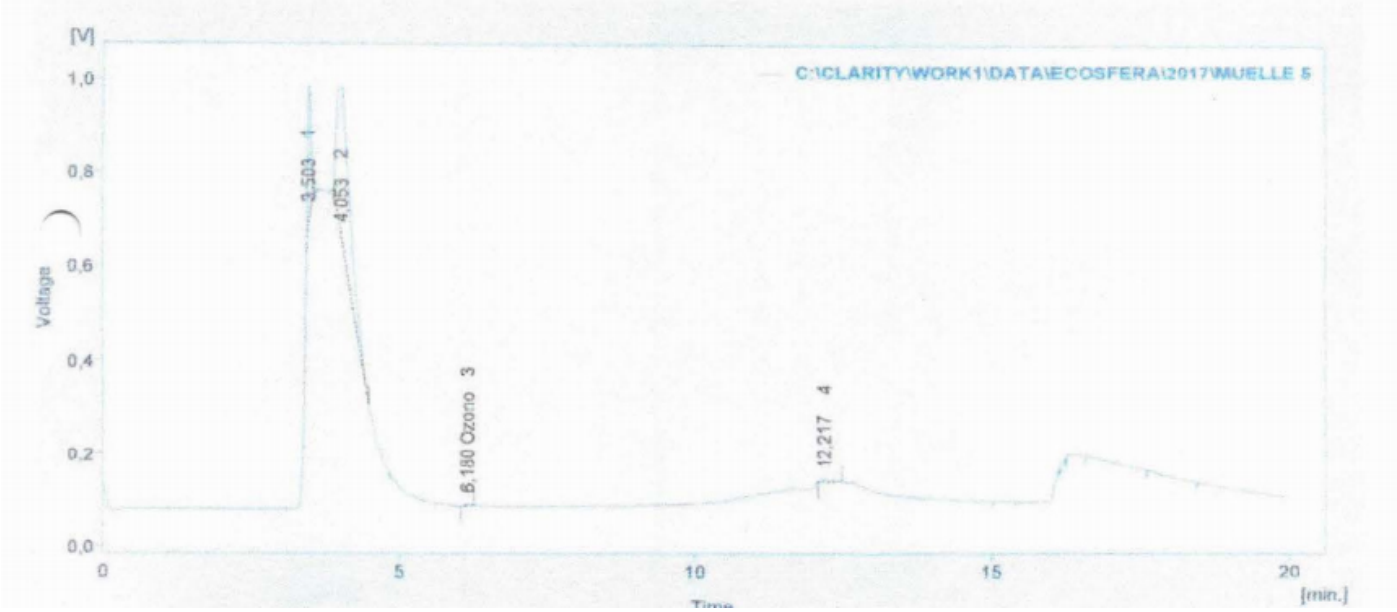
CONTACT PERSON: ENG. HARRY VEINTIMILLA

Printed Version Info:

Printed Version	: 24/04/2017 8:15:32 Recent (Linked Calibration)	Printed Date	: 24/04/2017 8:37:11
Report Style	: Chromatogram	By	: None
Calibration File	: OZONO		

Sample Info:

Sample ID	: ECOSFERA CIA. LTDA.	Amount [ug/m3]	: 1
Sample	: MUELLE 5	ISTD Amount	: 0
Inj. Volume [ml]	: 1	Dilution	: 1



	Reten. Time (min)	Response	RB	Amount (µg/m^3)	Amount (%)	Peak Type	Compound Name
3	6.180	22.183	A	22.868	2286.8	Ordnt	Ozone
	Total			1.000	2286.8		

SUPELCO

CHEMICAL STANDARDS GENERAL USE STANDARDS
Phone: (314) 286-7750. FAX: (314) 771-5757 email: supelco@sial.com

Certificate of Analysis

Certificate Number: 0721311

Certification Date: 2016-05-09
Certificate expiration: 2017-05
Lot. Number: M-CNP24879

Supelco certifies that this unit has been verified in terms of the standars maintained by this laboratory, using instruments that are traceable to the U.S. National Institute of Standars and Technology (NIST). Supporting documentation is on file and available for inspection upon request.
Some og these products are classified as hazardous under European Union (EU) legislation. The risk and safety (R and S) phrases assigned by the EU are listed in the index of EU.

DESCRIPTION	CAT No	CONCENTRATION
CO	EPA PROTOCOLS COMPLIANCE	500 µg/mL each component
NO		Bal nitrogen
SO2		

Store betwen 25 +/- 5ºC
Maximum usable shelf life one year from date of manufacture

William J. Sacher
Director of Technical Services

Document: 35266.CERT15.BMP

Visit our Web site at http://www.sigma-alderich.com/supelco

CERTIFICATE OF CALIBRATION

Guayaquil City, 1st street mz 21 solar 10
Guayaquil – Ecuador Pbr 04-2282007 Fax ext. 403
http://www.elicrom.com mail: ventas@elicrom.com

Acreditación N° OAE LC C 10-509 LABORATORIO DE CALIBRACIÓN

CLIENT IDENTIFICATION

COMPANY	ELICROM CIA LTDA.
ADDRESS	GUAYAQUIL CITY, 1ST STREET MZ 21 SOLAR 10
PHONE	2282007

EQUIPMENT IDENTIFICATION

EQUIPMENT	THERMOHYGROMETER	TEMPERATURE MEASUREMENT UNIT	°C
BRAND	ATM	TEMPERATURE RESOLUTION	0.1
MODEL/TYPE	HT9214	TEMPERATURE RANK	(-10 to 50) °C
SERIE	NOT SPECIFIC	MOISTURE MEASUREMENT UNIT	%HR
CLIENT CODE	ELPT211	MOISTURE RESOLUTION	0.1
LOCATION	ENVIRONMENT	MOISTURE RANK	(20 to 99)%HR

EQUIPMENT USED

CODE	NAME	BRAND	MODEL	SERIES	CALIBRATION DATE	NEXT CALIBRATION
EL.PC 013	PATRON THERMOHYGROMETER	VAISALA	[illegible]	[illegible]	Feb-06-15	Feb-06-17
EL PT 038		ELICROM	[illegible]	Does not apply	Aug-12-16	Aug-12-17
EL PT 365		CENTER	342	140113655	Apr-02-16	Apr-02-17

CALIBRATION

METHOD	DIRECT COMPARISON WITH PATRON THERMOHYGROMETER AND STABILITY CHAMBER
PROCEDURE	PEC EL 04
CALIBRATION PLACE	T H LABORATORY (ELICROM)
AVERAGE TEMPERATURE (°C)	22.7
AVERAGE MOISTURE (%HR)	49.0

Description	Unit	Pattern	Equipment	Adjustment	Uncertainty
Internal temperature 1	°C	28.04	28.0	0.0	1.0
Moisture 1	%HR	24.82	28.3	-3.5	4.9
Moisture 2	%HR	45.32	46.4	-1.1	4.9
Moisture 3	%HR	75.40	70.6	4.8	4.9

OBSERVATIONS

The calculation of the expanded uncertainty was made on the basis of the guide OAE G02 R01, multiplying the typical uncertainty for the coverage k=2.00, so that a t distribution (of Student) with Veff = ω (effective degrees of freedom) corresponds to a coverage probability of approximately 95,45%. The typical measurement uncertainty has been determined in accordance with the document EA-4/02. This certificate cannot not be reproduced except completely without the written approval of the laboratory *Elicrom-Calibración*. This certification refers only to the equipment described above at the moment of the assay.

CALIBRATION MADE BY: Sergio Rodriguez
CALIBRATION DATE: 2017-01-07 **NEXT DATE**: 2017-07-07

AUTHORIZED BY:

AUTORIZADO POR
Ing. Sabino Parada
GERENTE TÉCNICO

TECHNICAL MANAGER

RECEIVED BY

RECIBIDO POR
RESPONSABLE - CLIENTE

RESPONSIBLE - CLIENT

Calibration complies with ISO/IEC 17025 and ANSI/NCSL Z540-1

Cert. No.:3655-7473034

Traceable® Certificate of Calibration for Micro-Anemometer/Thermometer

Instrument Identification:

Model: 3655 S/N: 160252813 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Air Velocity Standard	1016966	11/21/16	201511211620
Digital Thermometer	90969500	10/01/16	4000-7091939

Certificate Information:

Technician: 177 Procedure: CAL-3655 Cal Date: 3/04/16 **Cal Due: 3/04/18**

Test Conditions: 22.1°C 42.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
FPM		N.A.		0	0	Y	20	20	7	2.9:1
FPM		N.A.		1,029	990	Y	736	1,322	7	>4:1
FPM		N.A.		1,630	1,499	Y	1,337	1,923	7	>4:1
°C		N.A.		24.22	23.4	Y	22.2	26.2	0.06	>4:1

This Instrument was calibrated using instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full without the written permission of Control Company.

Aaron Justice, Technical Manager

Nominal=Standard's Reading, As Left=Instrument's Reading, In Tol=In Tolerance, Min/Max=Acceptance Range, ±U=Expanded Measurement Uncertainty, TUR=Test Uncertainty Ratio: Accuracy=±(Max-Min)/2

Maintaining Accuracy:

In our opinion most calibrated your Micro-Anemometer/Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Micro-Anemometer/Thermometers change little, if any, at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

Control Company 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 1081-7473887

Traceable® Certificate of Calibration for Barometer with Clock

Instrument Identification:

Model: 1081 S/N: 160253706 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	9/21/16	1000380976
Non-Contact Frequency Counter	26.66887	5/15/16	1000374678

Certificate Information:

Technician: 57 Procedure: CAL-31 Cal Date: 3/01/16 Due Date: 3/01/18

Test Conditions: 24.3°C 43.0 %RH 1015 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
mb/hPa		N.A.		929.45	927	Y	923	935	0.70	>4:1
mb/hPa		N.A.		979.75	977	Y	974	985	0.70	>4:1
mb/hPa		N.A.		1,014.55	1,011	Y	1,009	1,021	0.70	>4:1
Sec/24hr		N.A.		0.000	0.700	Y	-8.640	8.640	0.13	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez, Quality Manager

Aaron Jusica, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Barometer with Clock should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Barometer with Clocks change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

APPENDIX 7

	ASSAY REPORT N° M-ME-0260-002-17 EXTERNAL ENVIRONMENTAL NOISE MONITORING DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR

CLIENT IDENTIFICATION

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6 MANEUVERING ZONE AND ACCESS CHANNEL OF PUERTO BOLÍVAR
El Oro Province: Machala, Av Bolívar Madero Vargas S/N-. Puerto Bolívar
Engineer Harry Veintimilla
0992909970

Guayaquil. April 20, 2017

MONITORING PRESENTATION

Land use:	Industrial (ID3)	*Sampling methodology:*	15 seconds
Geographic coordinates:	0610941 -9639369	*Project coordinator:*	Jose Marcial, Eng.
Work order:	OT-0260-17	*Technician:*	Gabriel Sellán
Sampling technical regulation:	Ministerial Resolution 097-A	*Start date:*	April 20, 2017
Sampling procedure:	PEE. EL.001	*Close date:*	April 20, 2017

EQUIPMENT USED

CODE	*NAME*	*BRAND*	*MODEL*	*SERIES*	*DATE CAI.*	*CERTIFICATES*
EL.EM.022	*SONOMETER*	*CENTER*	*390*	*150207044*	*05-12-16*	*http://www.elicrom.com/trazabilidad/*
EL.PC.003	*GAGE*	*SPER SCIENTIFIC*	*850016*	*081202542*	*06-06-16*	
EL.PT.211	*THERMOHYGROMETER*	*ATM*	*HT9214*	*NOT SPECIFIC*	*01-07-12*	
EL.PT.567	*ANEMOMETER*	*CONTROL COMPANY*	*3655*	*1600252813*	*03-04-16*	
EL.PT.547	*BAROMETER*	*CONTROL COMPANY*	*1081*	*160253706*	*03-01-16*	

STATION LAYOUT:

Address: Guayaquil City Block 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007,
Cell Phone 099337519, 099448710; jmarcial@elicrom.com
GUAYAQUIL- ECUADOR

FFR EVALUATION:

NAME:	*DREDGING OF DOCKS 1, 2, 3, 4, 5, 6 MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR*
ACTIVITY:	*CONTAINERS STORAGE, LOAD AND UNLOADING*
CRITICAL POINTS AFFECTATION:	***RECEPTORS:*** *HOUSES NEARBY* *ADMINISTRATIVE STAFF* *PORT STAFF*
SURFACES NEARBY REFLECTING SOUND:	***TRANSMITTER:*** *WITHOUT PHYSICAL BORDERS* ***RECEIVER:*** *CONCRETE WALLS*
FFR POINTS OF HIGHEST NPS EMISSIONS:	*ENVIRONMENTAL MANAGEMENT PLAN*
OPERATION REGIME:	***SHIFTS:*** *3 (8 HOURS EACH)* ***DAYS AT MONTH****: 30 DAYS* ***HOURS AT MONTH:*** *720 HOURS*
RESIDUAL NOISE DESCRIPTION: *P1: TAKEN AT THE VEHICLES PASS TOWARD WAREHOUSE* *P2: TAKEN BEHIND ADMINISTRATIVE AREAS* *P3: TAKEN AT BARREN LAND NEAR DOCK MANEUVERING AREA* *P4: TAKEN NEAR PARISH HALL*	***CONTRIBUTING SOURCES:*** *NO NOISE EFFECT OBSERVED*
SPECIFIC NOISE DESCRIPTION: *P1: TAKEN AT THE VEHICLES PASS TOWARD PRODUCTS LOAD AND UNLOAD* *P2: TAKEN NEAR ADMINISTRATIVE AREAS* *P3: TAKEN AT MANEUVERING AREA AND VEHICLES PASS* *P4: TAKEN IN VEHICLES PASS*	***CONTRIBUTING SOURCES:*** *VEHICLE PASS*

Address: Guayaquil City Block 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007,
Cell Phone 099337519, 099448710; jmarcial@elicrom.com
GUAYAQUIL- ECUADOR

ENVIRONMENTAL CONDITIONS

The following environmental conditions were present in the monitoring site:

Stations	Measurement Site	Average Temperature (°C)	Relative Moisture (%HR)	Wind Speed (m/s)	Atmospheric pressure (mmHg)
1	DOCK # 1	31.6	69.3	1.5	753.6
2	ADMINISTRATIVE AREAS	31.9	67.9	1.3	753.6
3	DOCK # 5	32.1	66.5	1.1	753.6
4	COASTAL DOCK	32.3	66.5	0.9	753.6

METHOD DEVIATION

No deviation occurred during the procedure.

RESULTS

Station	Measurement Site	Score	Coordinates		Total Noise Leg, t (dB)	Lmax (dB)	Lmin (dB)	Residual Noise Leq,r (dB)	Specific Noise LKeq = te (dB)	LKeq = Le+ [ileg] (dB)	Uncertainty (dB)
1	DOCK 1	A	0610941	9639369	65.2	69.8	62.7	50.9	65.0	68.0	±5.0
		C	0610941	9639369	77.6	79.3	77.3	58.5	77.5		
2	ADMINIS-TRATIVE AREAS	A	0611136	9639401	65.1	71.4	59.1	62.3	61.9	64.9	±6.0
		C	0611136	9639401	78.5	81.9	77.0	75.0	76.0		
3	DOCK 5	A	0611014	9640135	63.7	66.1	62.4	61.3	59.9	65.9	±6.0
		C	0611014	9640135	81.8	87.1	79.6	78.5	79.1		
4	COASTING DOCK	A	0610892	9639050	58.0	63.1	55.0	51.3	57.0	60.0	±5.0
		C	0610892	9639050	72.1	77.2	70.4	60.9	71.7		

Station	Date	Score	Start Hour	Finish Hour	Measuring Time	Total Sampling
1	20-04-17	A	15:15:26	15:17:26	00:02:00	5
	20-04-17	C	15:21:19	15:23:19	00:02:00	5
2	20-04-17	A	15:31:40	15:33:40	00:02:00	5
	20-04-17	C	15:34:00	15:36:00	00:02:00	5
3	20-04-17	A	15:57:31	15:59:31	00:02:00	5
	20-04-17	C	16:00:00	16:02:00	00:02:00	5
4	20-04-17	A	16:39:39	16:41:39	00:02:00	5
	20-04-17	C	16:42:10	16:44:10	00:02:00	5

Address: Guayaquil City Block 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007,
Cell Phone 099337519, 099448710; jmarcial@elicrom.com
GUAYAQUIL- ECUADOR

Appendix 5, Maximum Levels of Noise Emission and measurement methodology for fixed and mobile sources and maximum levels of vibration and measurement methodology, sets out in its Annex 5: ***"The person or company that accomplishes the measurements is not who determines if a FFR complies or not with the maximum levels of noise emission. Its only duty is to determine and report the LKeq value. The environmental competent Authority will be who determines if there is compliance or not".***

Address: Guayaquil City Block 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007,
Cell Phone 099337519, 099448710; jmarcial@elicrom.com
GUAYAQUIL- ECUADOR

"REPORT ATTACHMENT / CERTIFICATE NUMBER ME-0260-002-17"

AUTHORIZED BY:

ENGINEER SHIRLEY SAENZ
TECHNICAL COORDINATOR M.A.

ANNEXES:

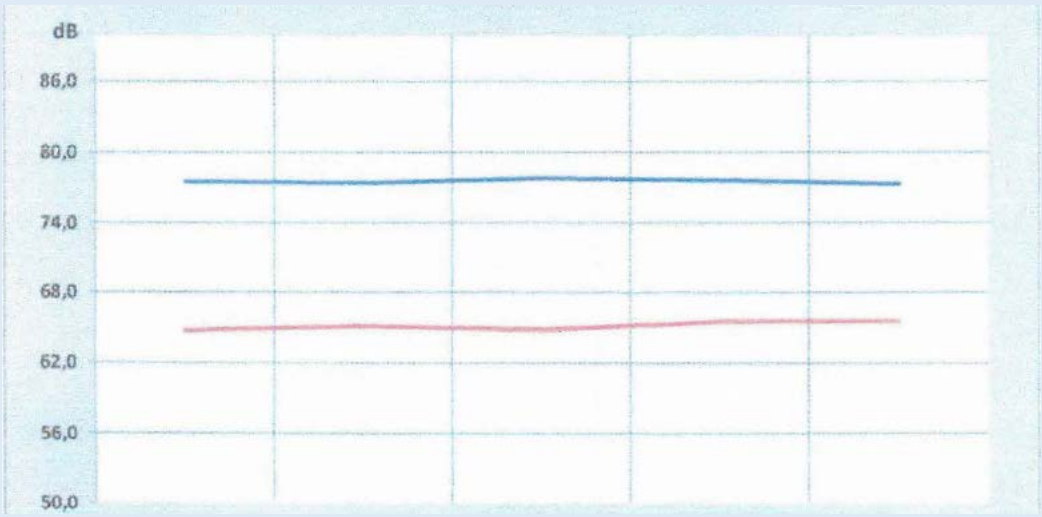
1. ***EQUIPMENT DATA***
2. ***CERTIFICATE OF CALIBRATION***
3. ***PHOTOGRAPH EVIDENCE***

Address: Guayaquil City Block 21, 1st Solar street 10, in front of Mall del Sol. Pbx: 2282007,
Cell Phone 099337519, 099448710; jmarcial@elicrom.com
GUAYAQUIL- ECUADOR

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
EXTERNAL ENVIRONMENTAL NOISE MONITORING
APRIL, 2017

LOCATION: DOCK 1
GEOGRAPHIC COORDINATES: (0610941; 9639369)

DOCK 1



SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR

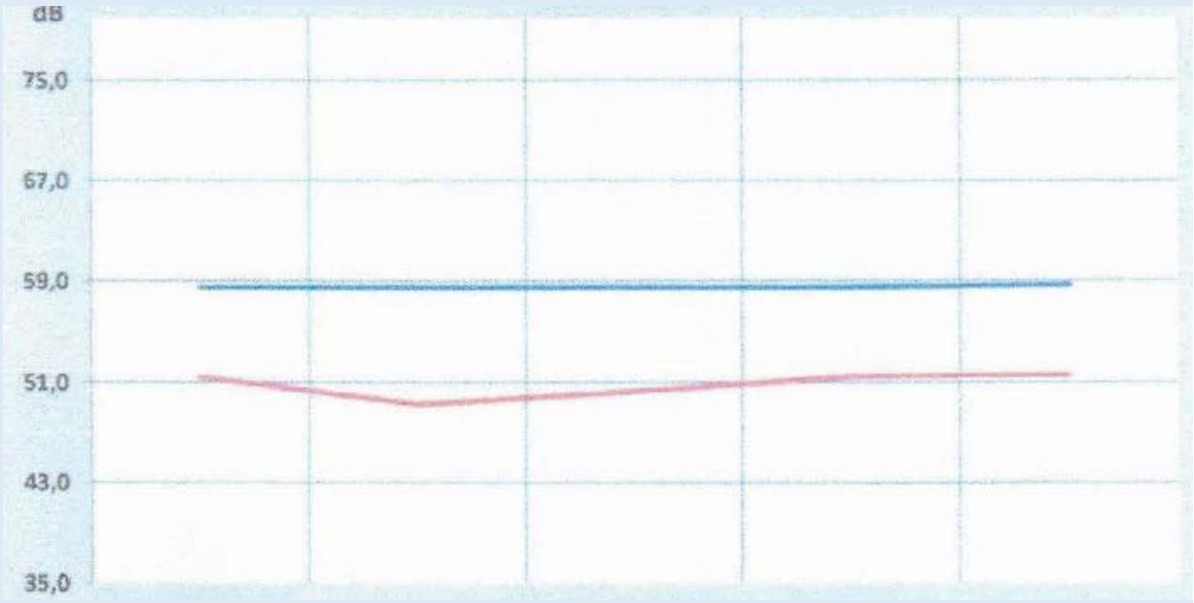
EXTERNAL ENVIRONMENTAL NOISE MONITORING

APRIL, 2017

LOCATION: RESIDUAL NOISE – BEHIND WAREHOUSES GOING TO DOCK 1

GEOGRAPHIC COORDINATES: (0611088; 9639374)

