Ministério dos Transportes

PHE

Plano Hidroviário Estratégico

Inland Waterways Strategic Plan






Produto 3 - Relatório de Diagnóstico e Avaliação

Product 3 - Assessment and Diagnosis Report

Chapters 1 to 3.2

2013

Consórcio

ARCADIS logos

English Version

Ministério dos Transportes

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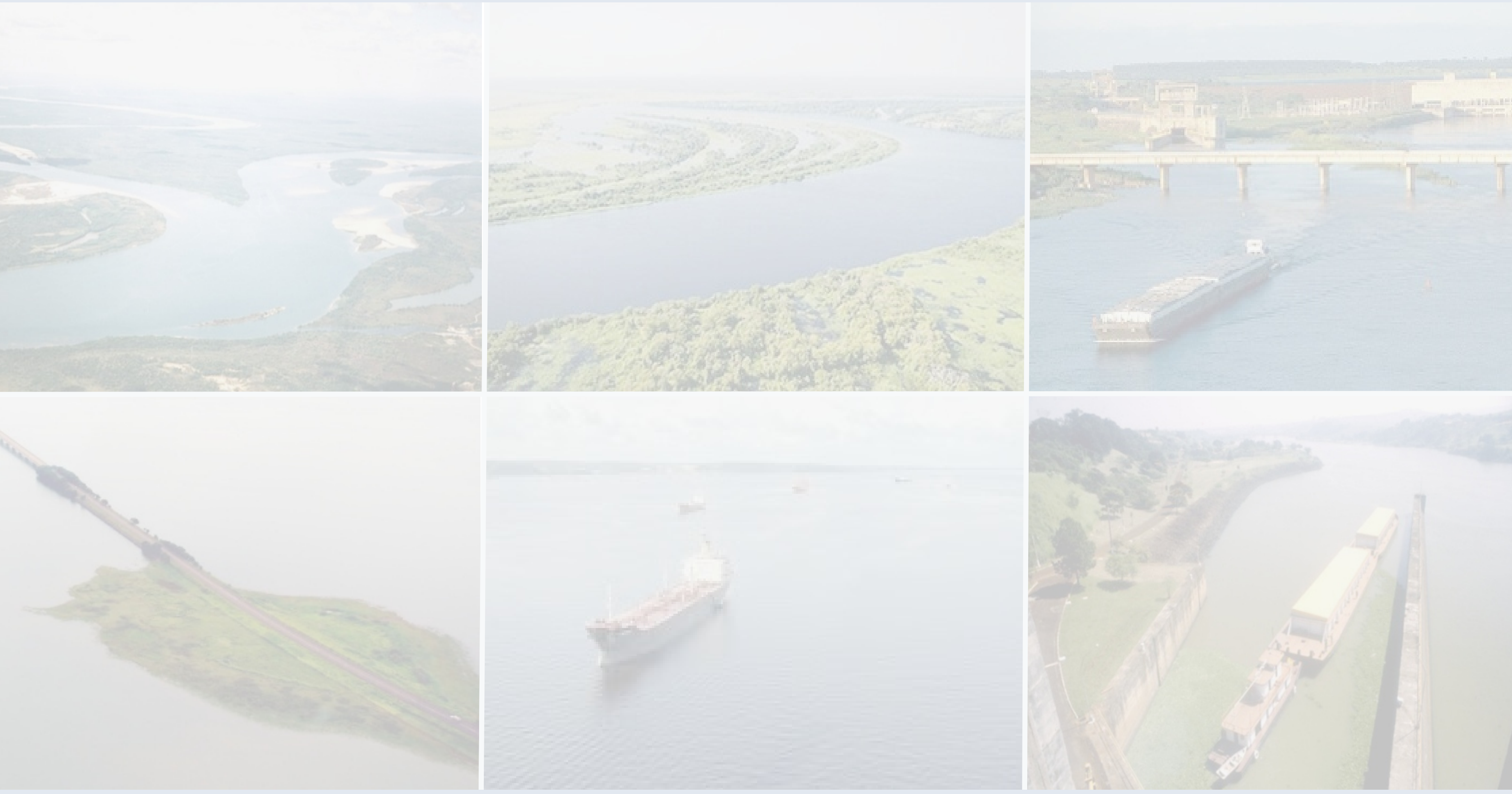