RESIDUAL NOISE – BEHIND WAREHOUSES GOING TO DOCK 1



SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR

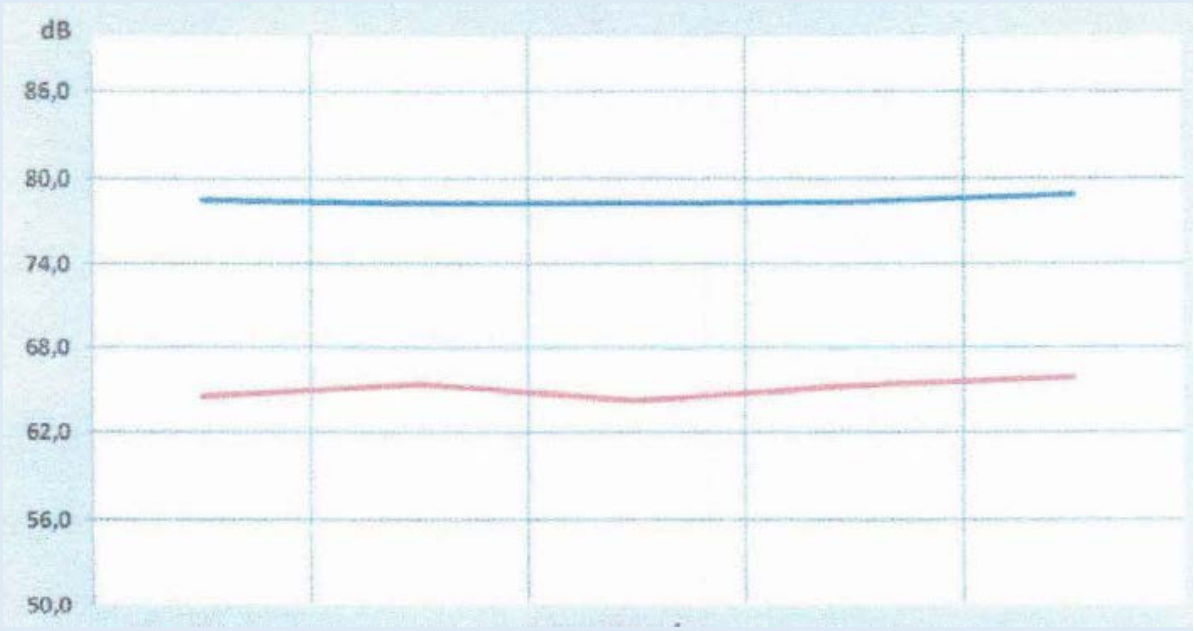
EXTERNAL ENVIRONMENTAL NOISE MONITORING

APRIL, 2017

LOCATION: RESIDUAL NOISE – ADMINISTRATIVE AREAS

GEOGRAPHIC COORDINATES: (0611136; 9639401)

RESIDUAL NOISE – ADMINISTRATIVE AREAS



SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR

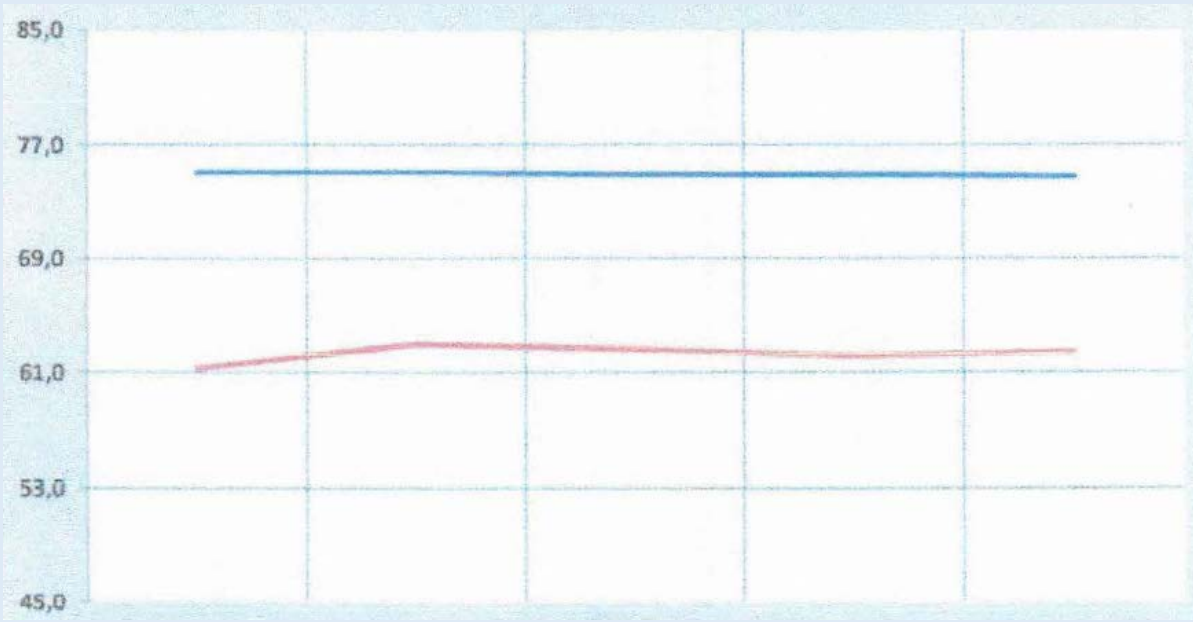
EXTERNAL ENVIRONMENTAL NOISE MONITORING

APRIL, 2017

LOCATION: RESIDUAL NOISE – WITHOUT NUMBER STREET

GEOGRAPHIC COORDINATES: (0611161; 9639350)

RESIDUAL NOISE – WITHOUT NUMBER STREET



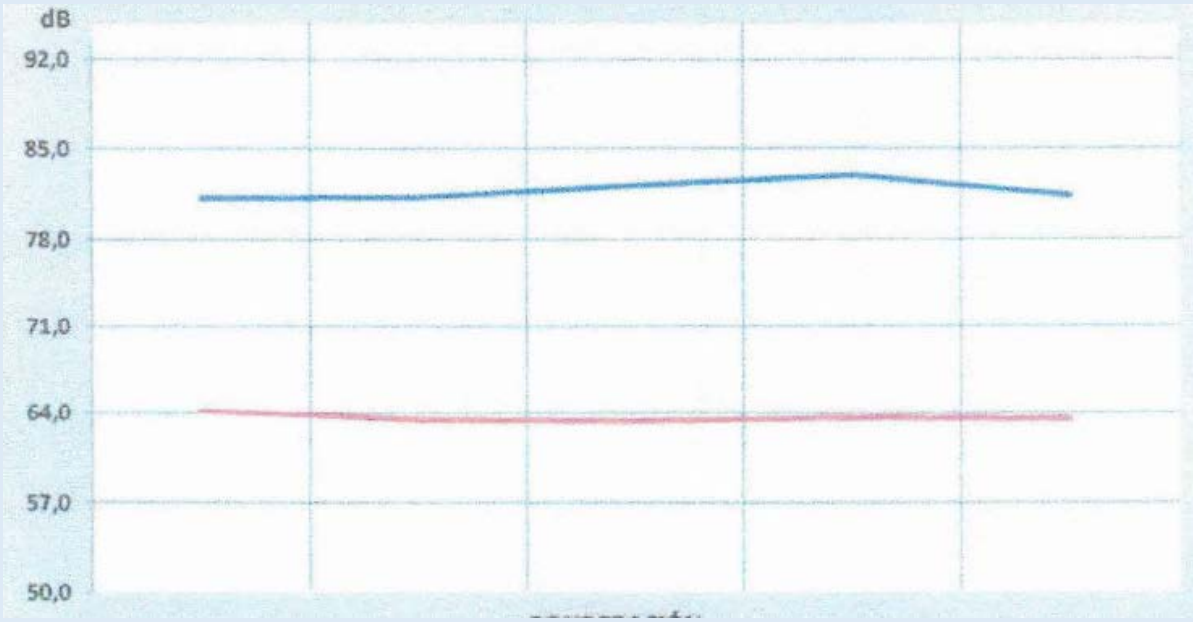
SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
EXTERNAL ENVIRONMENTAL NOISE MONITORING
APRIL, 2017

LOCATION: DOCK 5
GEOGRAPHIC COORDINATES: (0611014; 0640135)

DOCK 5



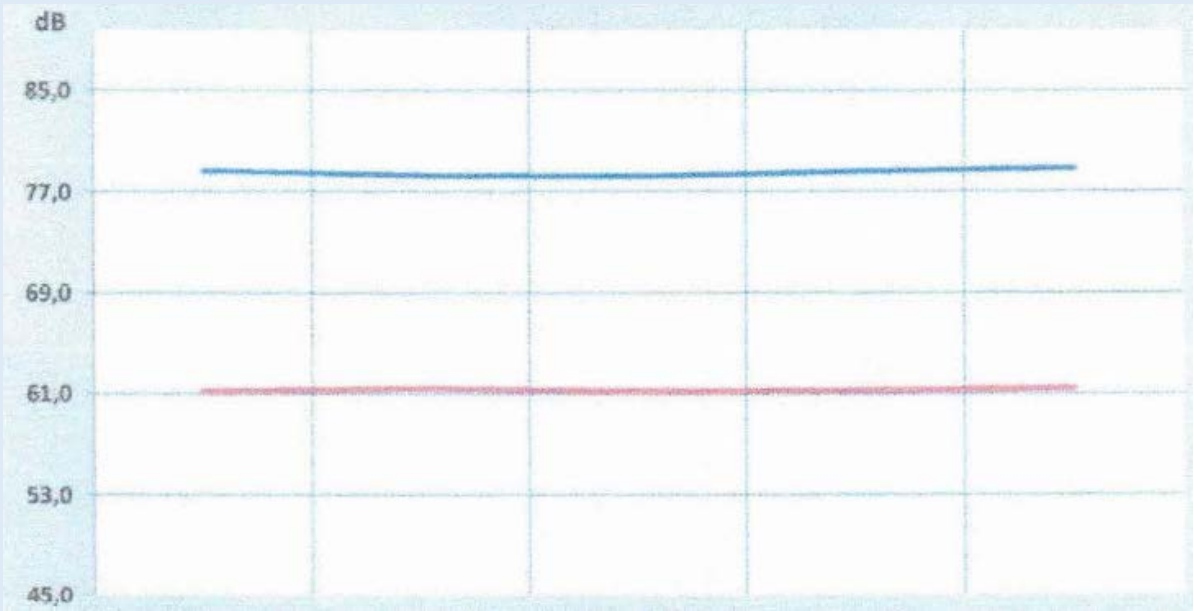
SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
EXTERNAL ENVIRONMENTAL NOISE MONITORING
APRIL, 2017

LOCATION: RESIDUAL NOISE - BARREN LAND
GEOGRAPHIC COORDINATES: (0611068; 9640082)

RESIDUAL NOISE – BARREN LAND



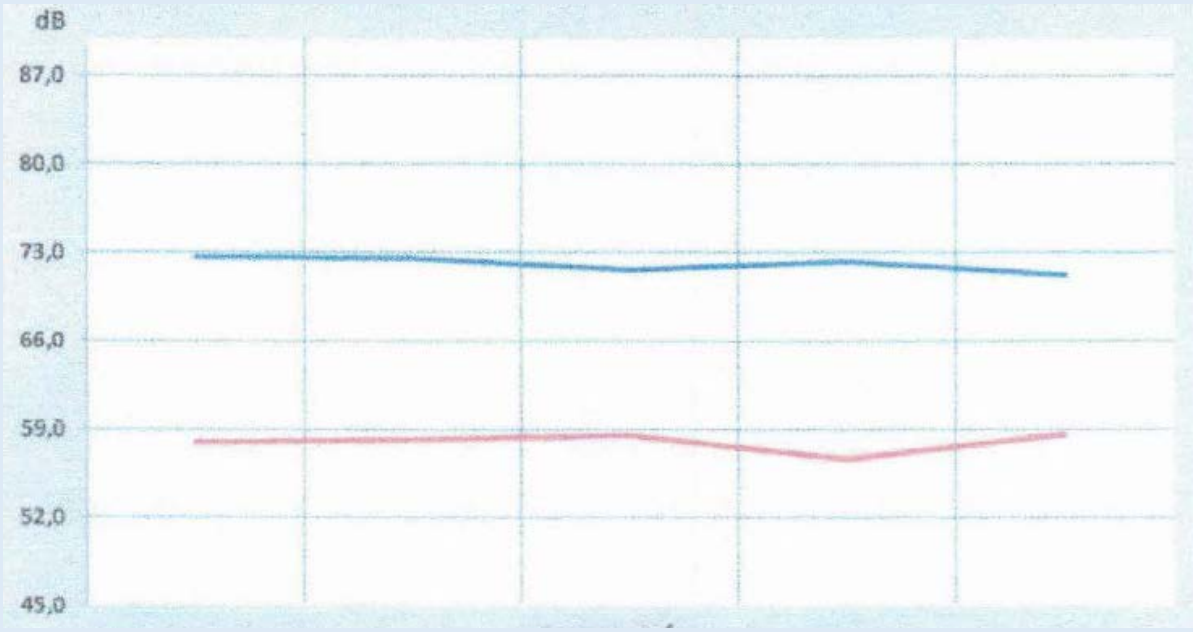
SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
EXTERNAL ENVIRONMENTAL NOISE MONITORING
APRIL, 2017

LOCATION: COASTAL DOCK
GEOGRAPHIC COORDINATES: (0610892; 9639050)

COASTAL DOCK



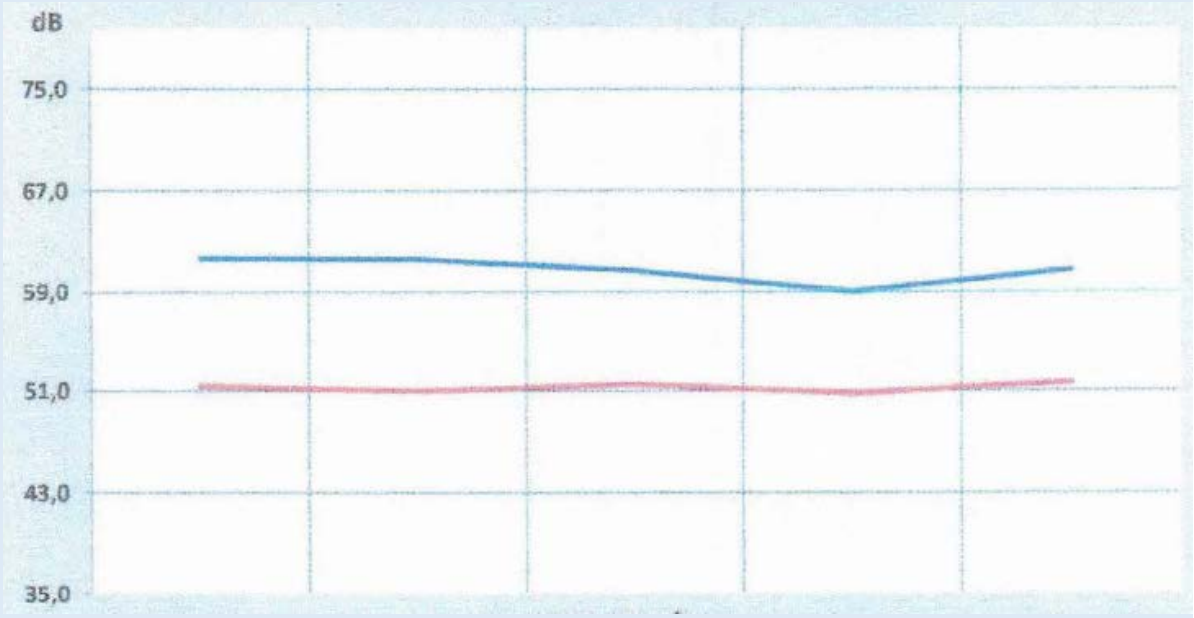
SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

DREDGING OF DOCKS 1, 2, 3, 4, 5, 6, MANEUVERING ZONE AND ENTRANCE CHANNEL OF PUERTO BOLIVAR
EXTERNAL ENVIRONMENTAL NOISE MONITORING
APRIL, 2017

LOCATION: RESIDUAL NOISE – WITHOUT NUMBER STREET
GEOGRAPHIC COORDINATES: (0610963; 9639060)

RESIDUAL NOISE – WITHOUT NUMBER STREET



SCORE

Thursday 20th, April of 2017 ------(A) ------(B)

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

SOUND LEVEL METER

Manufactured by:	CENTER
Model No:	390
Serial No:	150207044
Calibration Recall No:	26344

Submitted By:

Customer:	ELICROM CIA. LTDA.
Company Address:	Cdla Guayaquil, Mz. 21 Calle 1 era Slr. 10 Frente al Mall del Sol Ecuador GUAYAQUIL

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 390 CENT

Upon receipt for Calibration, the instrument was found to be:

Within (X)

tolerance of the indicated specification. See attached Report of Calibration.

West Caldwell Calibration Laboratories' calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Approved by:

Calibration Date: 12-May-16

FC

Certificate No: 26344 - 4

Felix Christopher (QA Mgr.)

QA Doc. #1051 Rev. 2.0 10/1/01

Certificate Page 1 of 1

ISO/IEC 17025:2005

West Caldwell Calibration Laboratories, Inc.

uncompromised calibration

1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED

Calibration Lab. Cert. # 1533.01

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

2 PT. ACOUSTICAL CALIBRATOR

Manufactured by:	SPER SCIENTIFIC
Model No:	850016
Serial No:	081202542
Calibration Recall No:	26503

Submitted By:

Customer:	ELICROM CIA. LTDA.
Company:	Cdla. Guayaquil, Mz. 21 Calle 1era Str.
Address:	10 Frente al Mall del Sol
	Ecuador-Guayaquil

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. [illegible] SPER

Upon receipt for Calibration, the instrument was found to be:

Outside (X)

tolerance of the indicated specification. See attached Report of Calibration.

West Caldwell Calibration Laboratories' calibration control system meets the requirements ISO 10012-1 MIL-STD-45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025.

Note: With this Certificate, Report of Calibration is included.

Approved by:

Calibration Date: 06-Jun-16

FC

Certificate No: 26503 - 12

Felix Christopher (QA Mgr.)
ISO/IEC 17025:2005

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED
Calibration Lab. Cert. # 1333.01

CERTIFICATE OF CALIBRATION

Guayaquil City, 1st street block 21 solar 10
Guayaquil – Ecuador Pbx 04-2282007 Fax ext. 403
http://www.elicrom.com mail: ventas@elicrom.com

Acreditación N° OAE LC C 10-509
LABORATORIO DE CALIBRACIÓN

CLIENT IDENTIFICATION

COMPANY	ELICROM CIA LTDA.
ADDRESS	GUAYAQUIL CITY, 1ST STREET BLOCK 21 SOLAR 10
PHONE	2282007

EQUIPMENT IDENTIFICATION

EQUIPMENT	THERMOHYGROMETER	TEMPERATURE MEASUREMENT UNIT	°C
BRAND	ATM	TEMPERATURE RESOLUTION	0.1
MODEL/TYPE	HT9214	TEMPERATURE RANK	(-10 to 50) °C
SERIE	NOT SPECIFIC	MOISTURE MEASUREMENT UNIT	%HR
CLIENT CODE	EL.PT.211	MOISTURE RESOLUTION	0.1
LOCATION	ENVIRONMENTAL	MOISTURE RANK	(20 to 99)%HR

EQUIPMENT USED

CODE	NAME	BRAND	MODEL	SERIE	CALIBRATION DATE	NEXT CALIBRATION
EL.PC 013	THERMOHYGROMETER PATRON	VAISALA	[illegible]	H4510020/H4950006	Feb-06-15	Feb-06-17
EL.PT.038	STABILITY CHAMBER	ELICROM	Does not apply	Does not apply	Aug-12-16	Aug-12-17
EL.PT.365	THERMOHYGROMETE	CENTER	342	140103655	Apr-02-16	Apr-02-17

CALIBRATION

MHETOD	DIRECT COMPARISON WITH THERMOHYGROMETER PATRON AND STABILITY CHAMBER
PROCEDURE	PEC.EL.04
CALIBRATION PLACE	T H LABORATORY (ELICROM)
AVERAGE TEMPERATURE (°C)	22.7
AVERAGE MOISTURE (%HR)	49.0

Description	Unit	Pattern	Equipment	Adjustment	Uncertainty
Internal temperature 1	°C	28.04	28.0	0.0	1.0
Moisture 1	%HR	24.82	28.3	-3.5	4.9
Moisture 2	%HR	45.32	46.4	-1.1	4.9
Moisture 3	%HR	75.40	70.6	4.8	4.9

OBSERVATIONS

The calculation of the expanded uncertainty was made on the basis of the guide OAE G02 R01, multiplying the typical uncertainty for the coverage k=2.00, so that a t distribution (of Student) with Veff = ω (effective degrees of freedom) corresponds to a coverage probability of approximately 95,45%. The typical measurement uncertainty has been determined in accordance with the document EA-4/02. This certificate cannot not be reproduced except completely without the written approval by the laboratory *Elicrom-Calibración*. This certificate refers only to the equipment described above at the moment of the assay

CALIBRATION MADE BY: Sergio Rodriguez
CALIBRATION DATE: 2017-01-07 **NEXT DATE**: 2017-07-07

AUTHORIZED BY:

TECHNICAL MANAGER

RECEIVE BY

RESPONSIBLE - CLIENT

Calibration complies with ISO/IEC 17025 and ANSI/NCSL Z540-1

Cert. No.:3655-7473034

Traceable® Certificate of Calibration for Micro-Anemometer/Thermometer

Instrument Identification:

Model: 3655 S/N: 160252613 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Air Velocity Standard	1018965	11/21/16	201511211620
Digital Thermometer	90949500	10/01/16	4000-1061939

Certificate Information:

Technician: 177 Procedure: CAL-3655 Cal Date: 3/04/15 Cal Due: 3/04/16

Test Conditions: 22.1°C 42.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
FPM		N.A.		0	0	Y	20	20	7	2.9:1
FPM		N.A.		1,029	999	Y	736	1,322	7	>4:1
FPM		N.A.		1,500	1,499	Y	1,337	1,923	7	>4:1
°C		N.A.		24.22	23.4	Y	22.2	26.2	0.09	>4:1

This instrument was calibrated using instruments Traceable to National Institute of Standards and Technology.

Aaron Lucca, Technical Manager

Maintaining Accuracy:

Recalibration:

Control Company 4456 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Calibration Certificate No. [illegible]

Cert. No.: 1081-7473887

Traceable® Certificate of Calibration for Barometer with Clock

Instrument Identification:

Model: 1081 S/N: 160253706 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4640001	9/21/16	1000380976
Non-Contact Frequency Counter	26.66887	5/15/16	1000374878

Certificate Information:

Technician: 67 Procedure: CAL-31 Cal Date: 3/01/16 Due Date: 3/01/18

Test Conditions: 24.3°C 43.0 %RH 1015 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
mb/hPa		N.A.		929.45	927	Y	923	935	0.70	>4:1
mb/hPa		N.A.		979.75	977	Y	974	986	0.70	>4:1
mb/hPa		N.A.		1,014.55	1,011	Y	1,009	1,021	0.70	>4:1
Sec/24hr		N.A.		0.000	0.700	Y	-8.640	8.640	0.13	>4:1

This instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

[illegible]

[illegible]

[illegible], Quality Manager

[illegible], Technical Manager

Maintaining Accuracy:

[illegible]

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA

Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

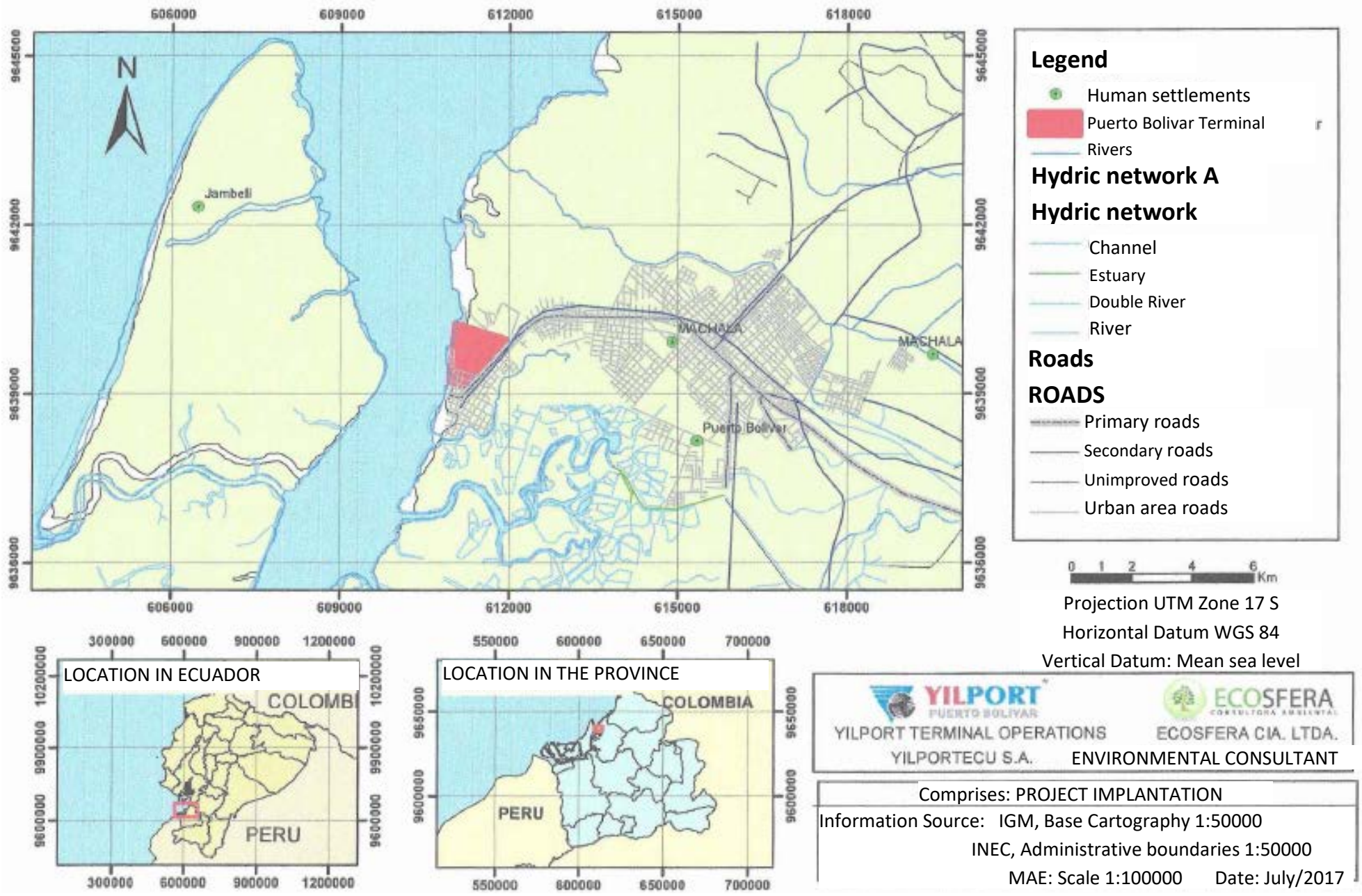
PHOTOGRAPHIC EVIDENCE

It should be noted that the source of noise analyzed finds herself masked by the noise produced by the pass of light and heavy vehicles that circulate constantly close to the evaluated source.

Project dredging area (original route)
Puerto Bolívar Port Terminal Construction and Operation Project
Resolutions for Sustainable Mangrove Use & Safekeeping-MAE 2017
main access road
Crossroad Guayaquil
Méndez route
Location Diagram of the Primary Wastewater Treatment Plant
Jambelí Channel in the Gulf of Guayaquil
bathymetric measurements
High Seas Sediment Dump Area

APPENDIX 8

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level

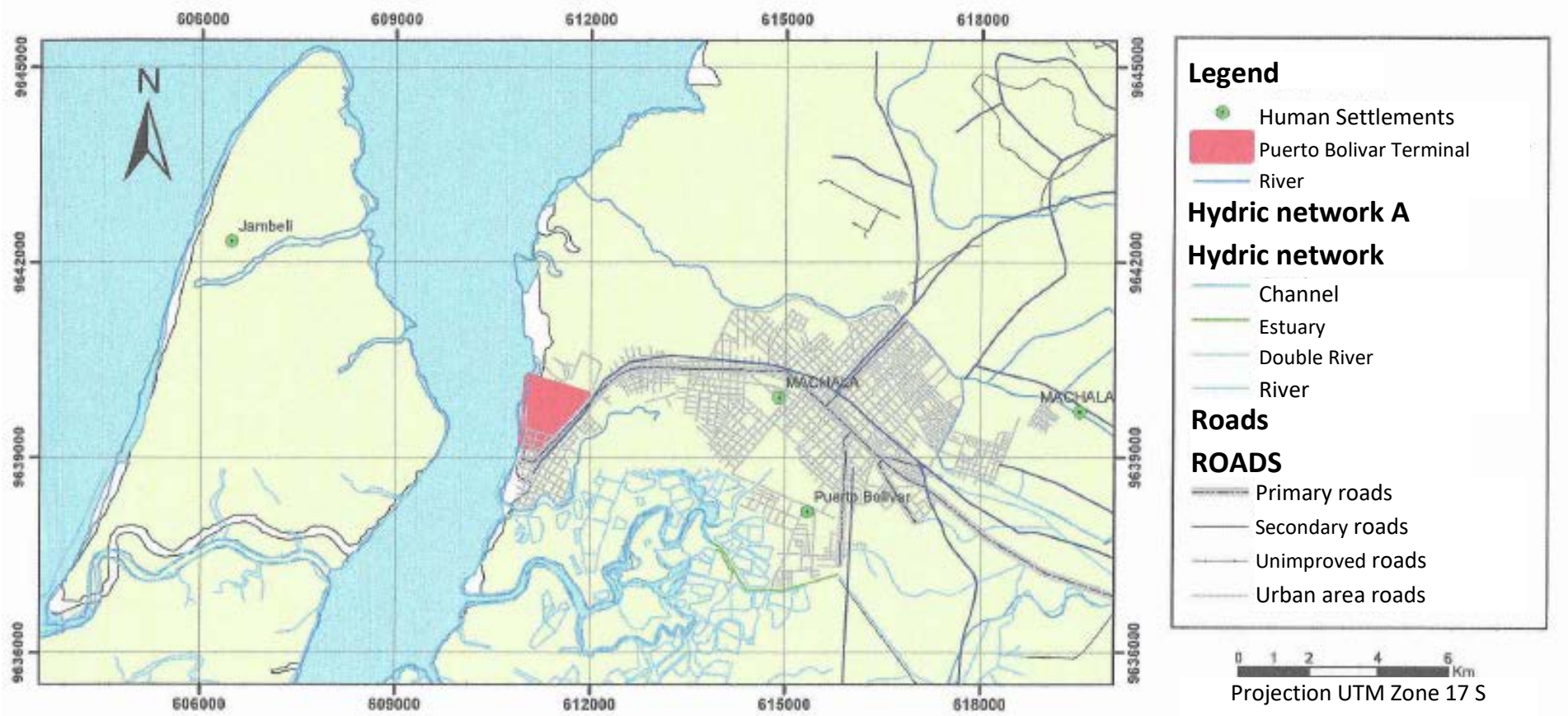
YILPORT PUERTO BOLIVAR — YILPORT TERMINAL OPERATIONS — YILPORTECU S.A.

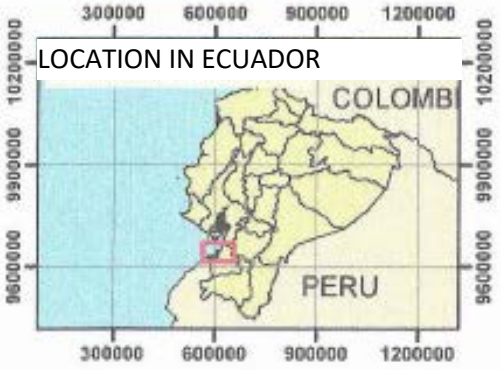
ECOSFERA CONSULTORA AMBIENTAL — ECOSFERA CIA. LTDA. — ENVIRONMENTAL CONSULTANT

Comprises: PROJECT IMPLANTATION

Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL





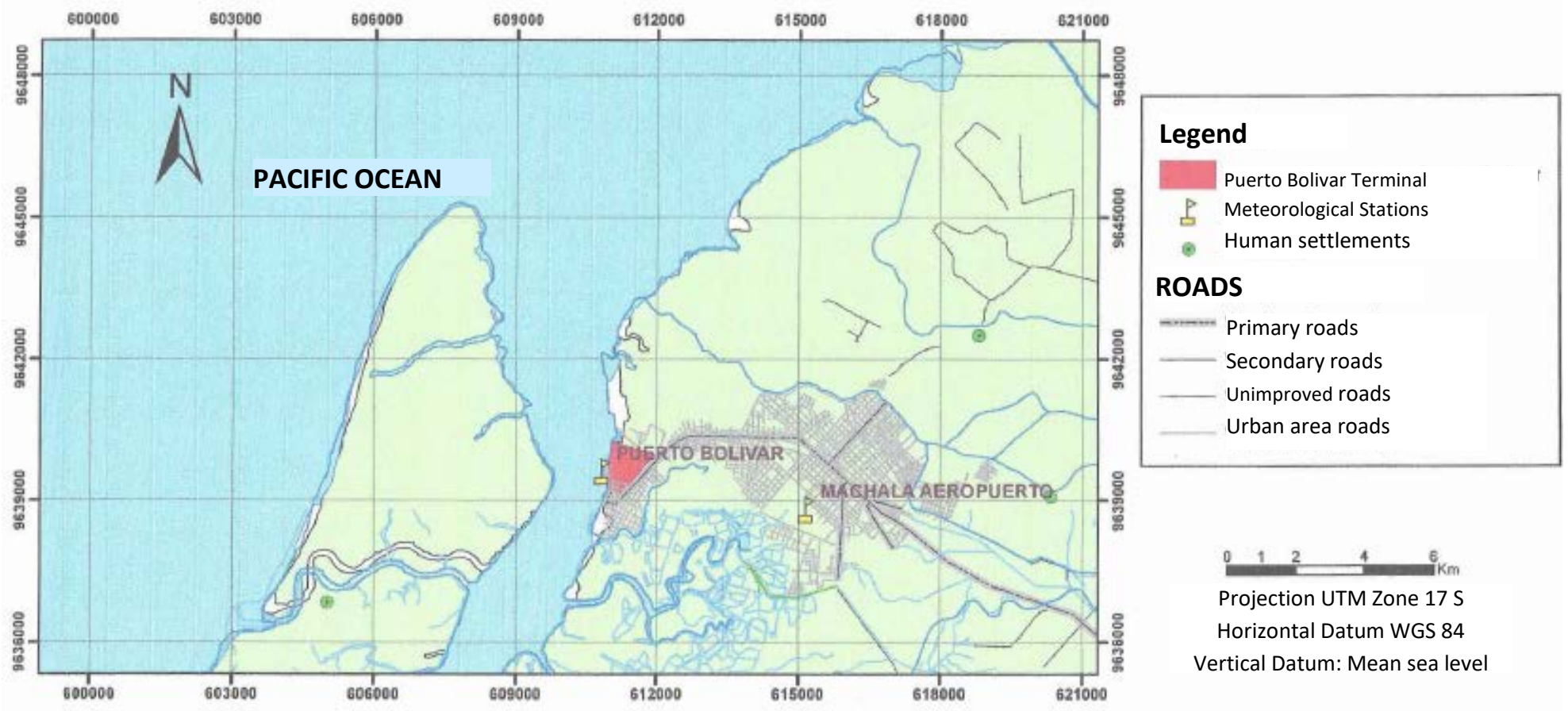
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level

YILPORT PUERTO BOLIVAR — YILPORT TERMINAL OPERATIONS
ECOSFERA CONSULTORA AMBIENTAL — ECOSFERA CIA. LTDA.
YILPORTECU S.A. ENVIRONMENTAL CONSULTANT

Comprises: PROJECT IMPLANTATION

Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



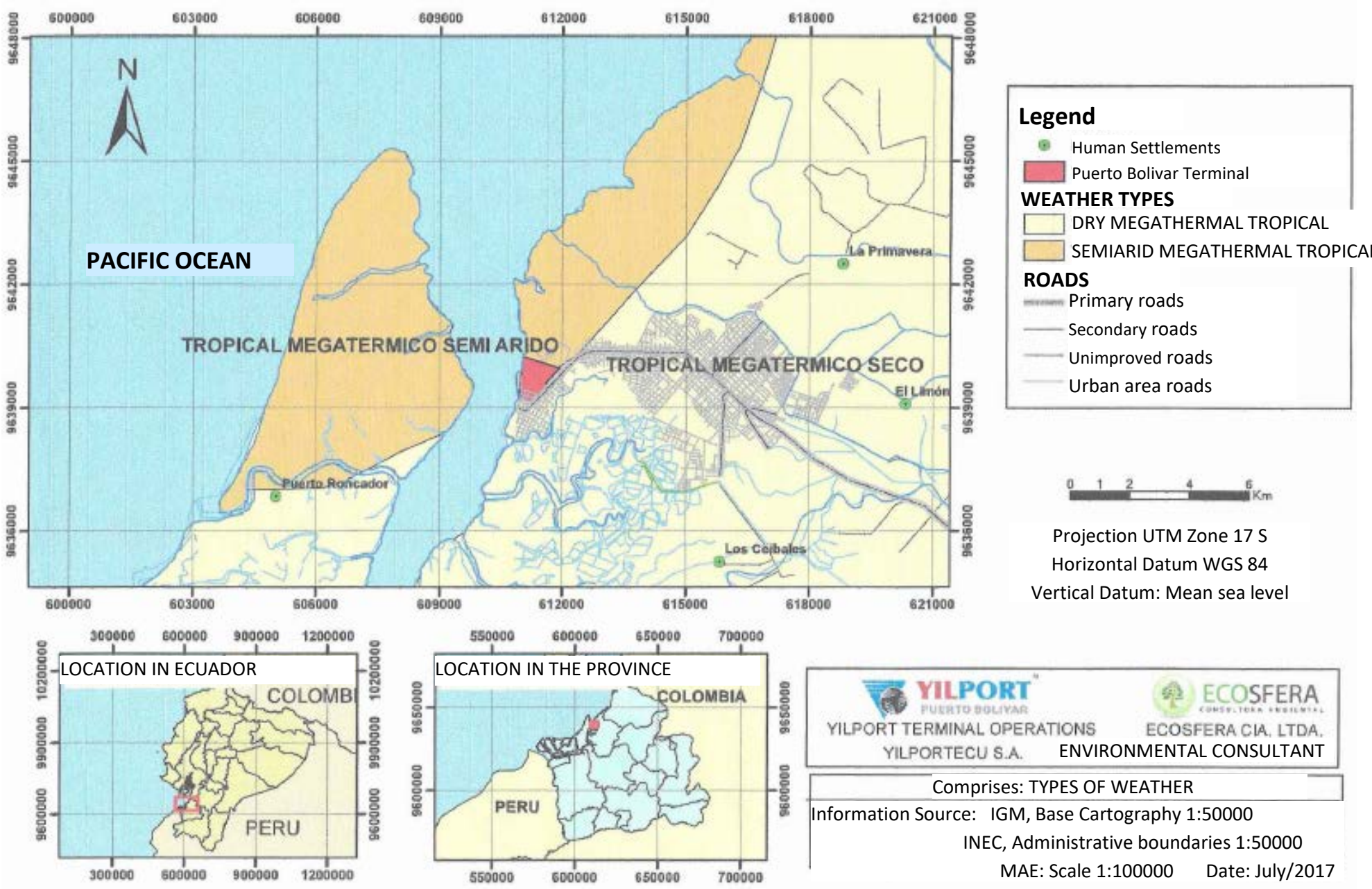
YILPORT PUERTO BOLIVAR — YILPORT TERMINAL OPERATIONS — YILPORTECU S.A.

ECOSFERA CONSULTORES AMBIENTALES — ECOSFERA CIA. LTDA. — ENVIRONMENTAL CONSULTANT

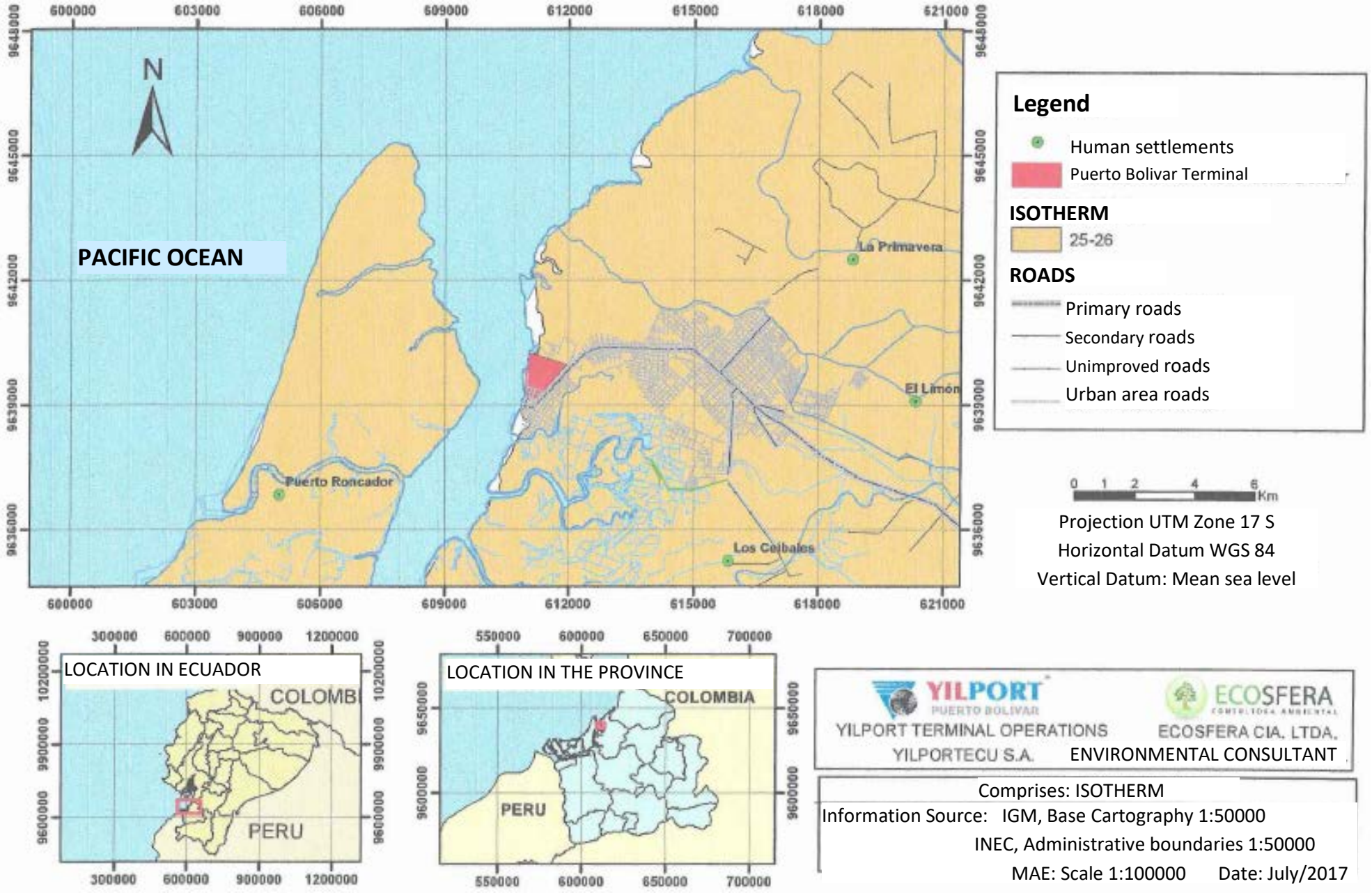
Comprises: METEOROLOGICAL STATIONS

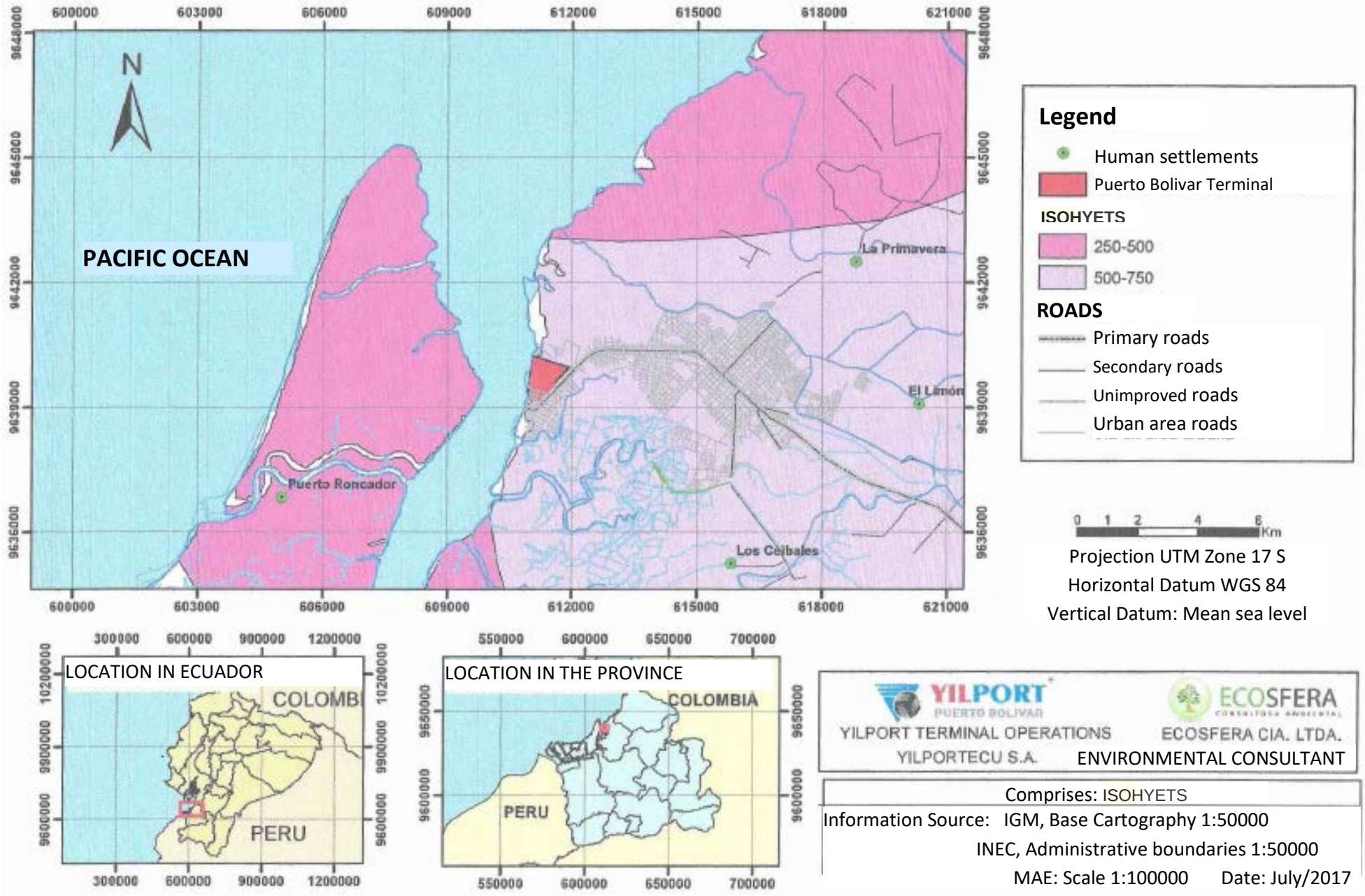
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000