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SANTAREM PA

ACRONYMS

AES - AES Eletropaulo

AHIMOC- Administração das Hidrovias da Amazônia Ocidental

AHIMOR – Administração das Hidrovias da Amazônia Oriental

AHINOR – Administração das Hidrovias do Nordeste

AHIPAR – Administração da Hidrovia do Paraguai

AHRANA – Administração da Hidrovia do Paraná

AHSFRA – Administração das Hidrovias do São Francisco

AHSUL – Administração das Hidrovias do Sul

ANA – Agência nacional de Aguas

ANEEL - Agência Nacional de Energia Elétrica

ANTAQ - Agencia Nacional de Transportes Aquaviários

ANTT - Agência Nacional de Transportes Terrestres

ANVISA - Agência Nacional de Vigilância Sanitária

ARCON - Agência de Regulação e Controle de Serviços Públicos do Estado do Pará

BNDES - Banco Nacional de Desenvolvimento Econômico e Social

CAP - Conselho de Autoridade Portuária

CBH - Comitês das Bacias Hidrográficas

CDP - Companhia Docas do Pará

CEHIDRO - Conselho Estadual de Recursos Hídricos

CEMIG - Companhia Energética de Minas Gerais

CENAT - Comissão Executiva para a Navegação do Tietê-Paraná

CENTRAN - Centro de Excelência em Engenharia de Transportes

CERH - Conselho Estadual de Recursos Hídricos

CESP - Companhia Energética de São Paulo

CETESB - Companhia de Tecnologia de Saneamento Ambiental

CF – Constituição Federal

CGTMO - Coordenação Geral de Transportes, Mineração e Obras Civis

CHESF - Companhia Hidroelétrica do São Francisco

CIH - Comitê Intergovernamental da Hidrovia Paraguai-Paraná

CNA - Confederação da Agricultura e Pecuária do Brasil

CNRH - Conselho Nacional de Recursos Hídricos

CODESP - Companhia Docas do Estado de São Paulo

CODESUL - Conselho de Desenvolvimento e Integração do Sul

CODEVASF - Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba

CODOMAR – Companhia Docas do Maranhão

CONAMA – Conselho Nacional de Meio Ambiente

CONAPORTOS - Comissão Nacional das Autoridades nos Portos

CONERH - Conselho Estadual de Recursos Hídricos

CONSETRANS - Conselho Nacional de Secretários de Transportes

COPPE - Coordenação de Programas e Projetos Estratégicos

CPAOR - Capitania dos Portos da Amazônia Oriental

CPH - Companhia de Portos e Hidrovias do Estado do Pará

DAQ – Departamento Aquaviário

DH - Departamento Hidroviário

DILIC - Despacho do Diretor da Diretoria de Licenciamento Ambiental

DNIT - Departamento Nacional de Infraestrutura de Transportes

DNIT – Departamento Nacional de Infraestrutura de Transportes

DNPM - Departamento Nacional de Produção Mineral

EAS - Estudos Ambientais Simplificados

EIA/RIMA - Estudo de Impacto Ambiental/ Relatório de Impacto Ambiental

EMAP - Empresa Maranhense de Administração Portuária

EPE - Empresa de Pesquisa Energética

EPL - Empresa de Planejamento e Logística

EVTEA - Estudo de Viabilidade Técnica Econômica e Ambiental

FONPLATA – Fundo Financeiro para o Desenvolvimento da Bacia do Prata

FUNAI - Fundação Nacional do Índio

GEOUT - Gerência de Outorga

IBAMA - Instituto Brasileiro do Meio Ambiente

ICMBio – Instituto Chico Mendes de Biodiversidade

IIRSA - Iniciativa para a Integração da Infraestrutura Regional Sul-americana

INCRA - Instituto Nacional de Colonização e Reforma Agrária

INPH – Instituto Nacional de Pesquisas Hidroviárias

IPHAN - Instituto do Patrimônio Histórico e Artístico Nacional

LI – Licença de Instalação

LO – Licença de Operação

LP - Licença Prévia

MD - Ministério da Defesa

MDA - Ministério do Desenvolvimento Agrário

MDL – Mecanismos de Desenvolvimento Limpo

MERCOSUL – Mercado Comum do Sul

MI - Ministério da Integração Nacional

MINC – Ministério da Cultura

MJ – Ministério da Justiça

MMA - Ministério do Meio Ambiente

MPA - Ministério da Pesca e Agricultura

MPF - Ministério Público Federal

MPF - Ministério Público Federal

MRE - Ministério das Relações Exteriores

MS – Ministério da Saúde

MT - Ministério dos Transportes

ONG's – Organizações Não Governamentais

ONS - Operador Nacional do Sistema Elétrico

PBA - Plano Básico Ambiental

PEI - Planos de Emergência Individual

PHE – Plano Hidroviário Estratégico

PNLT - Plano Nacional de Logística e Transportes

PNMA - Política Nacional de Meio Ambiente

PR – Presidente de Republica

RAP – Relatórios Ambientais Preliminares

SEP - Secretaria Especial de Portos

SFAT - Secretaria de Fomento para Ações de Transportes

SISNAMA - Sistema Nacional do Meio Ambiente

SNGRH - Sistema Nacional de Gerenciamento de Recursos Hídricos

SNPH – Superintendência Estadual de Navegação, Portos e Hidrovias

SNRH - Sistema Nacional de Recursos Hídricos

SOPH - Sociedade de Portos e Hidrovias do Estado de Rondônia

SRF – Secretaria da Receita Federal

STF – Supremo Tribunal Federal

TCU – Tribunal de contas da União

TR - Termo de Referência

TUP – Terminal de Uso Privativo

UC - Unidade de Conservação

LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS

INDEX

1 INTRODUCTION

1.1 BACKGROUND

The Federal Government of Brazil intends to increase the inland waterway transport (IWT), and consequently increase its contribution to the sustainable development of the Brazilian economy.

Therefore, the Ministry of Transport started the project 'Plano Hidroviário Estratégico' in July 2012. The aim of the PHE project is to prepare a strategic plan for the development of IWT in the period until 2031. This strategic plan will be used by the Ministry to communicate with stakeholders and other government officials involved in IWT. It focuses on the activities on IWT of the MT but also on the integration of the MT waterway activities with those of other sectors concerning the use of water resources. The strategic plan will contain:

- Development goals on the focus areas;
- A short, medium and long term action plan;
  - Interventions in infrastructure
  - Governmental/organizational/legal interventions interventions.
- A plan for communicating the PHE to stakeholders;
- A database.

The strategic plan will be prepared by the Consortium ARCADIS LOGOS through a joint effort with the Transport Planning team of the Ministry of Transport.

The project is divided into the following research activities:

- Step A: Elaboration of work plan
- Step B: Stakeholder consultations
- Step C: Assessment and diagnosis
- Step D: Elaboration and evaluation of strategies
- Step E: Formulation of the draft strategic plan
- Step F: Preparation of the final strategic plan

1.2 THE CONTENT OF THIS REPORT

This document contains Step C: Assessment and diagnosis. This activity was carried out from October 2012 to March 2013. It provides an overview of the strength and weaknesses of the current Inland Waterway Transportation (IWT) sector and the opportunities and threats for future development. The diagnosis has been carried out within the restrictions that time provided. Together with the stakeholder consultations, it forms the basis for preparing the final strategies.

The IWT system in Brazil is analysed on two levels, the macro level and the different waterway systems, using the four research pillars: physical river system, environment and social aspects; economic aspects, transport system and governance & institutions. The rest of chapter one explains the methodology used for the analysis. It starts with a general description of the research methodology and an overview of the main research questions that are addressed in this report. After this, the scope of the analysis is explained with the selection of the waterways (section 1.3.1).Chapter one concludes with explanations of the methodologies used for each of the research pillars.

Chapter two is a summary of the international benchmark report. The benchmark gives an overview of the IWT systems of Europe, the United States and some recommendation for IWT development in Brazil.

Chapter three contains the analysis of the IWT system in Brazil. The chapter is divided into the macro level and the different waterway systems. Several aspects are described for each of the waterway systems grouped into the four research pillars.

Suggestions for possible institutional and infrastructural measures are provided in chapter four. This long list will be used when elaborating strategies in the next phase.