MAE: Scale 1:100000 Date: July/2017


N
PACIFIC OCEAN
TROPICAL MEGATERMICO SEMI ARIDO
TROPICAL MEGATERMICO SECO
La Primavera
El Limón
Puerto Roncador
Los Cebales
600000
603000
606000
609000
612000
615000
618000
621000
9648000
9645000
9642000
9639000
9636000
Legend
Human Settlements
Puerto Bolivar Terminal
WEATHER TYPES
DRY MEGATHERMAL TROPICAL
SEMIARID MEGATHERMAL TROPICAL
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORIA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: TYPES OF WEATHER
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL




N
PACIFIC OCEAN
La Primavera
El Limón
Puerto Roncador
Los Cabales
Legend
Human settlements
Puerto Bolivar Terminal
ISOHYETS
250-500
500-750
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBIA
PERU
LOCATION IN THE PROVINCE
COLOMBIA
PERU
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: ISOHYETS
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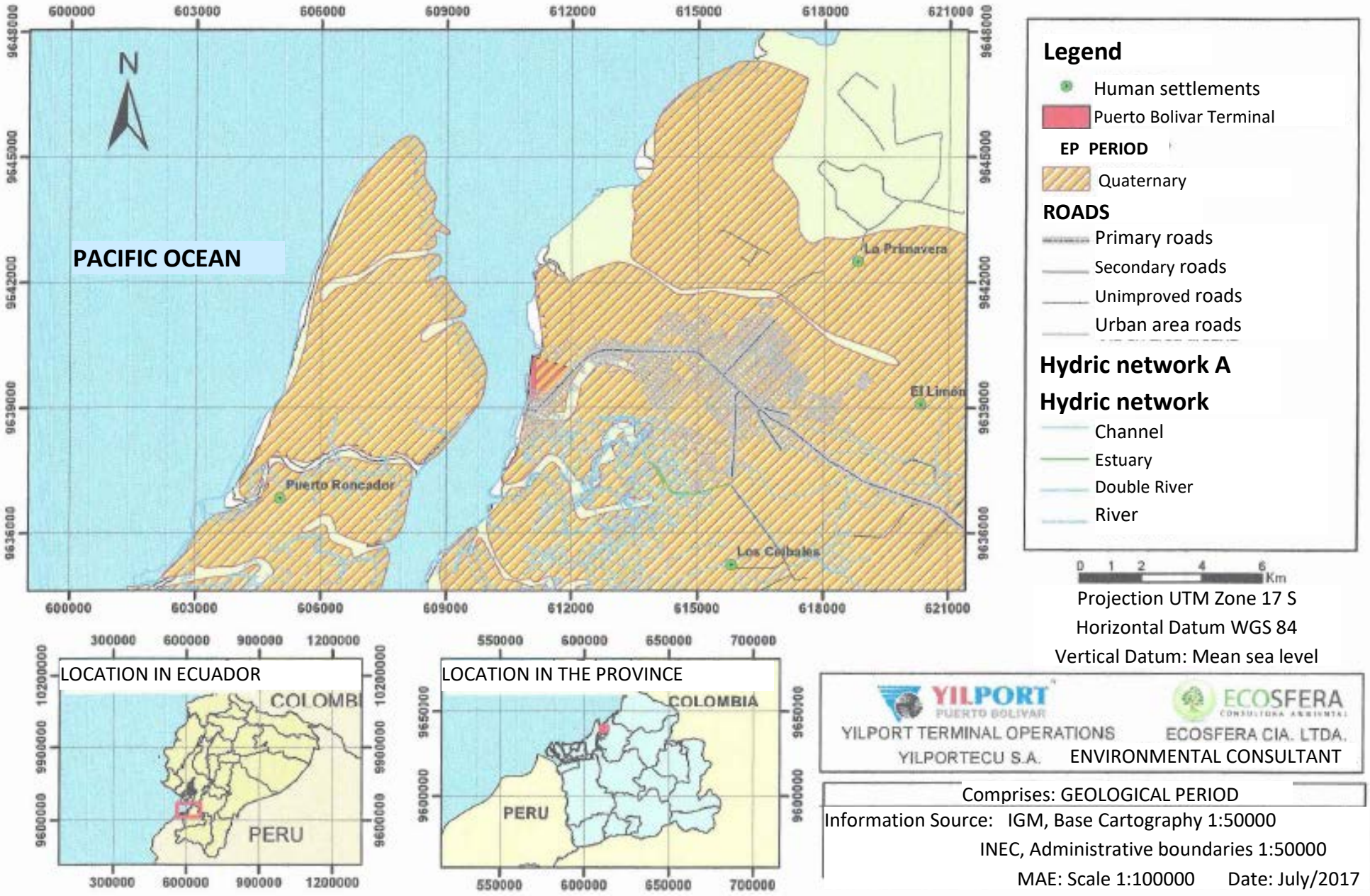
MAE: Scale 1:100000 Date: July/2017


N
PACIFIC OCEAN
La Primavera
El Limón
Puerto Roncador
Los Cobales
600000
603000
606000
609000
612000
615000
618000
621000
9648000
9645000
9642000
9639000
9636000
Legend
Human settlements
Puerto Bolivar Terminal
EP PERIOD
Quaternary
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
Hydric network A
Hydric network
Channel
Estuary
Double River
River
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORIA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: GEOLOGICAL PERIOD
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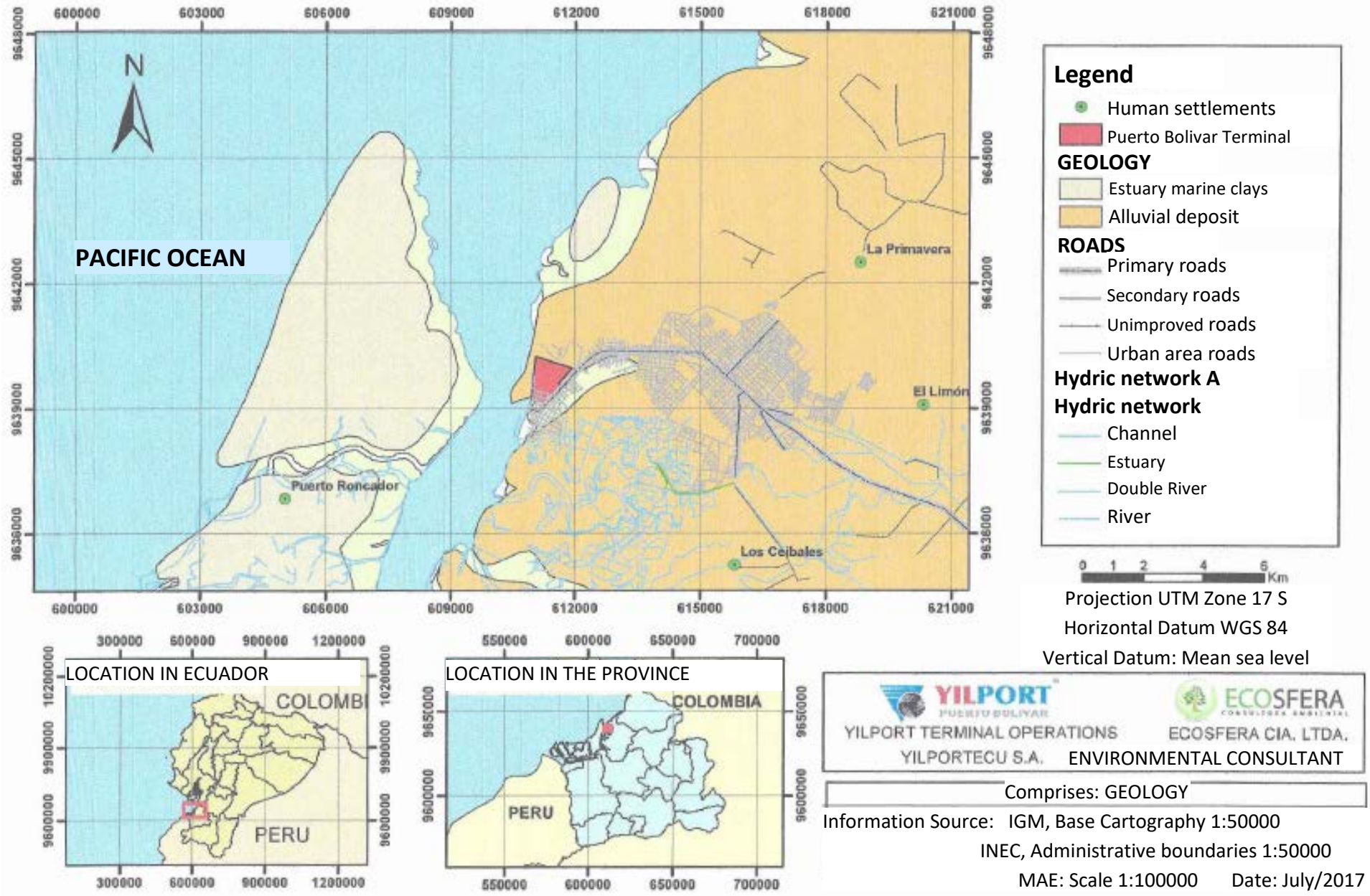
ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level

YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.

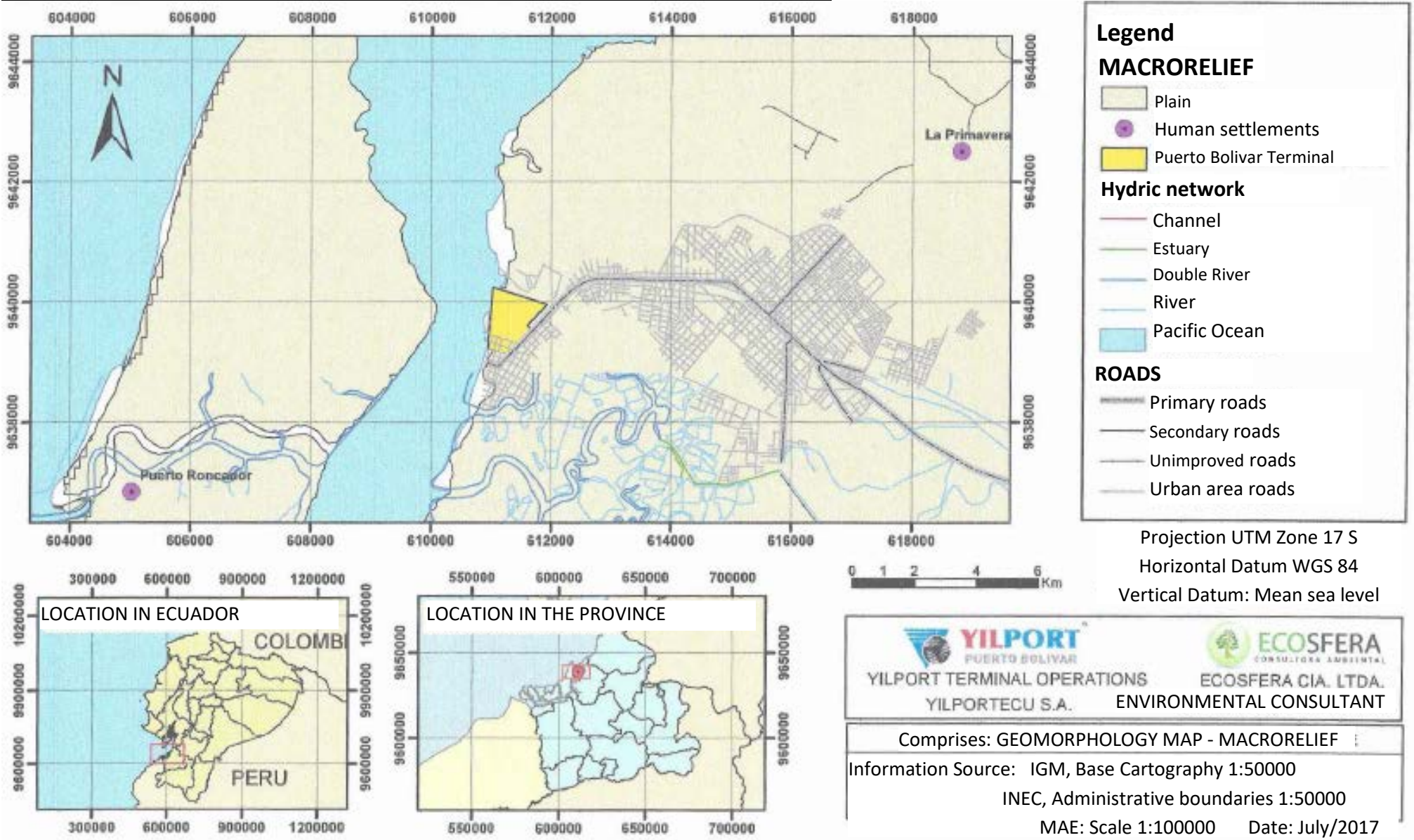
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT

Comprises: GEOLOGY

Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

CONSTRUCTION AND OPERATION OF PUERTO BOLIVAR TERMINAL OPERATED BY YILPORTECU S.A.

GEOMORPHOLOGICAL MAP - MACRORELIEF



Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level

YILPORT PUERTO BOLIVAR — YILPORT TERMINAL OPERATIONS — YILPORTECU S.A.

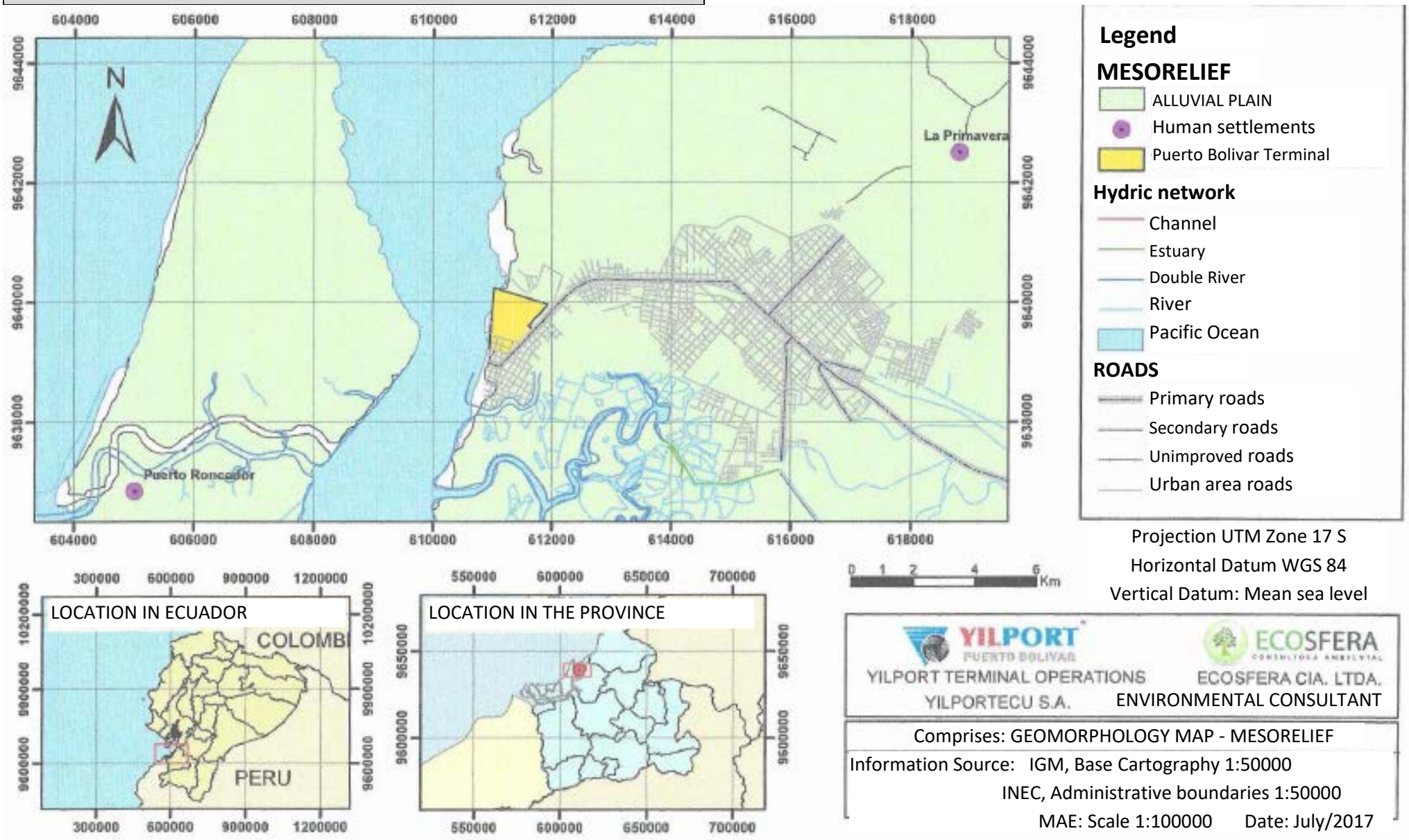
ECOSFERA CONSULTORA AMBIENTAL — ECOSFERA CIA. LTDA. — ENVIRONMENTAL CONSULTANT

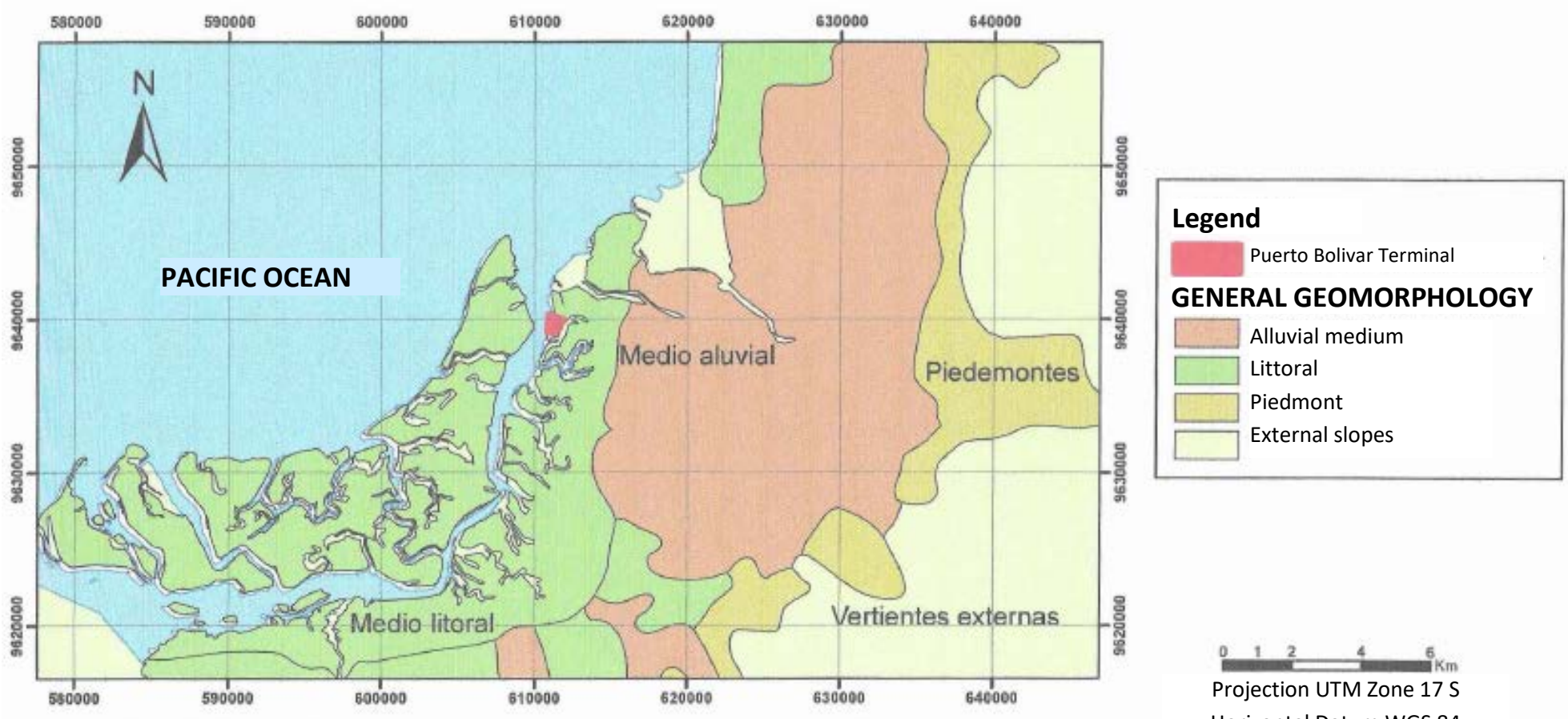
Comprises: GEOMORPHOLOGY MAP - MACRORELIEF

Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

CONSTRUCTION AND OPERATION OF PUERTO BOLIVAR TERMINAL OPERATED BY YILPORTECU S.A.