1.3 METHODOLOGY

The third phase in the PHE project is to analyze and diagnose the current river system and determine future threats and opportunities for IWT in Brazil. Together with the stakeholder analysis (second phase) it forms the basis for the scenarios that will be developed in the next phase (Development of Scenarios).

The main research questions for the assessment and diagnosis phase are:

- What are the strengths and weaknesses of the current situation as a starting point?
- What opportunities and threats may the future bring for IWT?
- What relevant information and data can you provide, in order to track the development of IWT as the MT is implementing this strategy?

These questions are incorporated in the research model as presented below. The strengths and weaknesses of the current situation are analyzed by current cargo flow, infrastructure and organization of waterway transportation (physical characteristics of the river bed, social and environmental restrictions, institutional structure and the transport system). After that, economic scenarios lead to future cargo flows. These macro and regional economic developments, together with infrastructure and transport system developments, provide opportunities or threats for the future IWT system.

The existing infrastructure and transport system needs to be upgraded to accommodate future cargo flows. The necessary measures for this are described in the strategies in the next phase of the project (Step D - Elaboration and Evaluation of Strategies).

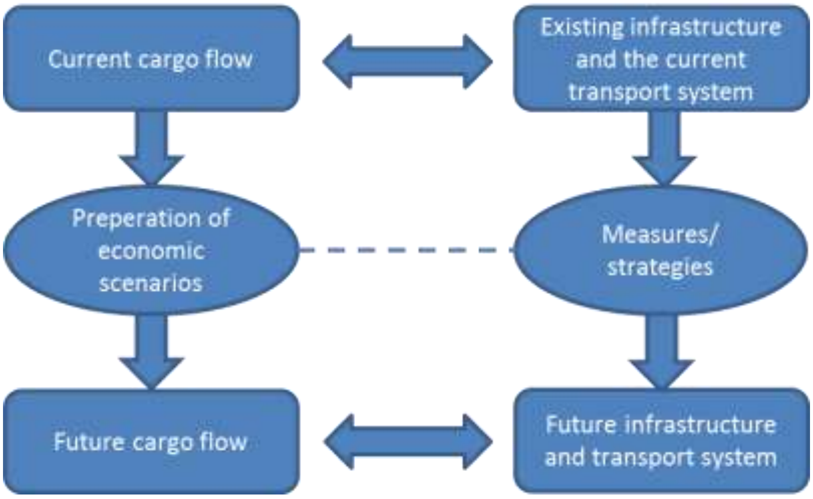

Figure 1.3.1: Research model - PHE project

As stated in the work plan, a successful inland waterway transport (IWT) system is characterized by four pillars: Economies of scale, a competitive transport system, a navigable waterway system and clear governance and institutions focused on sustainable development. To organize the research, detailed criteria are measured for each pillar. Some of these criteria have an effect on the macro level, and others point out differences between the river basins. Therefore the Diagnoses and Analyses phase was executed at two levels:

- Macro level: What are the Strengths, Weaknesses, Opportunities and Threats for IWT concerning all waterway system?
- Regional level: Which waterway system are most interesting for developing the IWT compared to others?

Specific methodology will be explained in the next paragraph. Below the criteria and pillars are placed in one overview (Table 1.3.1).

Table 1.3.1: Aspects per research pillar for the macro level and the waterway systems

	Analysis Macro Level	Analysis Waterway System
Physical river system, environment and social aspects		Navigability
		Social and environmental vulnerabilities for future investments
Economy	Macro economics	Cargo transport
	International Trade	Passenger transport
	IWT and international trade	Market share
Transport system	Market accessibility	Infrastructure
	Demand for new equipment	Fleet characteristics
	Qualified personnel	River information system
	Taxes and incentives	Intermodal competition
Governance and institutions	Juridical and institutional aspects	Waterway management characteristics
	Waterway management characteristics	

1.3.1 Waterway selection

For the current analysis it is initially worth setting the limits of use of the terms “waterway” and “waterway system” as employed within the context. It is clear that both terms refer to water routes allowing inland navigation of vessels, the former considering stretches of a river and the latter a group of waterways operating in an integrated manner inside a region. Throughout this step stretches of potentially navigable rivers were selected to be studied; it was agreed that they would also be called waterways. It is worth mentioning, however, that the use of this term on this occasion is not intended to give the idea that the river allows vessel navigation today, since it is well known that for such purpose civil, hydraulic and signaling works would be necessary to make its configuration as a waterway actually feasible.

Based on this, the selection of the waterways to be studied was made in two major phases, due to the importance of this activity for the structuring of the study at issue.

The first phase considered an investigation into the national waterway system, having the rivers presented in the technical proposal as a basis, namely: Amazonas / Solimões – Main river channel and tributaries; Madeira; Tapajós, Juruena and Teles Pires; Tocantins; Araguaia; São Francisco; Parnaíba; Paraná and Tietê; Paraná and Paraguai; and formers of the Guaíba River and Lagoa dos Patos.

This investigation was made during Step A - Preparation of the Work Plan, trying to identify all the rivers in the selected river basins showing some potential, especially with regard to commercial navigation, considering the horizon of the work (2031). As an outcome of this phase, a preliminary list of the river basins and rivers to be studied was prepared and sent to the Ministry of Transport along with the Work Plan.

After a meeting with the DNIT/DAQ, which coordinates the Technical-Economical and Environmental Feasibility Studies (EVTEA, in Portuguese) contracting processes for the different waterways in the country, the list was detailed. It was decided to incorporate in the study the rivers that the DNIT/DAQ, jointly with Waterway Administrations and other institutions working at the regional level, consider strategic from the point of view of river navigation. This list was then submitted to the Ministry of Transport, which had already requested its inclusion in the study of rivers composing the Uruguay River basin for evaluation and approval purposes.

This list, made available below, provides the final list of rivers that were analyzed, integrally or in specific stretches, in the Diagnosis and Evaluation Step. The list covers 8 of the 12 Brazilian river basins, where 63 rivers and one channel were studied.

Due to the continental size of the Amazon Hydrographic Region, composed of a large number of rivers to be analyzed, and as a result of the routes and (current and predicted) importance of certain rivers for inland navigation, in the current study it was decided to divide this Hydrographic Region into three waterway systems, as it can be seen in Table 1.3.2.