GEOMORPHOLOGICAL MAP - MESORELIEF

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N
PACIFIC OCEAN
Medio aluvial
Piedemontes
Medio litoral
Vertientes externas
Legend
Puerto Bolivar Terminal
GENERAL GEOMORPHOLOGY
Alluvial medium
Littoral
Piedmont
External slopes
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
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700000
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YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORES AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
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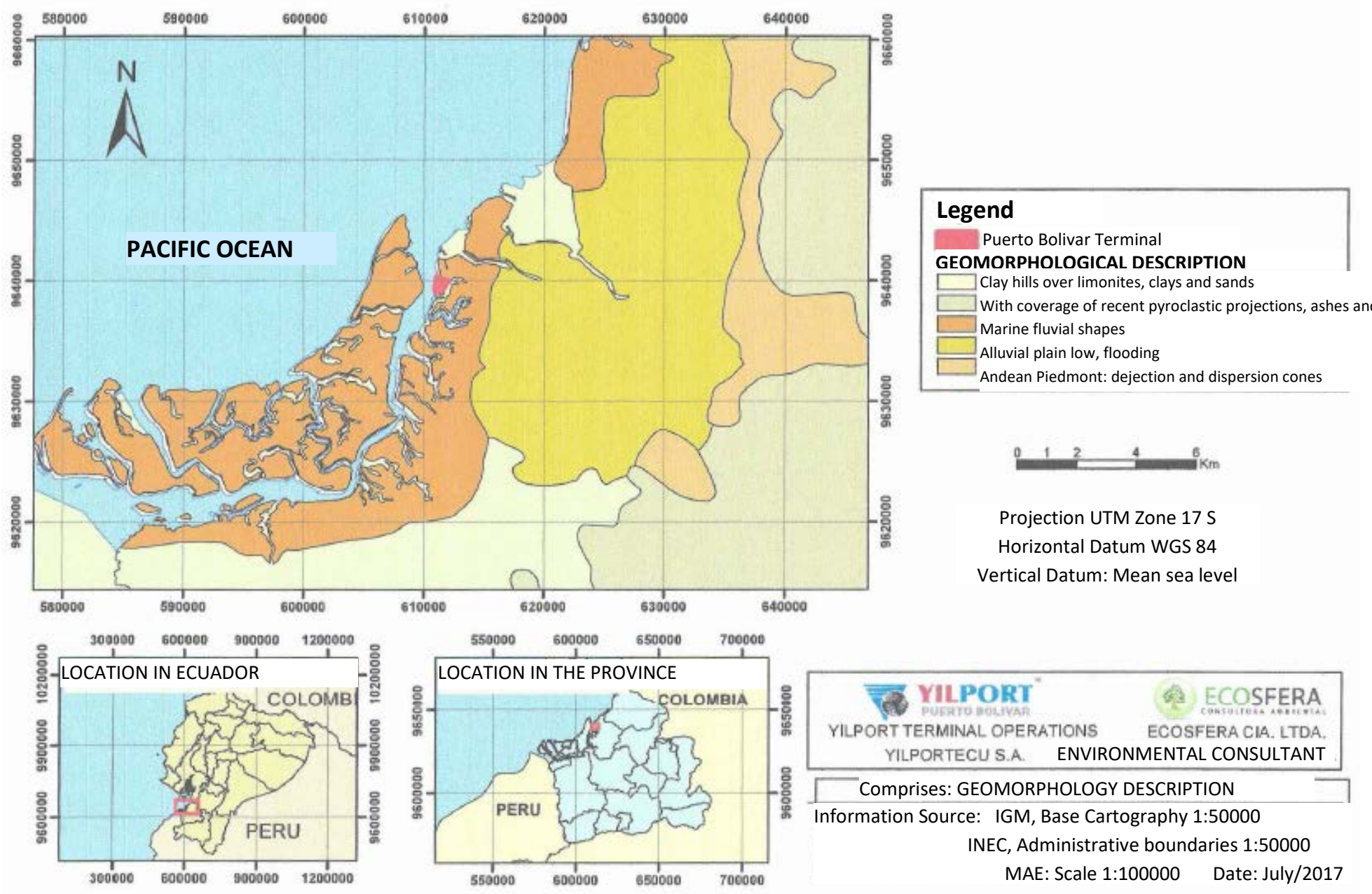
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9630000
9620000
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PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
GEOMORPHOLOGICAL DESCRIPTION
Clay hills over limonites, clays and sands
With coverage of recent pyroclastic projections, ashes and lapilli
Marine fluvial shapes
Alluvial plain low, flooding
Andean Piedmont: dejection and dispersion cones
0 1 2 4 6
Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
300000
600000
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1200000
10200000
9900000
9600000
LOCATION IN ECUADOR
COLOMB
PERU
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650000
700000
9650000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
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Information Source: IGM, Base Cartography 1:50000
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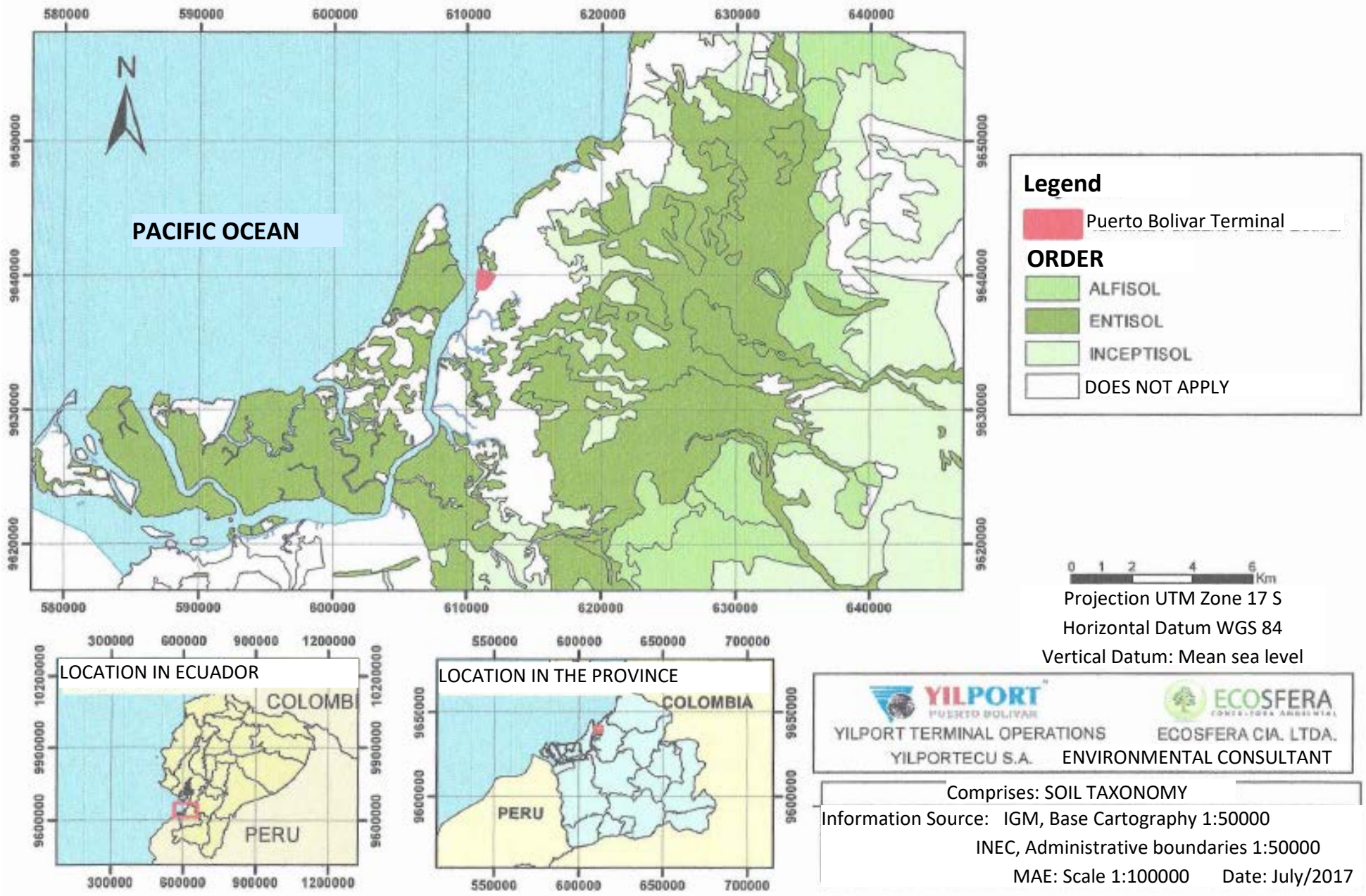
MAE: Scale 1:100000 Date: July/2017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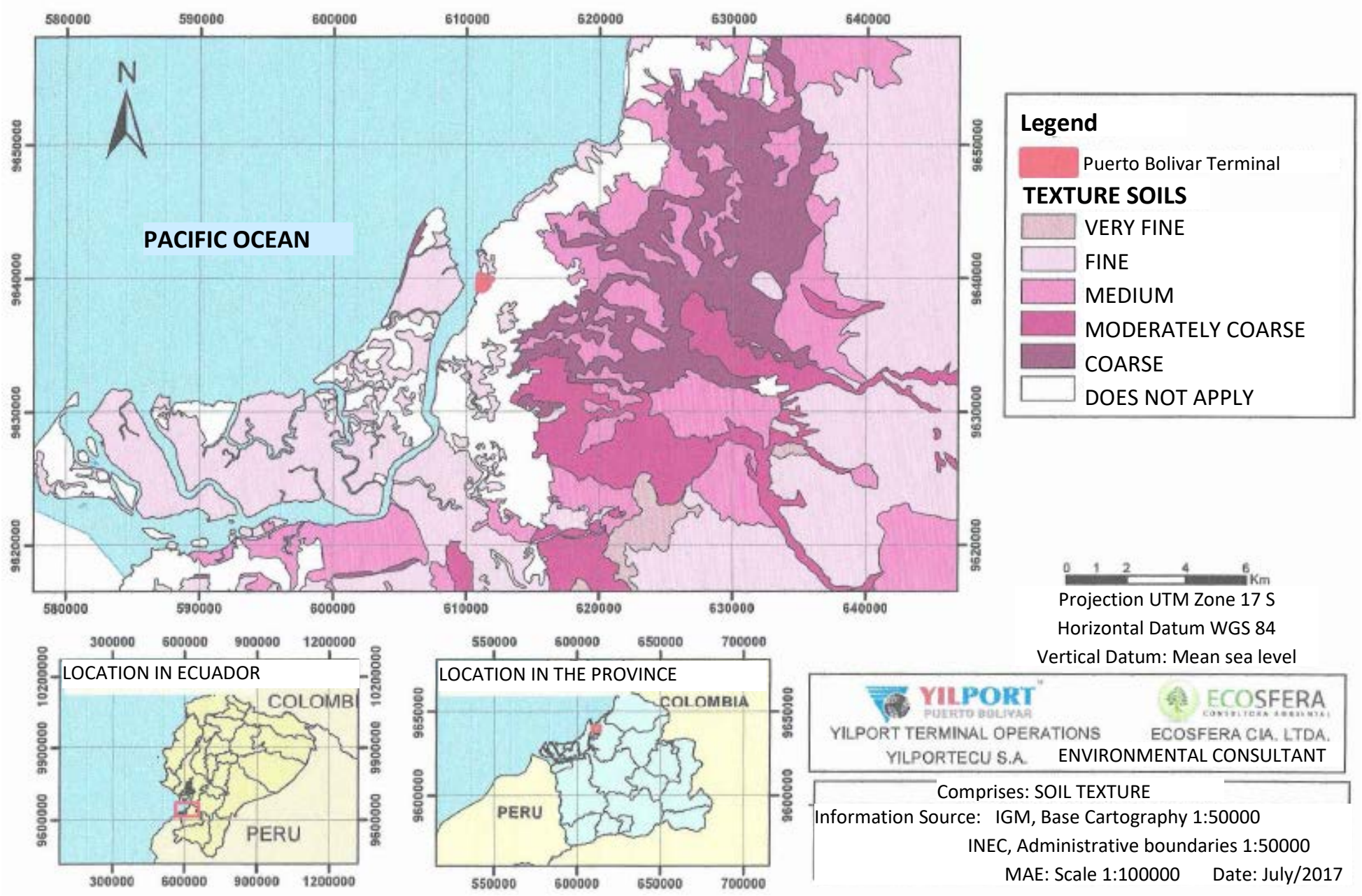
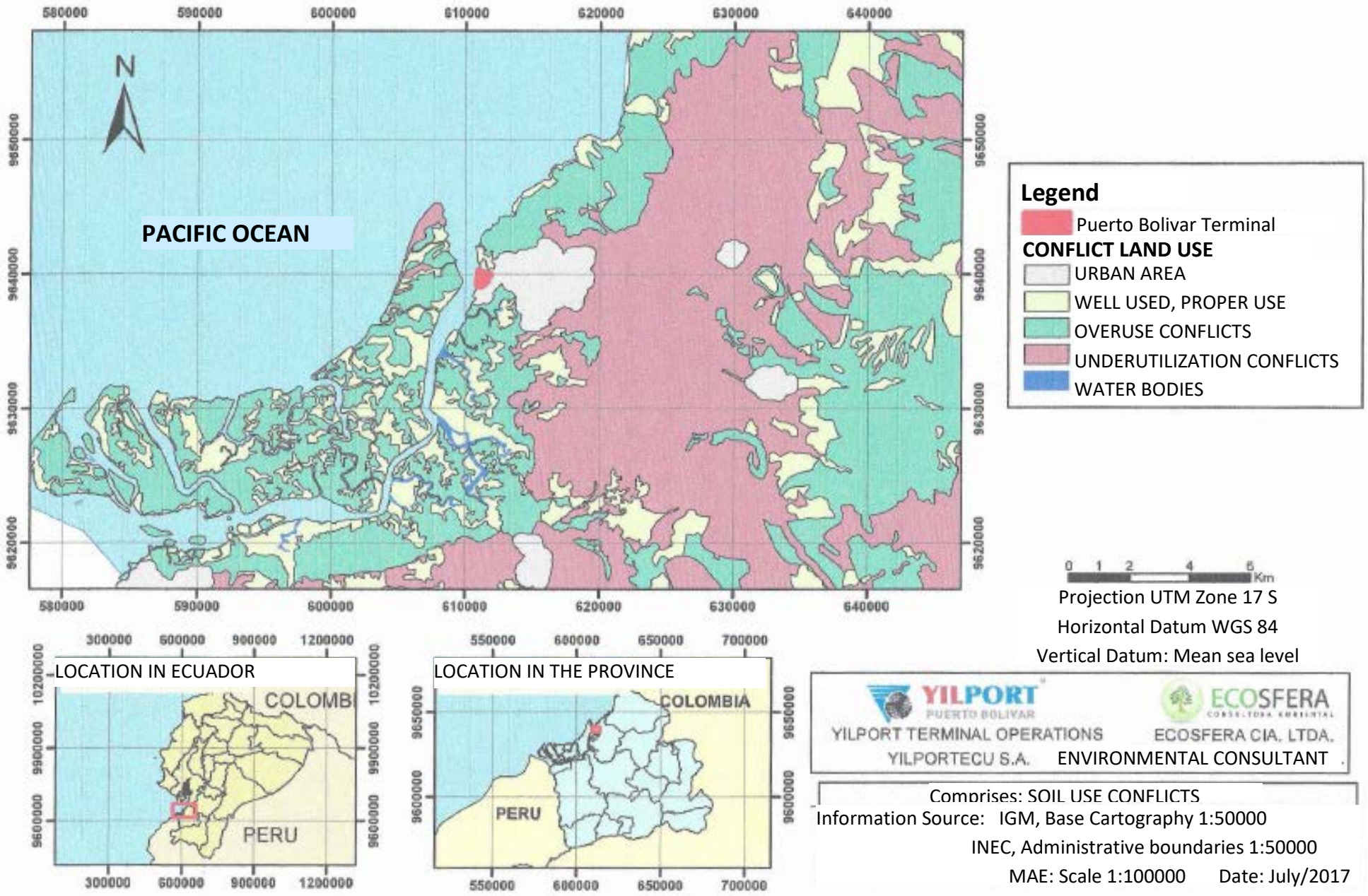
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
ORDER
ALFISOL
ENTISOL
INCEPTISOL
DOES NOT APPLY
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: SOIL TAXONOMY
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL

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640000
9650000
9640000
9630000
9620000
N
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
CONFLICT LAND USE
URBAN AREA
WELL USED, PROPER USE
OVERUSE CONFLICTS
UNDERUTILIZATION CONFLICTS
WATER BODIES
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMB
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
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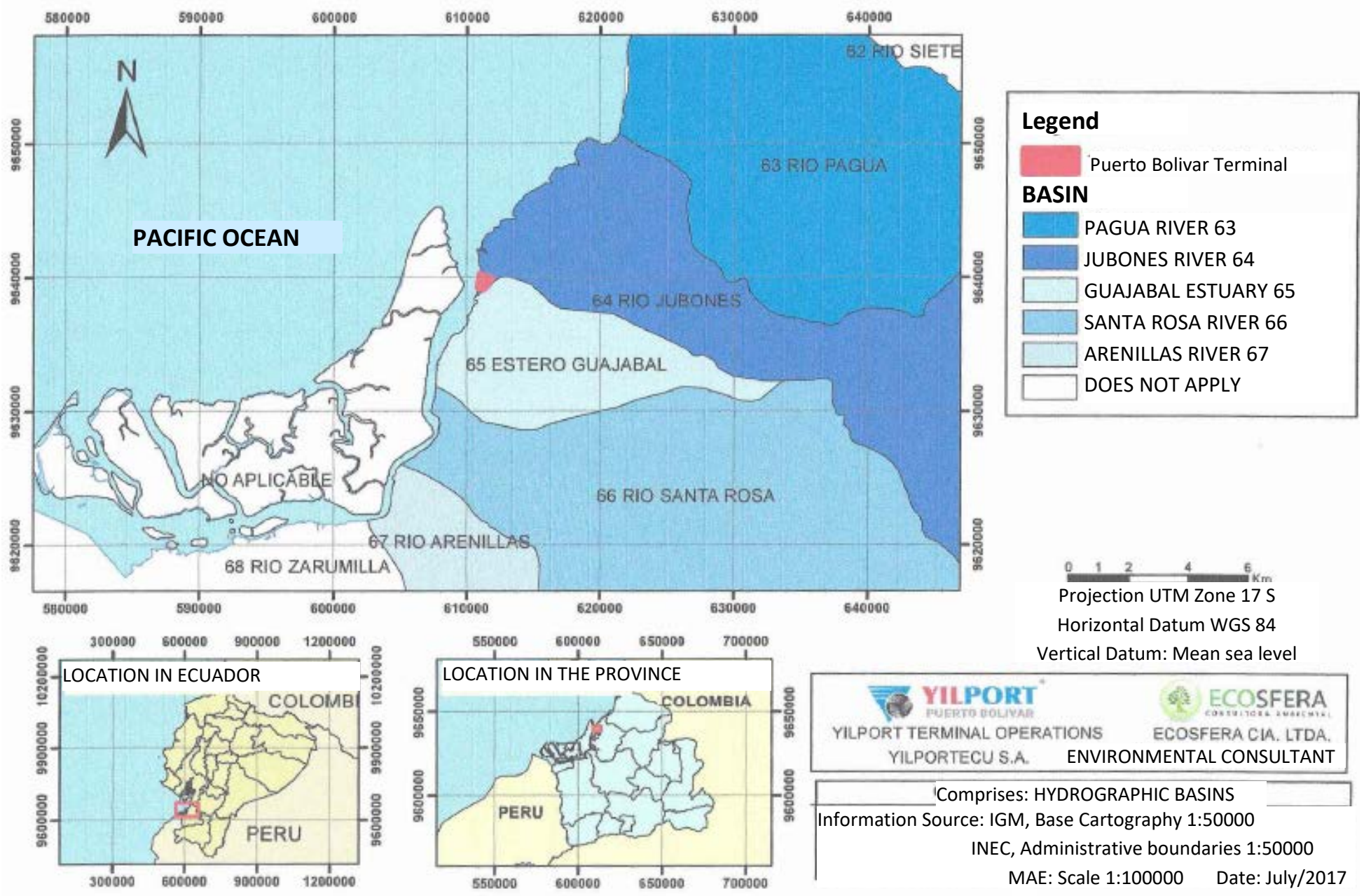
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017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590000
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640000
9650000
9640000
9630000
9620000
N
62 RIO SIETE
63 RIO PAGUA
64 RIO JUBONES
65 ESTERO GUAJABAL
66 RIO SANTA ROSA
67 RIO ARENILLAS
68 RIO ZARUMILLA
NO APLICABLE
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
BASIN
PAGUA RIVER 63
JUBONES RIVER 64
GUAJABAL ESTUARY 65
SANTA ROSA RIVER 66
ARENILLAS RIVER 67
DOES NOT APPLY
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
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Information Source: IGM, Base Cartography 1:50000
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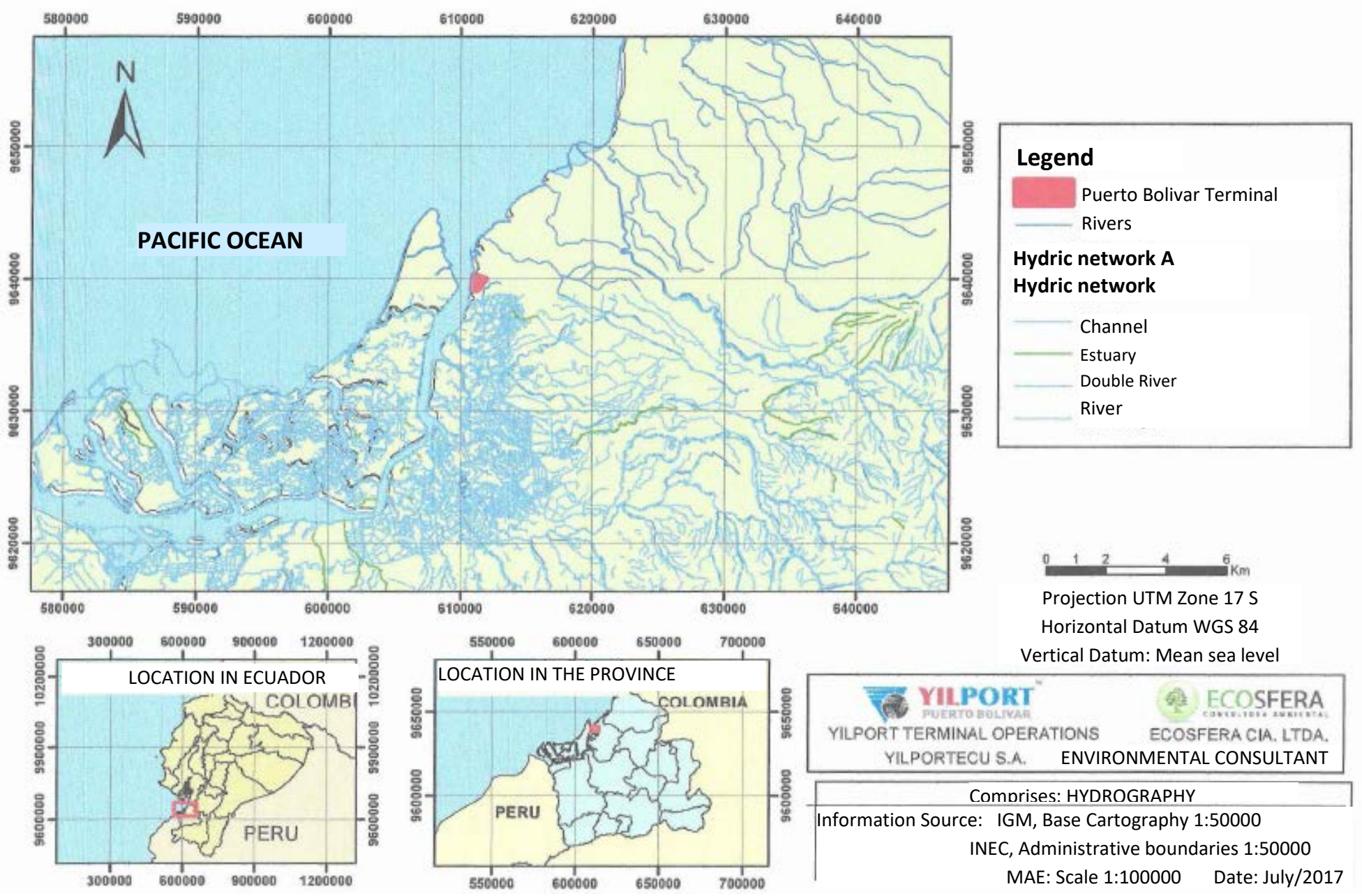
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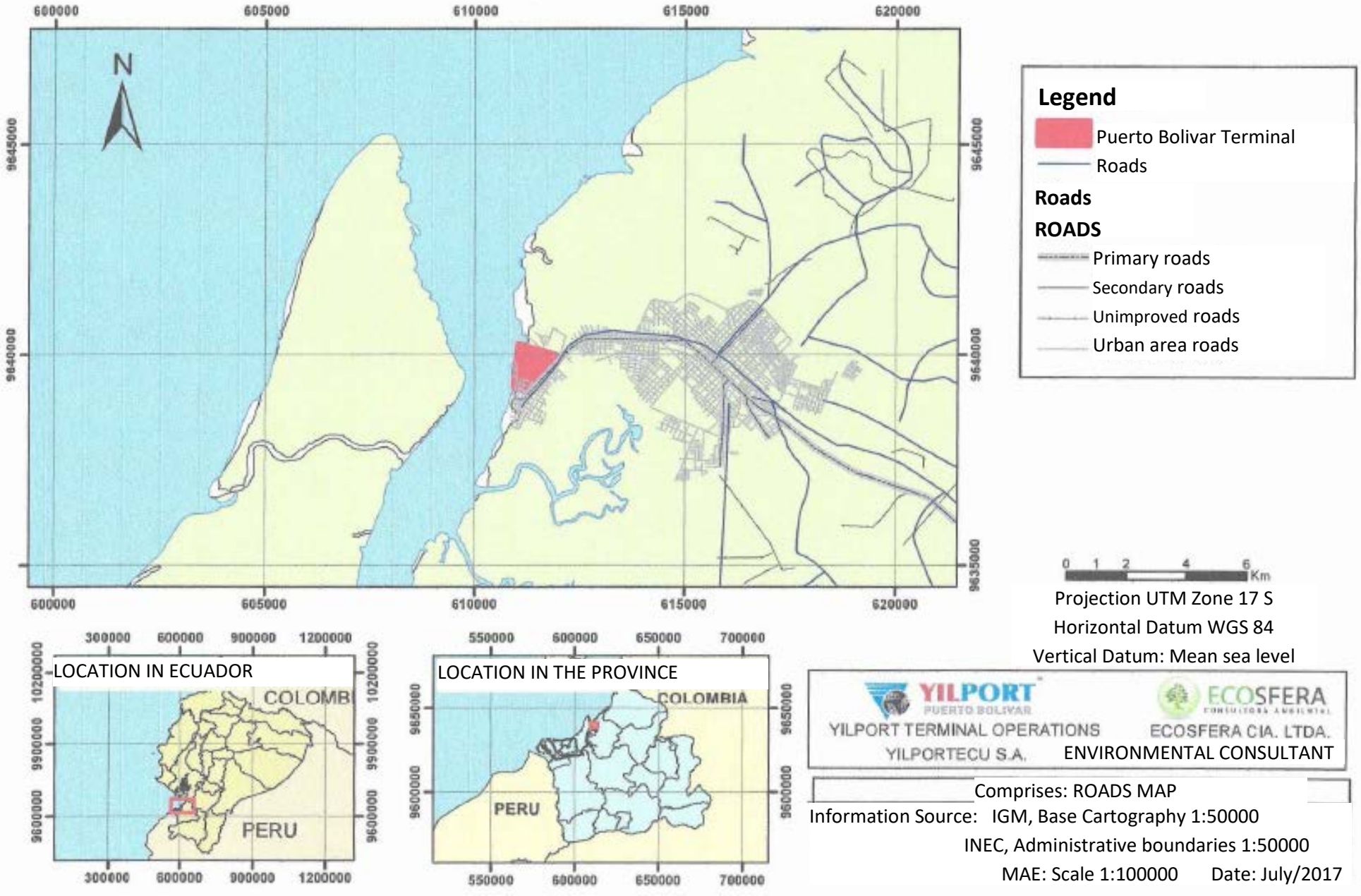
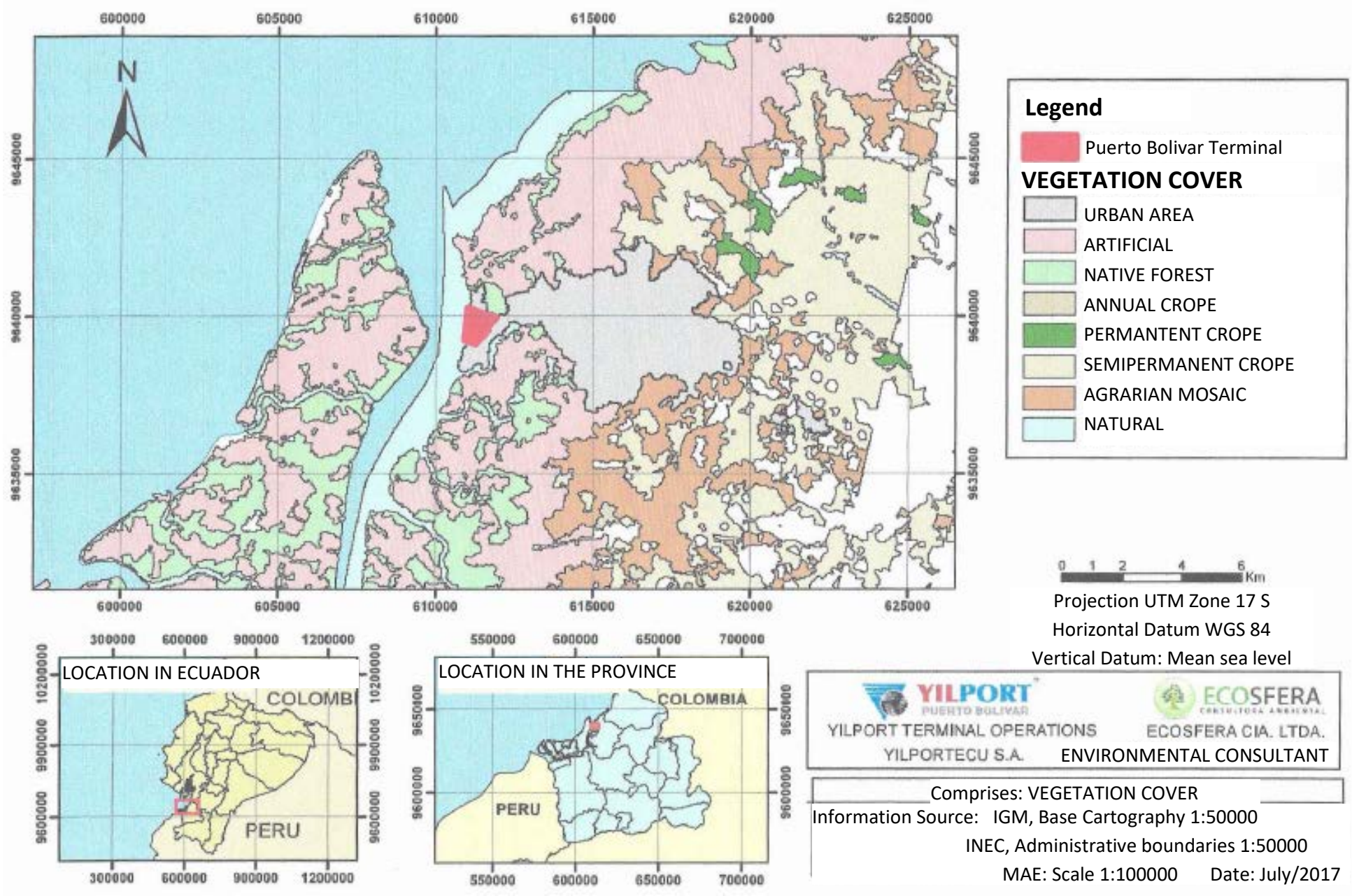
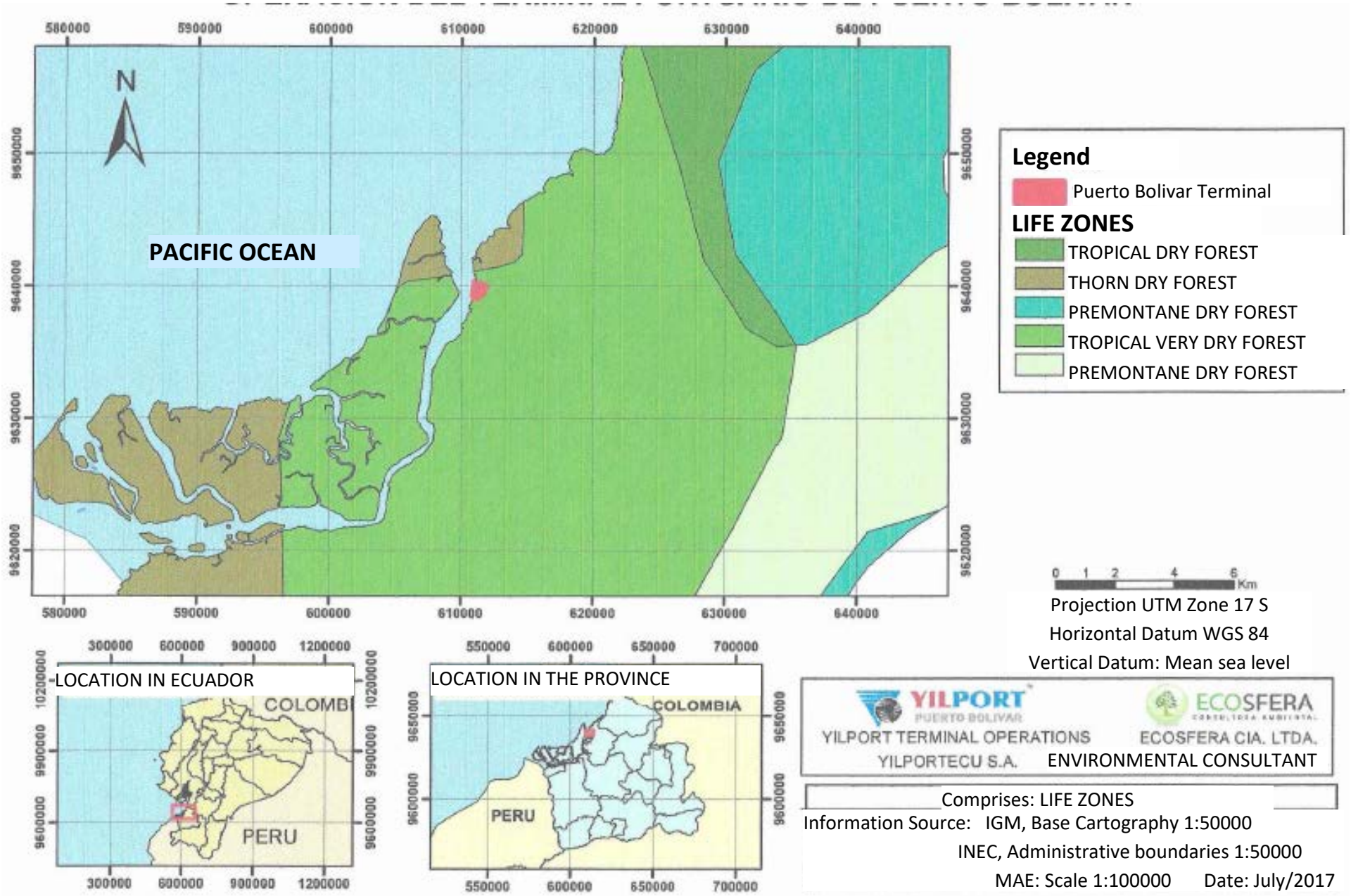
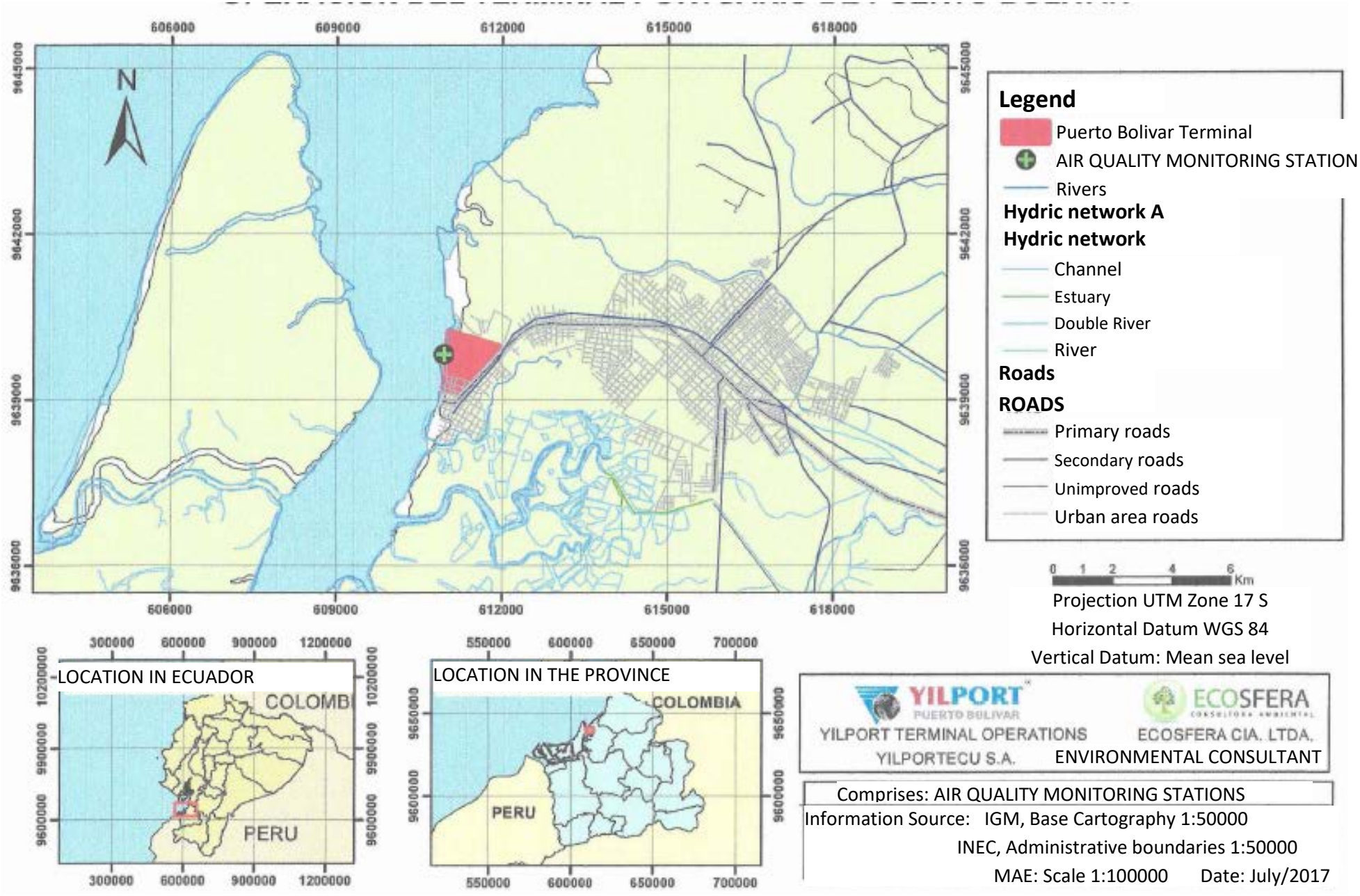
610000
620000
630000
640000
9650000
9640000
9630000
9620000
N
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
Rivers
Hydric network A
Hydric network
Channel
Estuary
Double River
River
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORIA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: HYDROGRAPHY
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

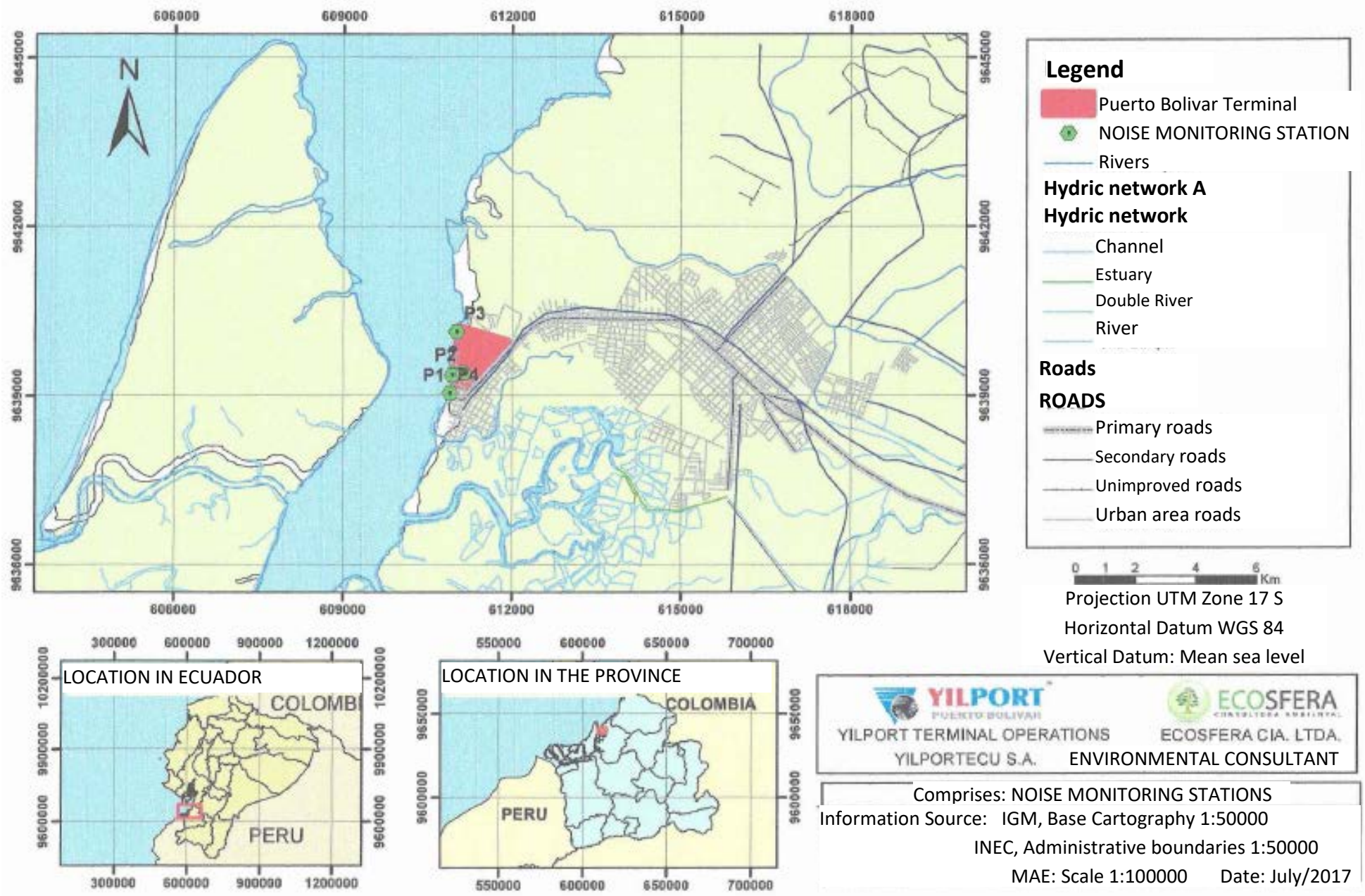

600000
605000
610000
615000
620000
9645000
9640000
9635000
N
Legend
Puerto Bolivar Terminal
Roads
Roads
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
0 1 2 4 6
Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMB
PERU
LOCATION IN THE PROVINCE
COLOMBIA
PERU
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: ROADS MAP
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