Table 1.3.2: River extensions per waterway system and hydrographic region

Hydrographic Region	Waterway System	Name	Extension (km)
Amazonas HR	Amazonas Waterway System	Acre River waterway	2342
		Branco River waterway	555
		Envira River waterway	144
		Içá River waterway	348
		Japurá River waterway	707
		Jari River waterway	151
		Juruá River waterway	2308
		Paru River waterway	64
		Tarauacá River waterway	406
		Trombetas River waterway	226
		Uatumã River waterway	317
		Xingu River waterway	202
		Amazonas River waterway	1434
		Negro River waterway	1241
		Solimões River waterway	1523
	Madeira Waterway System	Guaporé River waterway	1062
		Madeira River waterway	1419
		Mamoré River waterway	262
	Tapajós Waterway System	Arinos River waterway	211
		Juruena River waterway	572
		Tapajós River waterway	806
		Teles Pires River waterway	993
South Atlantic HR	South Waterway System	Camaquã River waterway	61
		Caí River waterway	87
		Jaguarão River waterway	37
		Rolante River waterway	53
		Taquari – RS River waterway	105
		Lagoa dos Patos waterway	309
		Lagoa Mirim waterway	289
		Gravataí River waterway	30
		Jacuí River waterway	324
Paraguai HR	Paraguai Waterway System	Cuiabá River waterway	338
		Miranda River waterway	233
		Paraguai River waterway	1202
		Taquari – MT River waterway	400
		São Lourenço River waterway	508

Table 1.3.2: River extensions per waterway system and hydrographic region (continued)

Hydrographic Region	Waterway System	Name	Extension (km)
Paraná HR	Paraná Waterway system	Amambaí River waterway	154
		Anhanduí River waterway	50
		Ivaí River waterway	120
		Ivinheima River waterway	176
		Paranapanema River waterway	414
		Paranaíba River waterway	537
		Paraná River waterway	809
		Piracicaba River waterway	177
		Sucuriú River waterway	18
		São José dos Dourados River waterway	38
		Tibagi River waterway	322
		Tietê River waterway	899
		Grande – MG River waterway	84
		Pereira Barreto Canal waterway	17
Parnaíba HR	Parnaíba Waterway system	Parnaíba River waterway	1211
		Alsas River waterway	233
São Francisco HR	São Francisco Waterway system	Corrente River waterway	103
		Paracatu River waterway	103
		Grande – BA River waterway	305
		São Francisco River waterway	2015
Tocantins HR	Tocantins/Araguaia Waterway system	Tocantins River waterway	1555
		das Mortes River waterway	542
		Itacaiúnas River waterway	129
		Araguaia River waterway	1629
		Javaés River waterway	524
Uruguai HR	Uruguai Waterway system	Chapecó River waterway	172
		Ibicuí River waterway	196
		Uruguai River waterway	852

In the current study, fourteen rivers contained in the Plano Nacional de Viação of 1973 (PNV, 1973) - the national highway plan - of which four are federal, were not addressed since potential for commercial navigation and passenger transport justifying their inclusion in the analyses was not found, having the horizon of the work, 2031, as reference.

Table 1.3.3 - List of the rivers contained in the PNV 1973 that were not addressed in the current study

Rivers of the PNV not considered in the WSP			
River	**Basin**	**End points of navigable stretches**	**Approx. extension in the PNV (km)**
Javari*	Amazonas	Mouth/Javari-Mirim	510
Mearin	Northeast	Mouth/entry do Corda	470
Grajaú	Northeast	Mouth/Grajaú	500
Pindaré	Northeast	Mouth/Pindaré-Mirim	110
Itapicuru	Northeast	Mouth/Colinas	565
Velhas	São Francisco	Mouth/Sabará	659
Paraopeba	São Francisco	Mouth/Florestal	240
Preto	São Francisco	Mouth/Ibipetuba	125
Doçe*	East Atlaântic	Mouth/ Ipatinga	410
Paraíba do Sul*	East Atlantic	MouthJacareí	670
Ribeira do Iguape*	Southeast Atlantic	Mouth/Registro	70
Brilhante	Paraná	Mouth/ Pto. Brilhante	67
Inhanduí	Paraná	Mouth/ Pto. Tupi	79
Iguaçu*	Paraná	Mouth/Curitiba	1.020

*** Federal rivers**

1.3.2 Physical system of the river and environmental and social aspects

1.3.2.1 Study object

The characterization of the physical and social-environmental aspects of the rivers under study was focused on two thematic axis, considering aspects related to the feasibility of potential waterways from the physical and social-environmental points of view.

The first axis is oriented to the physical navigability conditions of the rivers being studied. Thus, through the analysis of the major attributes that characterize the physiography and the hydrologic and hydraulic dynamics of the rivers, the main impedances related to navigability conditions may be identified, and they can make implementation of the waterway unfeasible or navigation difficult in certain stretches of the river.

The second thematic axis presents the social-environmental characteristics, which can in some degree amplify the level of complexity of the licensing process needed for waterway licensing or enlargement. To his end, it was decided to characterize them to make the integrated planning of future interventions instrumental when their purpose is to increase inland waterway navigation.

1.3.2.2 Methodology Procedures

Given the analytical complexity involved and the land extension object of analysis, for development of the present study it was decided to conduct a sequence of successive approaches, initially at the regional scale, integrating the river basins into the context, followed by various analyses of the surroundings of the waterways of interest. Such approaches encompass a progressive land definition through which the limits of the space of analysis are more clearly defined, both conceptually and in terms of area delimitation, which is thus reduced, concentrating on a specific interest area.

The methodology procedures used for development of the current plan phase involved the following steps, starting from the previous selection of the waterways that would be the object of this Strategic Waterway Plan:

- Delimitation of the study area
- Selection of variables of interest and data survey
- Data processing and analysis;
- Indicator composition

a) Definition of the research scope

Starting from a total of 64 previously chosen waterways, the contributing hydrographic basins were delimited aiming at composing the coverage areas for the surveys of the secondary data.

For such delimitation, the hierarchic classification in levels from the National Water Agency (ANA) was adopted for the hydrographic basins, selecting the level 2[1] of contributing hydrographic basins of every waterway.

After the coverage areas were defined, data availability research was conducted for data relating to the physical and social-environmental conditions of the area of interest of the Brazilian rivers considered in this study.

Given the data availability unbalance in the various regions of the country - with the South and Southeast regions having greater availability, while the other Brazilian regions (Center-West, North and Northeast) have low data availability –, the data acquisition, analysis and compilation steps were oriented as a function of the set of existing information and, mainly, comparability of all the waterways analyzed.

Moreover, due to the large discrepancy between the existence and availability of information for the various rivers, an analysis procedure was sought that would be able to study river conditions under a same focus, preventing rivers with less information from being underrated and vice versa.

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[1] Country' Division according to the River Basin areas, performed by "Projeto Hidrologia" of 1977, Hydrological Information System (HIS) activity.

Initially, all the rivers under study were framed in a geo-referenced environment. To do this, it was decided to use as a basic reference the axis of the rivers made available by the National Water Agency (ANA, in Portuguese) for calculation of the surroundings. Due to the fact that the water volume data are not uniform in Brazil - inherent to the low detail data scale made available by the ANA - the method of analysis becomes less accurate for very wide rivers, characterizing only an analysis of the water environments without reaching the area of the banks.

For the purpose of analyzing the possible occurrence of physical and social-environmental conditioning aspects in the rivers being studied, the waterway axis was segmented into 10 km long stretches, counted cumulatively in the reverse sense of the natural river course (from downstream to upstream).

With regard to navigability diagnosis, the analysis focus was more objectively related to the river and its characteristics at every stretch, in order to allow its current navigability conditions to be known, and how this can interfere with river transport [as well]. On the other hand, for the social-environmental vulnerability analysis, it was decided to enlarge the focus to a 10 km wide strip at both sides of the river, considered from its axis, so as to allow the characteristics around it to be known, to support future decision-making with regard to the construction of infrastructure that supports waterway operation.

Based on this segmentation, a geospatial database (BDG, in Portuguese) was created, fed with the information and data collected and the results obtained for every 10 km long stretch, thus generating a favorable environment for the future data processing step.

b) Selection of variables of interest and data survey

As already indicated, within the limits outlined for preparation of the study, some variables were established that could be obtained for all the selected hydrographic basins and were analyzed considering the study scales in the various approaches.

Thus, an initial picture was composed on a scale of approximately 1:250,000. It is worth stressing that these variables are neither exhaustive nor are able to provide a higher level of detail/description of the analyzed aspects (river navigability and vulnerability to possible interventions), but are considered sufficient for the strategic analysis. Moreover, the surveyed data compose a current panorama of the surroundings of these waterways, based on the data recently made available.

Based on the analysis of these variables, it was possible to identify stretches with different levels of criticality regarding navigability, as well as different levels of social-environmental vulnerabilities that could require greater emphasis in terms of analyses and discussions in the licensing steps, according to the methods and criteria stated below. The variables composing each of these analyses are described as follows.

Minimum depth

Depth is one of most important attributes for the diagnosis of the navigability conditions of river stretches. Its value remits to the nappe of the river at a specific time.

The river depth is variable over the year as a function of the hydrological regime and along the river course as well. Moreover, depth is very variable as a function of the presence of elements such as river islands, sandbanks and stone outcrops, thus becoming a hard-to-measure variable.

Focused on navigability conditions, a survey of minimum depths in every stretch over the year was sought, something that can result in difficulties or impediments to navigation. The methodology used for the minimum depth data survey consisted of collecting and analyzing the information available from the following sources:

- Brazilian Navy;
- Waterway administrations;
- Hydraulic-hydrological analysis of river station data along the rivers under study;
- Consultations with stakeholders;
- Other sources.

Minimum width

Width is one of the physical dimensions of the river that directly impact its navigability conditions.

The minimum width was obtained by measuring it using high resolution satellite images (Google Earth). The methodology consisted of measuring the smallest and the greatest distances verified for each 10 km long river stretch, between the banks of the main river channel.

It is worth stressing that, due to the fact that the measurements were performed on the main chute of the river, occasional obstacles existing in it, such as sandbanks and stone outcrops, could cause a narrowing of the river and consequently of the navigation route, not perceivable in this study.

Sinuosity

Sinuosity is a hydraulic and morphologic parameter that describes the degree of irregularity of a river, so that the more curves a river has, the more sinuous it is.

This was considered an attribute belonging to this study because it characterizes the geometry of each river segment by indicating the degree of difficulty of the maneuvering conditions of the vessels and by identifying routes whose navigation course is longer than expected.

Moreover, the sinuosity of a river stretch is tied to its width in the same stretch. Thus, the same river stretch can be sinuous for one vessel type and not sinuous for others, depending on the size of the vessel. This characteristic was taken into consideration.

The sinuosity (Sin) of the river stretches was calculated through the relation between the thalweg length of the river stretch (L) and the shortest length in a straight line between the end points of the same river stretch (Lt).

$$Sin = \frac{L}{Lt}$$

The calculation of sinuosity was made on/using the satellite images available from the Google Earth software.

The sinuosity value can be subject to variations, depending on the river segments (L) adopted. Thus, the sinuosity survey along the rivers was done as a function of their morphology, that is, in stretches having similar morphological behavior. Thus, the results obtained consist of average values within each segment (L) and can present diverging values in sub-stretches of this segment.

Figure 1.3.2: Example of sinuosity calculation

It is worth stressing that the sinuosity calculation was made on the course of the river chute. Occasional natural obstacles such as sandbanks and stone outcrops that are not visible through satellite images can make the effective navigation route more sinuous than expected, something not considered in this study.

The sinuosity value is always greater than or equal to 1. The unit value corresponds to the situation where the river alignment is a straight line. In the case of Brazilian rivers, it was found that the values oscillate between 1 and 5.

Energy

"River energy" means a variable related to the declivity of the main channel of the river and was classified as low, medium or high. The average declivity (in percentage) of every stretch was obtained by dividing the hydraulic gradient by the stretch length. In turn, the "hydraulic gradient" parameter corresponds to subtraction of the river stretch altimetric elevation of the downstream portion from the upstream portion, both values obtained from hypsometric maps (as shown in figure 3). For the definition of “river energy” class intervals a histogram was prepared from the declivity data of all the stretches considered.

The reservoirs existing along the rivers were also considered in this analysis.