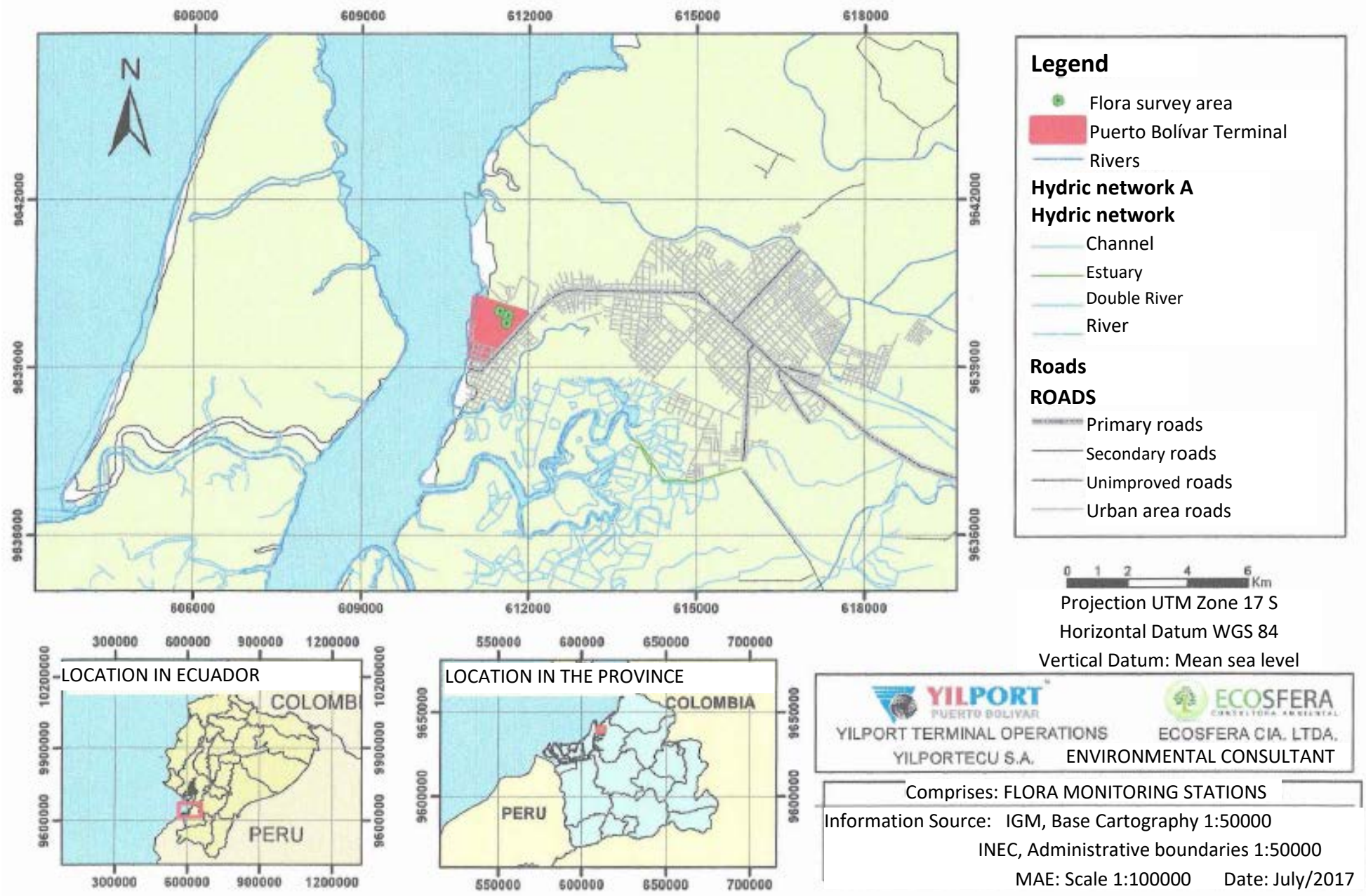

600000
605000
610000
615000
620000
625000
N
9645000
9640000
9635000
Legend
Puerto Bolivar Terminal
VEGETATION COVER
URBAN AREA
ARTIFICIAL
NATIVE FOREST
ANNUAL CROPE
PERMANTENT CROPE
SEMIPERMANENT CROPE
AGRARIAN MOSAIC
NATURAL
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBIA
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORIA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: VEGETATION COVER
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017


580000
590000
600000
610000
620000
630000
640000
9650000
9640000
9630000
9620000
N
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
LIFE ZONES
TROPICAL DRY FOREST
THORN DRY FOREST
PREMONTANE DRY FOREST
TROPICAL VERY DRY FOREST
PREMONTANE DRY FOREST
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: LIFE ZONES
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

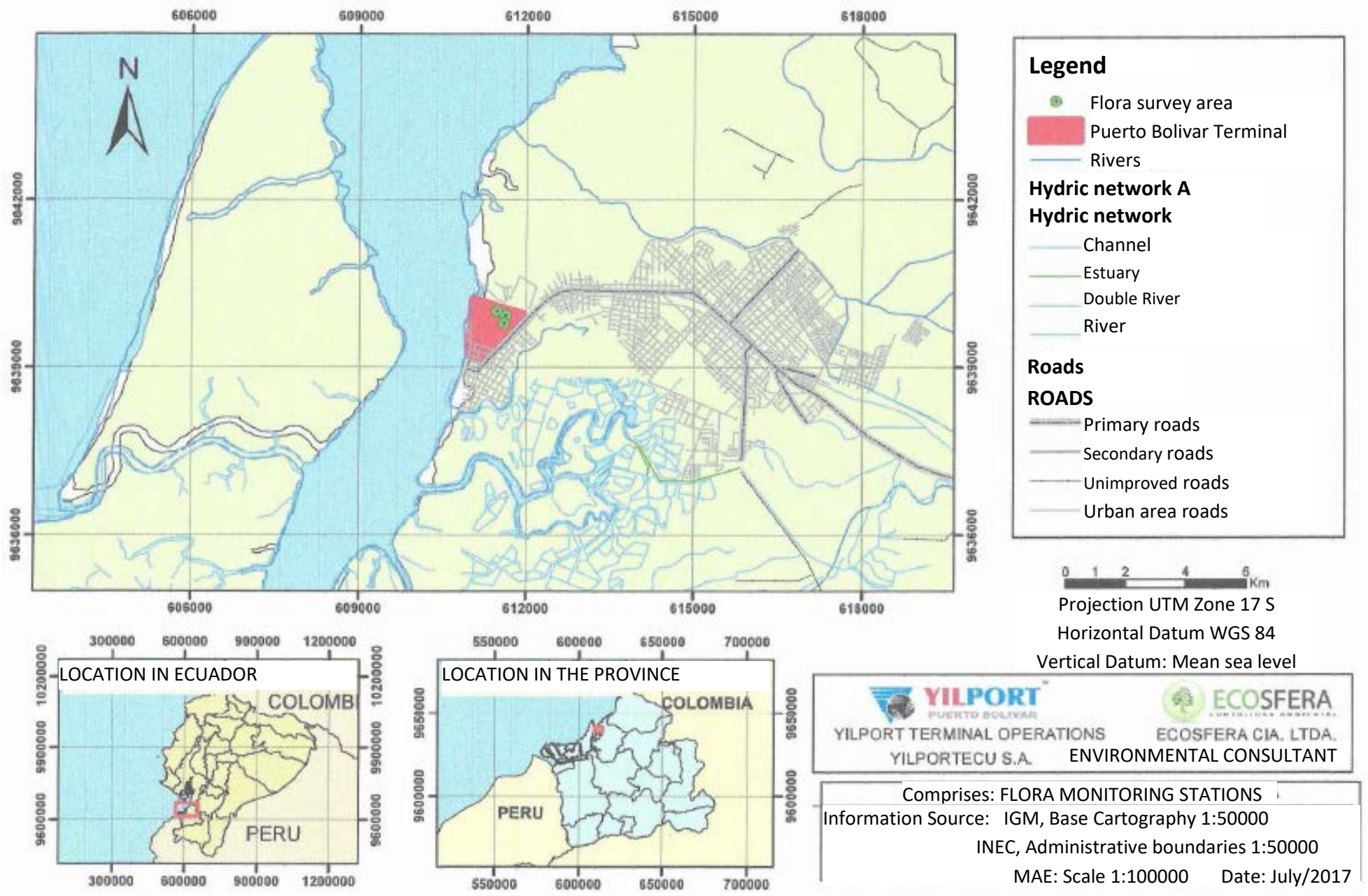

606000
609000
612000
615000
618000
9645000
9642000
9639000
9636000
N
Legend
Puerto Bolivar Terminal
AIR QUALITY MONITORING STATION
Rivers
Hydric network A
Hydric network
Channel
Estuary
Double River
River
Roads
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMB
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: AIR QUALITY MONITORING STATIONS
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL

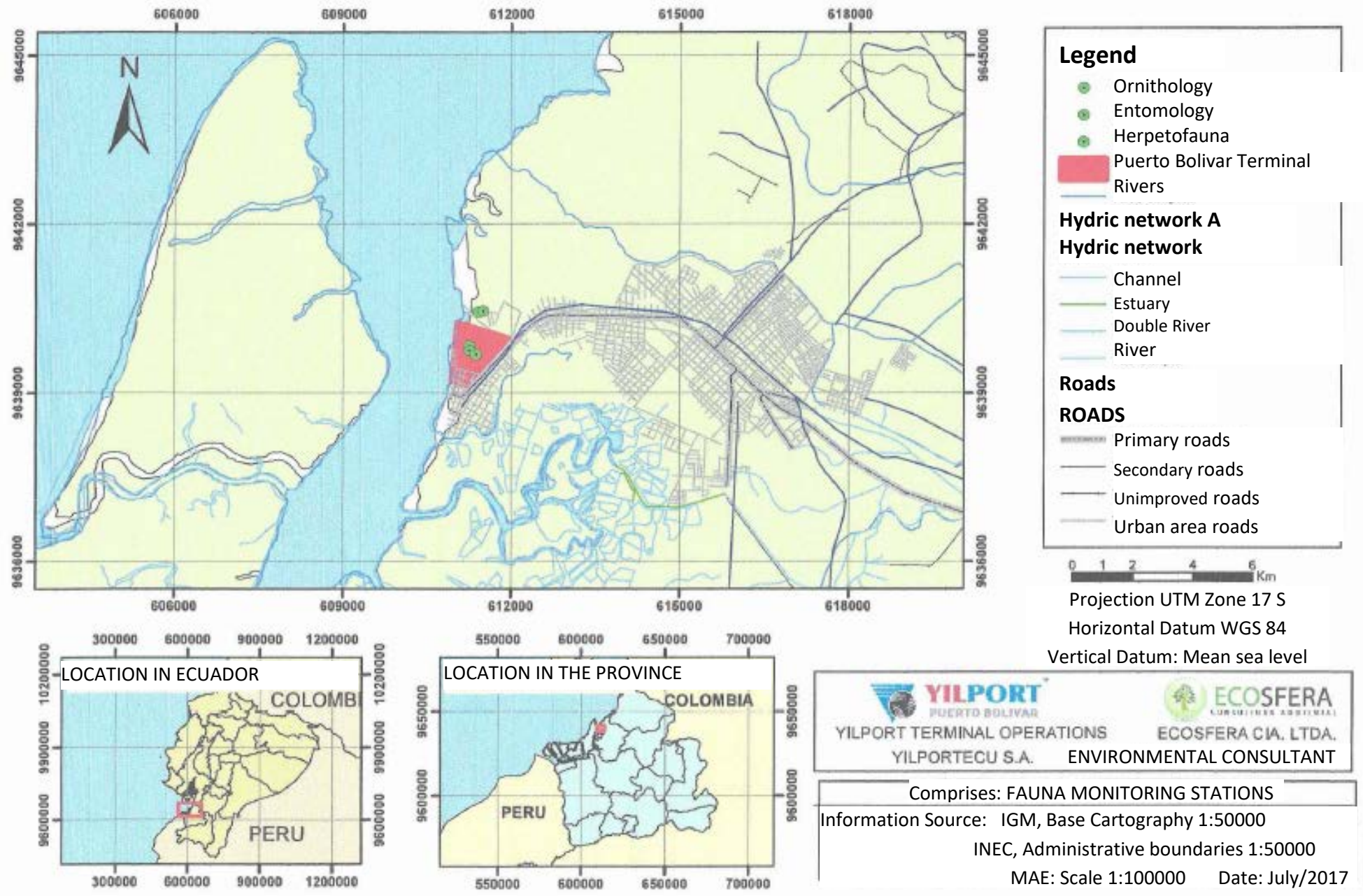



606000
609000
612000
615000
618000
9642000
9639000
9636000
N
Legend
Flora survey area
Puerto Bolívar Terminal
Rivers
Hydric network A
Hydric network
Channel
Estuary
Double River
River
Roads
ROADS
Primary roads
Secondary roads
Unimproved roads
Urban area roads
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: FLORA MONITORING STATIONS
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

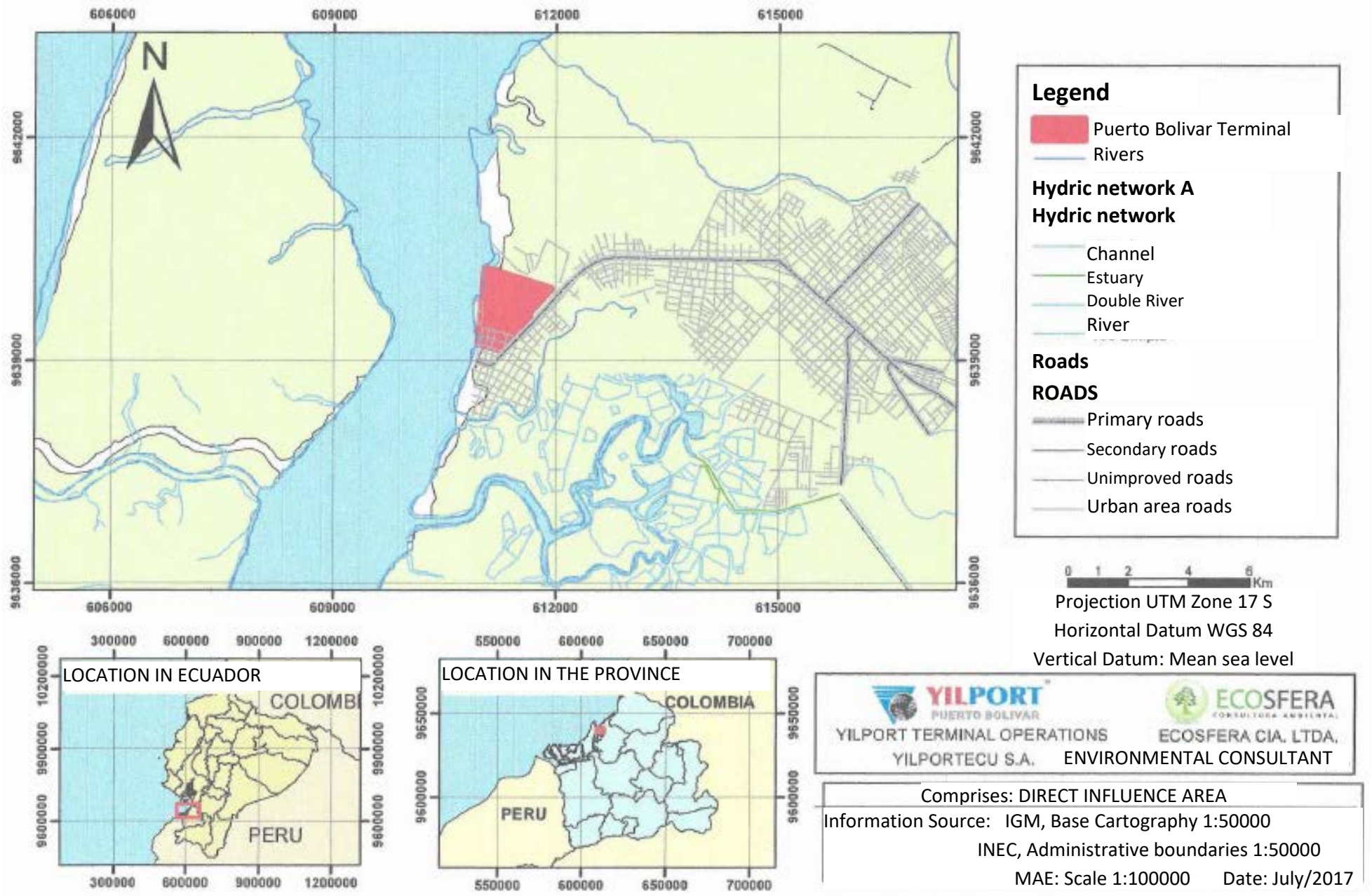
ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



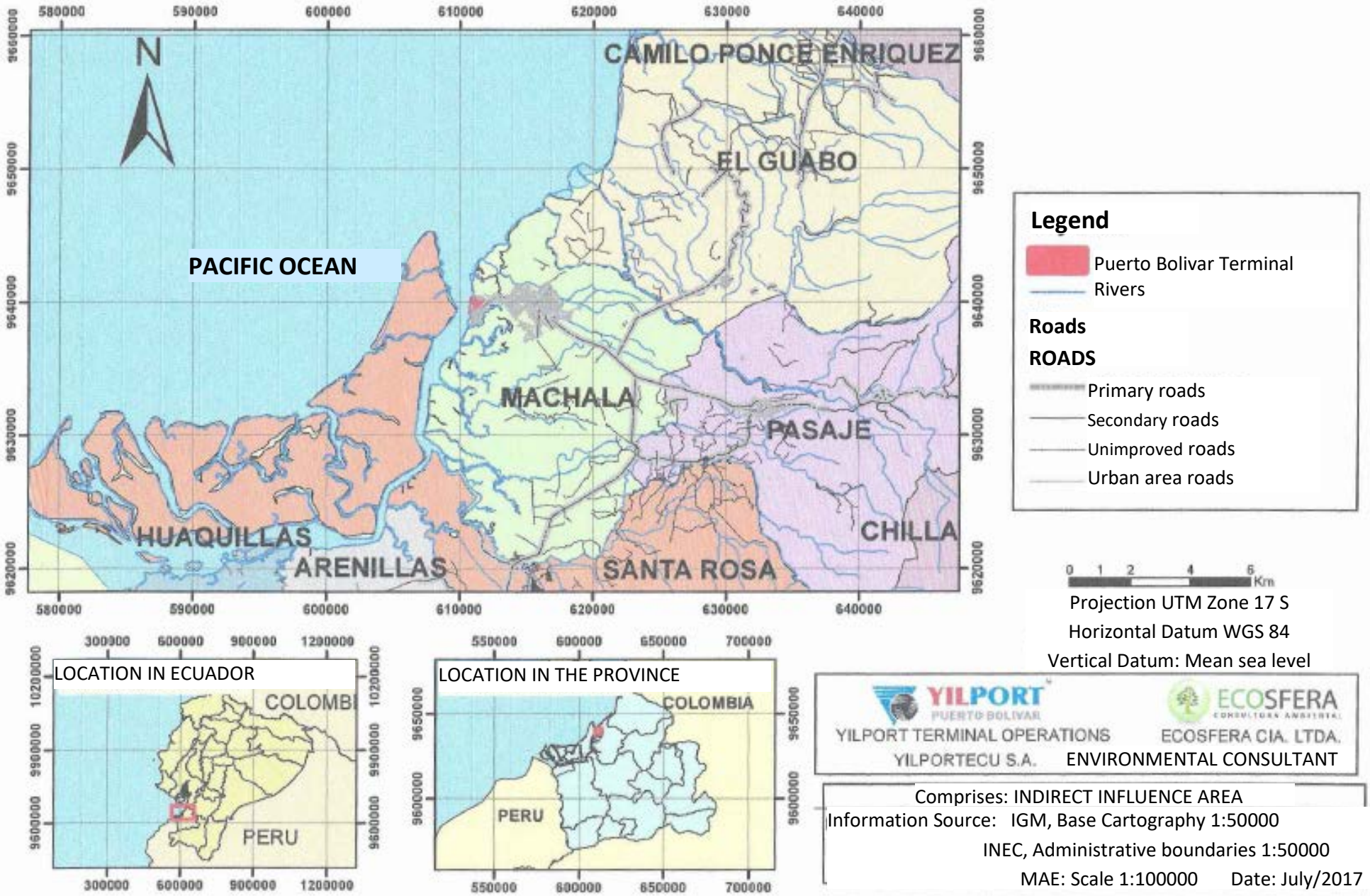
ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL



Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level

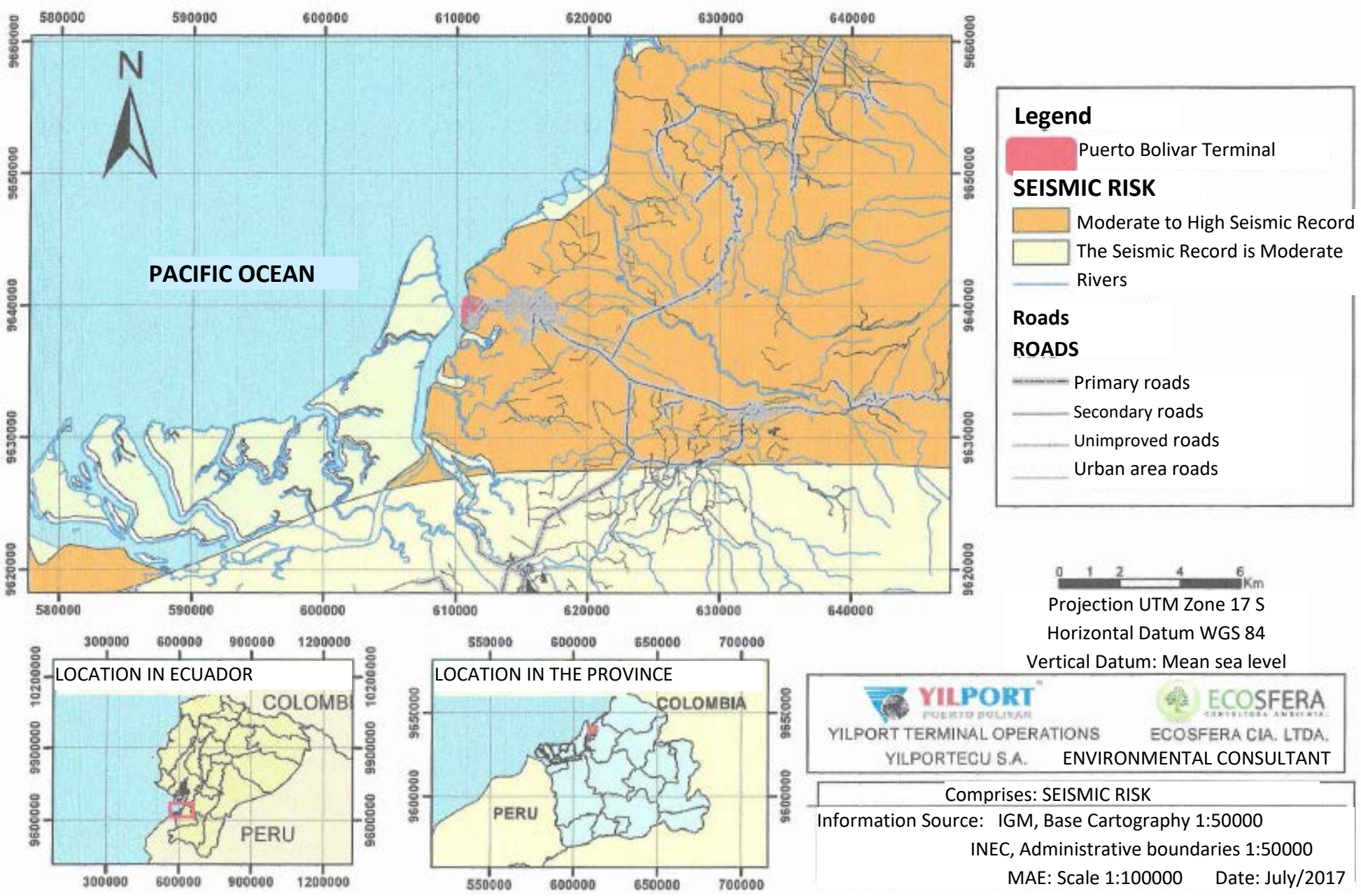
YILPORT PUERTO BOLIVAR — YILPORT TERMINAL OPERATIONS — YILPORTECU S.A.