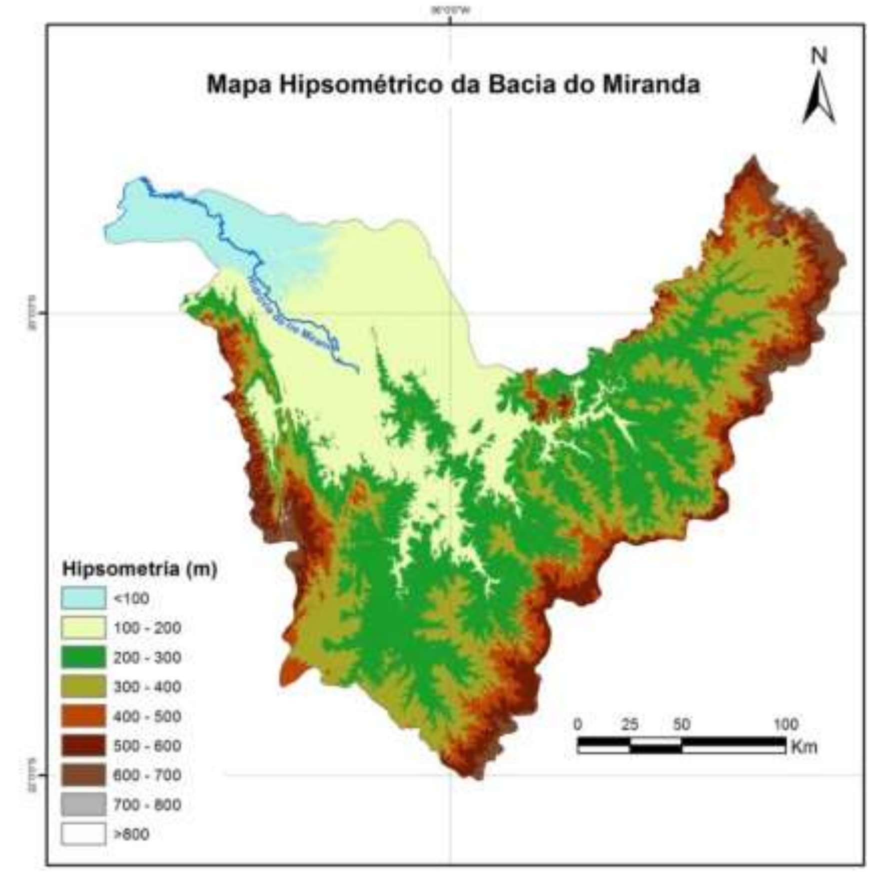

Figure 1.3.3: Example of hypsometric map generated for the study (Miranda basin).

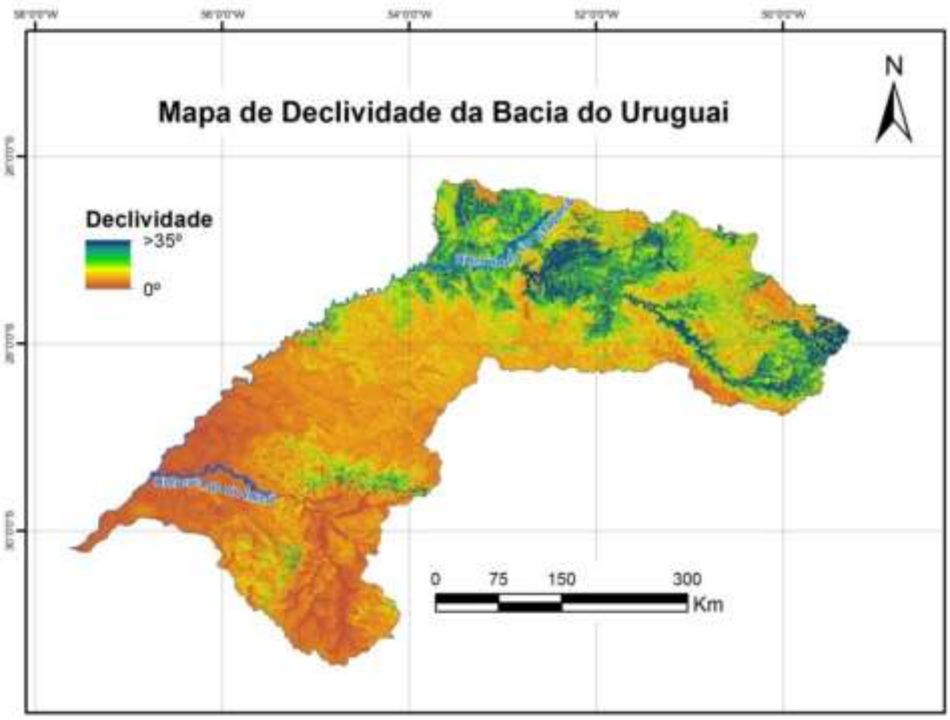

Figure 1.3.4: Example of declivities generated for the study (Uruguai River basin).

Natural Barriers

The 'Natural Barriers' attribute corresponds to natural barriers and physiographic accidents existing in the main channel of the river, which, when present, can make commercial vessel navigation difficult or even prevent it. The major elements considered are: river islands, sandbanks, rock outcrops, stone outcrops, among others.

The barriers can represent a combined variable when there are two or more natural obstacles to navigation.

The natural barrier survey was conducted based on the following sources:

- Brazilian Navy;
- Waterway administrations;
- Consultations with stakeholders;
- Third party reports and field surveys;
- Hydroelectric inventories;
- Satellite images (Google Earth).

Physical impediments to navigation

Physical impediments to navigation consist of civil and hydraulic works existing along the river that can represent difficulties or restrictions to navigation. The major impediments identified were dams and bridges, but footbridges and water intakes were also identified.

In order to classify these impediments, the following division was adopted:

- Dams (Hydroelectric power plants or flow and level regulation dams)
  - With locks whose dimensions do not restrain the passage of current convoys;
  - With locks whose dimensions restrain the passage of convoys;
  - Without locks.
- Highway and/or railway bridges
  - With clear height not restricting the passage of commercial convoys;
  - With clear height restricting the passage of commercial convoys;
  - No information.
- Other physical impediments.

Type of bed

The function of this parameter is to analyze in a preliminary way the beds of the rivers under study. Thus, the bed of the main channel of the rivers was classified as rocky, sedimentary or mixed. This classification was obtained from integration of the geologic and geomorphologic characteristics of the stretches analyzed. The sources consulted for the definition of this variable were CPRM (2004) – Brasil ao Milionésimo (Brazil to the Millionth) for the geologic information, and IBGE (2006) – Map of Relief Units in Brazil, for aspects referring to the geomorphology of the area.

Silting

The silting attribute characterizes the susceptibility to sedimentation processes along the rivers under study in a theoretical way.

The sedimentation processes are one of the major phenomena involved in the appearance of natural obstacles to navigation, such as sandbanks and river islands.

The silting parameter was obtained from integration of the river energy attribute with the terrain erosion frailty map. Frailty to erosion assesses the sedimentary contribution to the river bed from the surrounding slopes and affluent drainages, so that terrain with high susceptibility to erosion tends to provide a greater sedimentary load to near-by river courses.

Frailty to erosion (figure 1.3.5) was calculated based on an algebraic operation composed of three main parameters, which are briefly described below.

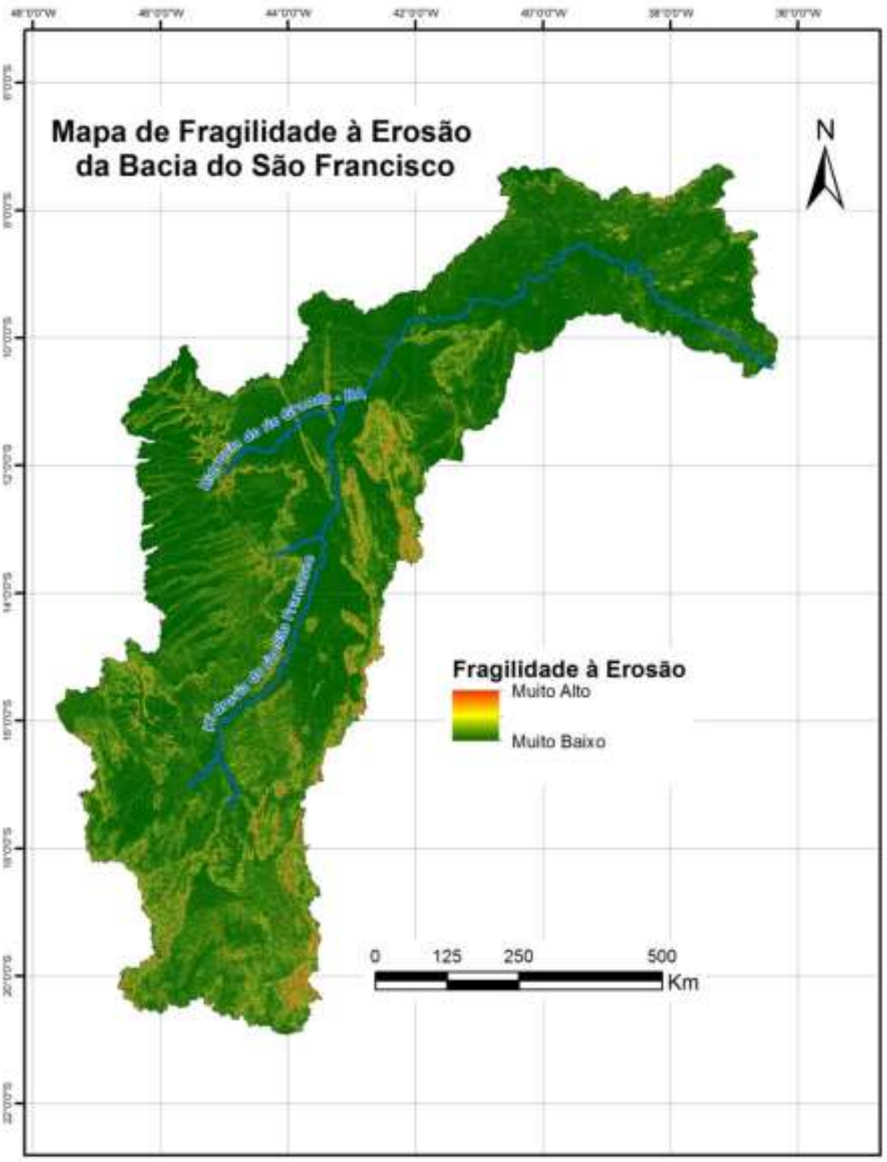

Figure 1.3.5: Example of a terrain erosion frailty map generated for the study (São Francisco basin).

- Rain erosivity: a numerical index expressing the capacity of expected rain in a particular location to cause erosion in an unprotected area. This factor was determined by "Erosividade Brasil 1ª versão" software, Brazil erosivity version 1, (Silva et al., 2006), which provides erosivity rates by municipality for the entire Brazilian territory.

- Erodibility: the quantity of material removed per area unit when the other erosion-determining factors remain constant. This parameter was obtained through bibliographic research considering erodibility values calculated for the various types of soil in the Brazilian territory (Silva & Alvares, 2005; Mannigel et al., 2002; Mannigel et al., 2002; Lombadi et al., 1975; Wischmeier & Smith, 1978; Baptista, 1997). The types of soil characteristic of each region were obtained from information contained in Brazil Soil Map (IBGE, 2001).

- Relief factor: an expression for calculating the relief factor based on flow build-up (or contribution area, Figure 6) and declivity, directly affecting run-off velocity (Moore & Burch, 1986).