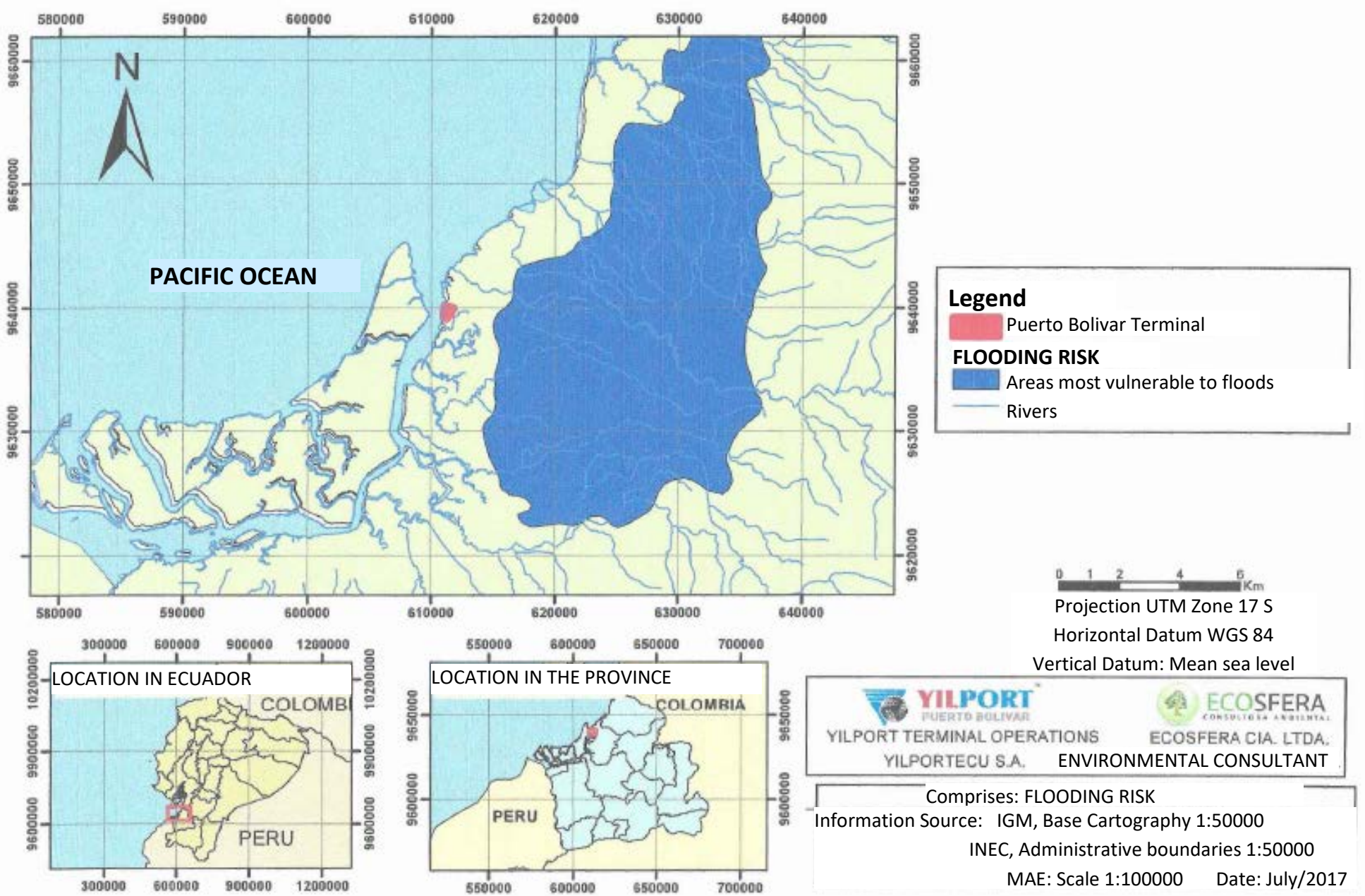
ECOSFERA CONSULTORA AMBIENTAL — ECOSFERA CIA. LTDA. — ENVIRONMENTAL CONSULTANT

Comprises: INDIRECT INFLUENCE AREA

Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN
OPERATION OF THE PUERTO BOLIVAR TERMINAL




580000
590000
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640000
9660000
9650000
9640000
9630000
9620000
N
PACIFIC OCEAN
Legend
Puerto Bolivar Terminal
FLOODING RISK
Areas most vulnerable to floods
Rivers
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
300000
600000
900000
1200000
10200000
9900000
9600000
LOCATION IN THE PROVINCE
COLOMBIA
PERU
550000
600000
650000
700000
9650000
9600000
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORIA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: FLOODING RISK
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

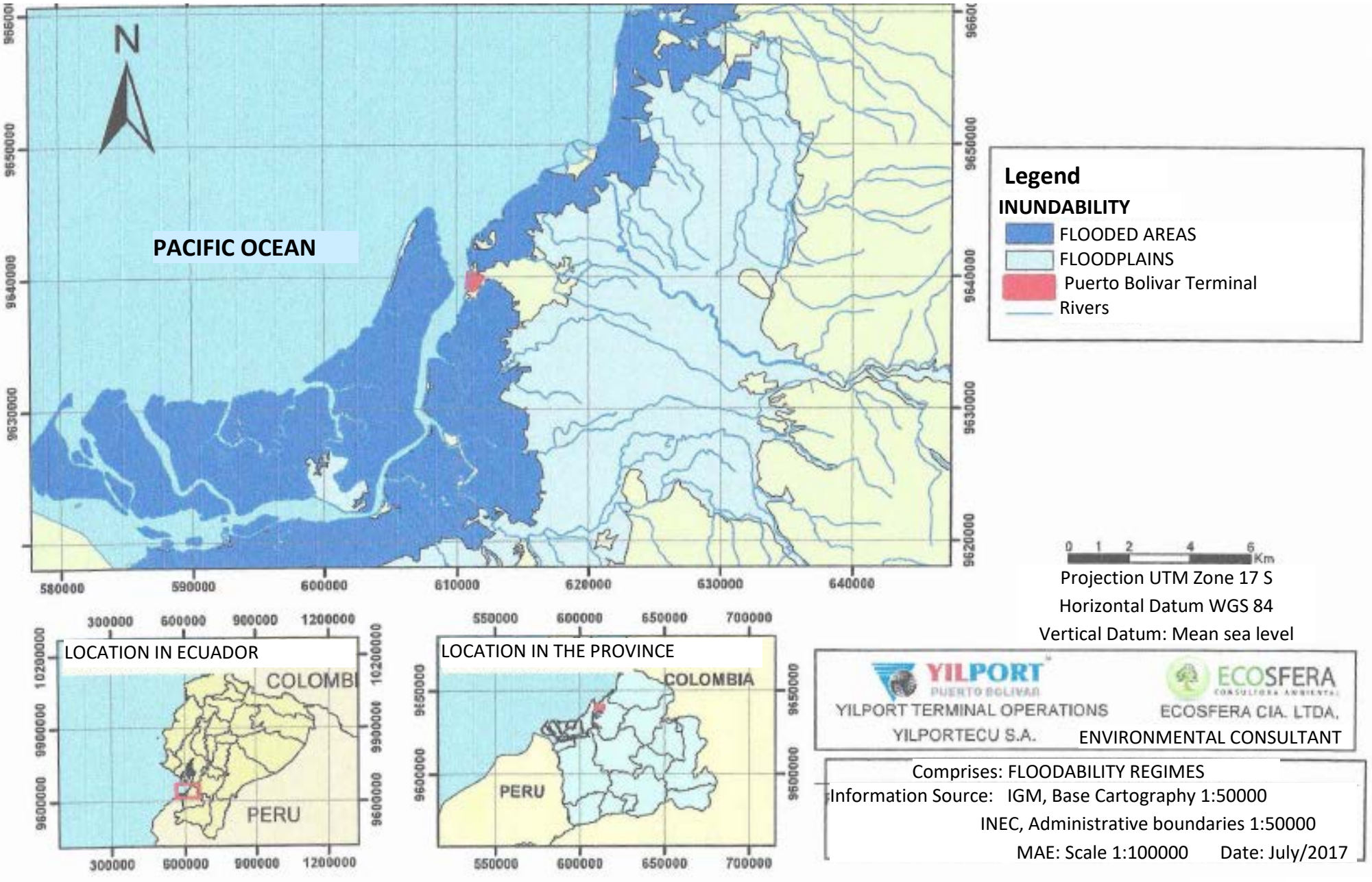
N
PACIFIC OCEAN
Legend
INUNDABILITY
FLOODED AREAS
FLOODPLAINS
Puerto Bolivar Terminal
Rivers
0 1 2 4 6 Km
Projection UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Mean sea level
LOCATION IN ECUADOR
COLOMBI
PERU
LOCATION IN THE PROVINCE
COLOMBIA
PERU
YILPORT
PUERTO BOLIVAR
YILPORT TERMINAL OPERATIONS
YILPORTECU S.A.
ECOSFERA
CONSULTORA AMBIENTAL
ECOSFERA CIA. LTDA.
ENVIRONMENTAL CONSULTANT
Comprises: FLOODABILITY REGIMES
Information Source: IGM, Base Cartography 1:50000
INEC, Administrative boundaries 1:50000
MAE: Scale 1:100000 Date: July/2017

Ilustración 1:
Kelsen's Pyramid

- Political constitution
- Treaties, International Agreements
- Internal Organization Acts
- General Acts
- Regional regulations and district ordinances
- Decrees and regulations
- Ordinances
- Resolutions
- Other acts and decisions of the government

Ilustración 2:

PROJECT LOCATION IN THE PROVINCE
Legend
Puerto Bolívar Port Terminal
Province of El Oro
CANTONS

LOCATION IN THE COUNTRY

COORDINATES
SCALE 1: 50.000

Ilustración 3:
PROJECT LOCATION IN THE CANTON AND PARISH
Legend
Puerto Bolívar Port Terminal
Machala Canton
PARISHES

Urban Parishes

LOCATION IN THE PROVINCE

COORDINATES
SCALE 1: 50.000

Ilustración 4:
Map 1: PUERTO BOLÍVAR PORT TERMINAL
Map 2: Port Authority Reserved Area

Ilustración 6:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

Meteorological Stations
Towns

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: METEOROLOGICAL STATIONS
Source of Information:

Date: July 2017

Ilustración 7:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal

CLIMATE TYPES
Mega-thermal dried tropical
Mega-thermal semi-arid tropical

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: CLIMATE TYPES
Source of Information:

Date: July 2017

Ilustración 8:

TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 9:

TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 10:

TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 11:

MAXIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 12:

MAXIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:

Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 13:

MAXIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 14:

MINIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 15:

MINIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 16:

MINIMUM TEMPERATURE °C
Puerto Bolívar
Latitude:
Longitude:

Temperature °C

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 17:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal

ISOTHERMS

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: ISOTHERMS
Source of Information:

Date: July 2017

Ilustración 19:

PRECIPITATION - mm
Puerto Bolívar
Latitude:

Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 20:

PRECIPITATION - mm
Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 21:

PRECIPITATION - mm
Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March

April
May
June
July
August
September
October
November
December

Ilustración 22:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal

ISOHYETS

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: ISOTHERMS
Source of Information:

Date: July 2017

Ilustración 23:

RELATIVE HUMIDITY %
Puerto Bolívar
Latitude:
Longitude:

Percentage %

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 24:

RELATIVE HUMIDITY %
Puerto Bolívar
Latitude:
Longitude:

Percentage %

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 25:

RELATIVE HUMIDITY %
Puerto Bolívar
Latitude:
Longitude:

Percentage %

MONTHS
January

February
March
April
May
June
July
August
September
October
November
December

Ilustración 26:

HELIOPHANY – HOURS

Puerto Bolívar
Latitude:
Longitude:

Hours

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 27:

HELIOPHANY – HOURS

Puerto Bolívar
Latitude:
Longitude:

Axis Title

MONTHS
January

February
March
April
May
June
July
August
September
October
November
December

Ilustración 28:

HELIOPHANY – HOURS

Puerto Bolívar
Latitude:
Longitude:

Hours

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 29:

ATOMOPHERIC PRESSURE

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March

April
May
June
July
August
September
October
November
December

Ilustración 30:

ATMOSPHERIC PRESSURE

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 31:

ATMOSPHERIC PRESSURE

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July

August
September
October
November
December

Ilustración 32:

VAPOR PRESSURE MB

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 33:

VAPOR PRESSURE MB

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November

December

Ilustración 34:

DEW POINT °C

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 35:

DEW POINT °C

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 36:

DEW POINT °C

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 37:

DEW POINT °C

Puerto Bolívar
Latitude:
Longitude:

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 38:

CLOUDINESS – OCTAS

Puerto Bolívar
Latitude:

Longitude:

Octas

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 39:

CLOUDINESS – OCTAS

Puerto Bolívar
Latitude:
Longitude:

Octas

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 40:

CLOUDINESS – OCTAS

Puerto Bolívar
Latitude:

Longitude:

Octas

MONTHS
January
February
March
April
May
June
July
August
September
October
November
December

Ilustración 49:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal

PERIOD_EP
Quaternary

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Water Supply System A
Water Supply System
Channel
Estuary
Double river
Single river

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: GEOLOGICAL PERIOD
Source of Information:

Date: July 2017

Ilustración 50:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal

GEOLOGY
Estuary sea clay
Alluvial deposit

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Water Supply System A
Water Supply System
Channel
Estuary
Double river
Single river

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: GEOLOGY
Source of Information:

Date: July 2017

Ilustración 51:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

GENERAL GEOMORPHOLOGY
Alluvial environment
Coastal environment
Piedmont
External slopes

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: GENERAL GEOMORPHOLOGY
Source of Information:

Date: July 2017

Ilustración 52:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

GENERAL GEOMORPHOLOGY
(illegible)

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: GENERAL GEOMORPHOLOGY
Source of Information:

Date: July 2017

Ilustración 53:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN

PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

ORDER
ALFISOL
ENTISOL
INCEPTISOL
NOT APPLICABLE

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: SOIL TAXONOMY
Source of Information:

Date: July 2017

Ilustración 54:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

SOIL TEXTURES
Very fine
Fine
Medium
Moderately coarse
Coarse
NOT APPLICABLE

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: SOILTEXTURES
Source of Information:

Date: July 2017

Ilustración 55:
Natural pastures
Moors
Mountains and forests
Other uses
Permanent crops
Temporary crops and fallow land
Recreation
Cultivated pastures

Ilustración 56:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

SOIL USE CONFLICT
URBAN AREA
GOOD USED, CORRECT USE
OVERUSE CONFLICTS
SUB-USE CONFLICTS
WATER BODIES

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: SOIL USE CONFLICT
Source of Information:

Date: July 2017

Ilustración 57:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend

Puerto Bolívar Port Terminal

BASIN
PAGUA RIVER
JUBONES RIVER
GUAJABAL RIVEL
SANTA ROSA RIVER
ARENILLAS RIVER
NOT APPLICABLE

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: RIVER BASIN
Source of Information:

Date: July 2017

Ilustración 58:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
Single rivers

Water supply system A
Water supply system
Channel
Estuary
Double River
Single River

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: HYDROGRAPHY
Source of Information:

Date: July 2017

Ilustración 60
MONITORING POINT

Ilustración 61:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
AIR QUALITY MONITORING POINT

Water supply system A
Water supply system
Channel
Estuary
Double River
Single River

Roads
ROADS

Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: AIR QUALITY MONITORING POINTS
Source of Information:

Date: July 2017

Ilustración 62:

CARBON MONOXIDE CONCENTRATION
FOUND CONCENTRATION
PERMITTED CONCENTRATION
Series1

Ilustración 63:

NITROGEN DIOXIDE CONCENTRATION
FOUND CONCENTRATION
PERMITTED CONCENTRATION
Series1

Ilustración 64:

SULFUR DIOXIDE CONCENTRATION
FOUND CONCENTRATION
PERMITTED CONCENTRATION
Series1

Ilustración 65:

OZONE CONCENTRATION
FOUND CONCENTRATION
PERMITTED CONCENTRATION
Series1

Ilustración 67:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
NOISE MONITORING POINTS

Water supply system A
Water supply system
Channel
Estuary
Double River
Single River

Roads
ROADS

Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: NOISE MONITORING POINTS
Source of Information:

Date: July 2017

Ilustración 68:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

LIFE ZONES
Tropical dry forest
Thorn tropical scrubland
Pre-montane moist forest
Tropical very dry forest
Pre-montane dry forest

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: LIFE ZONES
Source of Information:

Date: July 2017

Ilustración 69:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal

VEGETATION COVERAGE
Populated area
Artificial
Native forest
Annual crop

Permanent crop
Semi-permanent crop
Agricultural mosaic
Natural

Pre-montane dry forest

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: VEGETATION COVER
Source of Information:

Date: July 2017

Ilustración 70:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
FLORA MONITORING POINTS
Puerto Bolívar Port Terminal
Single rivers

Water supply system A
Water supply system
Channel
Estuary
Double River
Single River

Roads
ROADS

Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: FLORA MONITORING POINTS
Source of Information:

Date: July 2017

Ilustración 71

Abundance of Species

Ilustración 72:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Ornithology
Entomology
Herpetofauna
Puerto Bolívar Port Terminal
Single Rivers

Water supply system A
Water supply system
Channel
Estuary
Double River
Single River

Roads
ROADS

Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: FAUNA MONITORING POINTS

Source of Information:

Date: July 2017

Ilustración 74:

Abundance of Birds

Ilustración 75:

Abundance of Species

Ilustración 76:

Diversity of Species

Order
Families
Species
Individuals

Ilustración 77:

Abundance of Insects

Ilustración 78:

Percentage of Insects

Ilustración 79:

Diversity of Insects

Order
Families
Species
Individuals

Ilustración 80:

Abundance of Species

Ilustración 81:

Fish resources diversity

Ilustración 72:

PROVINCE POPULATION OF EL ORO

Ilustración 84:

POPULATION BY CANTONS

Ilustración 85:

WOMEN
MEN

Ilustración 86:
MACHALA POPULATION PER AGE GROUP
0 to 14 years
15 to 64 years
More than 65 years
Series1

Ilustración 87:

AVERAGE AGE

AVERAGE AGE

Ilustración 88:

Ethnic self-identification of the population

White
Indigenous
Mestizo
Montubio
Mulatto
Black/Afro-Ecuadorian

Ilustración 89:

Net rate of primary education attendance
Net rate of secondary education attendance
Net rate of post-secondary education attendance
Net rate of basic education attendance
Net rate of primary education attendance
Net rate of secondary education attendance

Ilustración 90:
LITERACY

Ilustración 91:

INFANT MORTALITY
RATE
YEAR

Ilustración 92:
MATERNAL MORTALITY
RATE
YEAR

Ilustración 93:
GLOBAL FERTILITY RATE (CONVENTIONAL)

Ilustración 94:
Primary Sector
Manufacture Industrial Sector
Service Sector

Ilustración 95:
Agriculture, livestock…
Mine exploration and…
Manufacture
Electric power supply
Construction
Commerce
Transportation and communication
Activities of…
Financial activities
Professional activities
Public administration
Education
Health
Arts, entertainment and…
Others

Ilustración 96:

Agriculture, livestock, forestry and fishing
Wholesale and retail commerce
Construction
Manufacturing industries
Transportation and supply
Education
Public administration and defense
Accommodation and food services
Home activities as employers
Mine exploitation

Ilustración 97:

Canton Gross Aggregate Value 2007 – 2012

GAV 2007
GAV 2012

Ilustración 98:

Primary
Industries
Services
Not declared
New employee

Urban Area
Rural Area

Ilustración 99:

Agriculture, livestock, forestry and fishing
Mine exploitation
Manufacturing industries
Construction
Wholesale and retail commerce
Transportation and supply
Accommodation and food services
Public administration and defence
Education
Home activities as employers
Others

Ilustración 100:

PROVINCE
Percentage of households with electric power supply
Percentage of households with sewage disposal through public sewerage system
Percentage of households with indoor water supply from public sewage system
Percentage of households that dispose of their garbage by garbage collection cart

Ilustración 101:

126% Fixed Telephony Increase

Ilustración 102:

Access to fixed telephony (telephone lines)
Access to permanent internet (users)

Ilustración 103:

Public network
Well
River, stream, irrigation ditch or channel
Water supply truck
Other (rain)

Ilustración 104:

Not piped water but by other means
Piped outside the building, lot or land
Piped outside the dwelling but inside the building, lot or land
Piped inside the dwelling

Ilustración 105:

By garbage collector truck
Dump garbage in vacant lots or creek
Burn garbage
Bury garbage
Dump garbage in the river, ditch or channel
Other

Ilustración 106:

Owned and fully paid
Owned but not fully paid
Owned (gift, donation, legacy or by possession)
Borrowed or assigned (not paid)
For services
Leased
Antichresis

Ilustración 107:

None
Other
Light generator (electric plant)
Solar panel
Electric power supply company network

Ilustración 108:

ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend

Puerto Bolívar Port Terminal
Roads

ROADS
Roads
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: ROAD MAP
Source of Information:

Date: July 2017

Ilustración 109:
YILPORT Holding N.V.
Yilport Ecuador
Operational Yilport

Towing and piloting services
Handling
Refrigeration facilities services

Grains

Ilustración 112:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Towns
Puerto Bolívar Port Terminal
Single rivers

Water Supply System A
Water Supply System
Channel
Estuary
Double river

Single river

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: PROJECT IMPLEMENTATION
Source of Information:

Date: July 2017

Ilustración 113:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
Single rivers

Water Supply System A
Water Supply System
Channel
Estuary
Double river
Single river

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: AREA OF DIRECT INFLUENCE
Source of Information:

Date: July 2017

Ilustración 114:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
Single rivers

Water Supply System A
Water Supply System
Channel
Estuary
Double river
Single river

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: AREA OF INDIRECT INFLUENCE
Source of Information:

Date: July 2017

Ilustración 115:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
EARTHQUAKE RISK

Moderate to high seismic record
Moderate seismic record Single rivers

ROADS
Primary road
Secondary road
Unimproved road
Urban area road

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: EARTHQUAKE RISK
Source of Information:

Date: July 2017

Ilustración 116:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Flooding
Flooded areas
Areas susceptible to flooding
Puerto Bolívar Port Terminal
Single rivers

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: FLOOD REGIMES
Source of Information:

Date: July 2017

Ilustración 117:
ENVIRONMENTAL IMPACT STUDY AND ENVIRONMENTAL MANAGEMENT PLAN
PUERTO BOLÍVAR PORT TERMINAL

Legend
Puerto Bolívar Port Terminal
Flood risk
Vulnerable areas with the highest risk of flooding
Single rivers

Projection: UTM Zone 17 S
Horizontal Datum WGS 84
Vertical Datum: Medium sea level

LOCATION IN ECUADOR

LOCATION IN PROVINCE

Content: RIESGO DE INUNDACIÓN
Source of Information:

Date: July 2017

Ilustración 118:

Risk levels
Consequence
Slightly harmful
Harmful
Extremely harmful

Probability:

Low	Trivial	Tolerable	Moderate
Medium	Tolerable	Moderate	Important
High	Moderate	Important	Intolerable