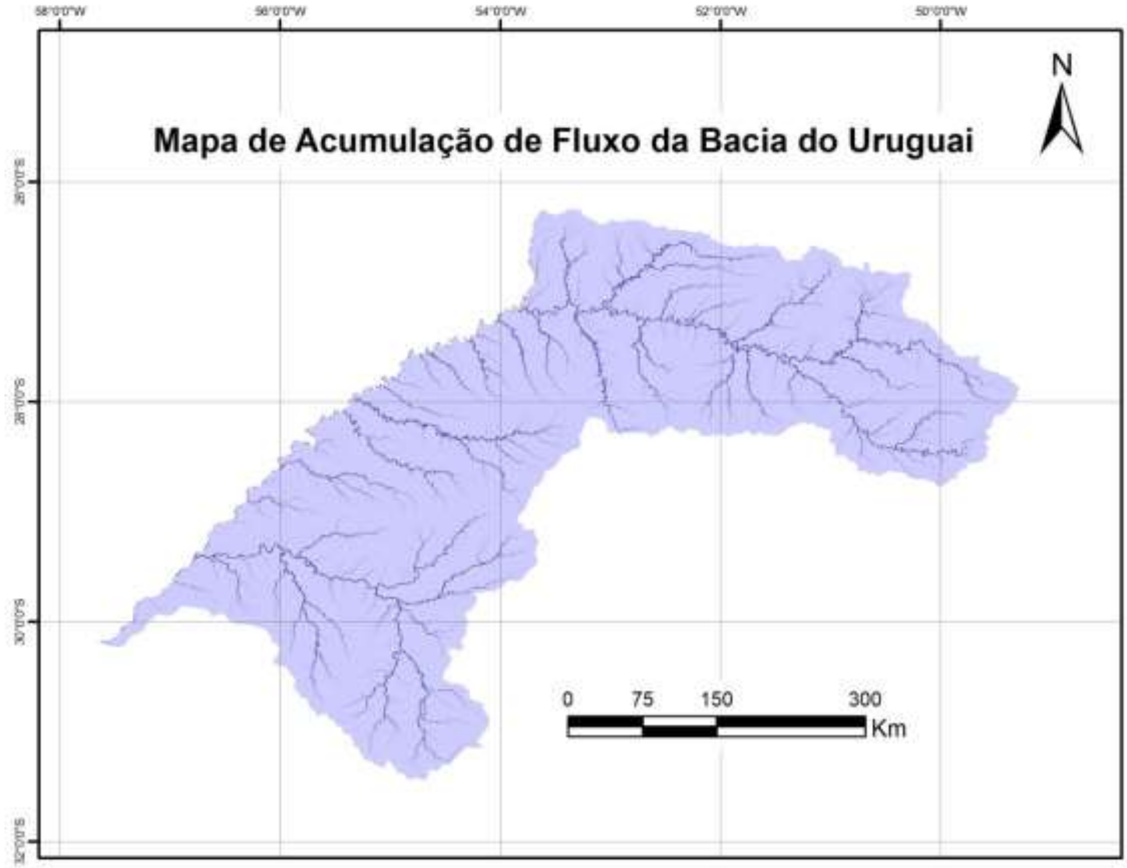

Figure 1.3.6: Example of build-up map (Uruguai River basin).

On the other hand, river energy indicates the sediment transport capacity in the main channel of the water course in an indirect manner. Thus, it is considers that rivers with reduced energy and with an alluvial character (running over their own deposits) are more susceptible to silting than those with greater energy.

Vegetation coverage

The analysis of the percentage of vegetation coverage in the considered stretch was made based on the cartography of the natural and anthropized areas (Ministry of the Environment - PMDBBS, 2007), selecting the “Remaining Forest” category to compose the deforestation rate. This rate was calculated discounting the area referring to water volume and/or water bodies, aiming to identify the percentage of plant coverage remaining in every 10 km long waterway stretch.

When vegetation coverage is predominant, it is considered that the stretch has a higher vulnerability level from the environmental point of view. On the contrary, if conversion for anthropic uses has already taken place, the vulnerability levels were considered lower. This information helps identify the levels of vulnerability to anthropic intervention, which determine greater or smaller licensing difficulties for structures such as ports, bank rectification, and channel implementation, among others.

Conservation Units (UC)

They are the legally protected areas for biodiversity maintenance, inserted into the Conservation Units National System, both at the national and state levels. There are two categories of Conservation Units, namely: (i) integral protection (UC-PI), which have high restriction levels, where only indirect uses, like scientific research, environmental education, and ecotourism are permitted, and: (ii) sustainable use (UC-US), where anthropic interventions are permitted in a sustainable way.

These UCs were identified and mapped with regard to categories and restriction levels (ICMBio, 2012), allowing verification of possible overlaps or nearness to navigation routes. Through this procedure critical stretches are identified with regard to current conservationist policy and possible conflicts relating to licensing;

Priority areas for Biodiversity Conservation (APCBs)

They correspond to areas identified by the Ministry of the Environment (PROBIO/MMA) in the various Brazilian biomes as being of interest for the development of conservationist actions at various priority levels, as acknowledged by Ordinance No. 9 of January 23, 2007 (MMA). In this study, the APCBs were considered in two categories: (i) Extremely high, very high and high, representing areas with large conservationist potential (for which legal restrictions are to be imposed), being thus adequate biodiversity indicators, and; (ii) Insufficiently known, because they represent land areas containing poorly known ecosystems with regard to their biological composition.

Duly mapped and overlapping the rivers where navigation development is intended, they indicate potential future areas with use restrictions and potential implications for the licensing process;

Indigenous lands (TI)

The identification and mapping of Indigenous Lands, homologated and in the homologation process, in the area of the basins studied was made based on data from the Fundação Nacional do Índio (FUNAI, 2012). According to paragraph 2 of Art. 231 of the Constitution, Indigenous lands, being special use public assets, as well as inalienable and nondisposable, cannot be the object of any kind of use by anyone but indigenous people themselves. The purpose of the analysis was to identify critical stretches with regard to interference with the way of life of these populations; the stretches are critical when, among other aspects, they are too close to these specially delimited and protected areas or, occasionally, when the waterway stretch overlaps the TI.

Maroons

Article 2 of Decree 4887/03 regulates the procedure for the identification, recognition, delimitation, demarcation and ownership of the lands occupied by the remains of maroon communities and defines remaining maroon according to self-assignment criteria, having their own historical trajectory, with specific land relationships, and presumed black ancestry related to resistance to the historical oppression they suffered.

Consultation of the Instituto Nacional de Colonização e Reforma Agrária (INCRA, 2010) enabled identication of the existence of remaining maroon communities, seeking to identify, through available secondary data, those that could have a direct relationship with the water courses studied and depend on them for maintenance of their way of life.

Rural Settlements

The agrarian reform settlements contained in the area of influence of the water courses studied were identified and mapped using data from the Instituto Nacional de Colonização e Reforma Agrária (INCRA, 2010). It was deemed important to map their locations, since the INCRA must be consulted for environmental licensing purposes whenever there are settlements in the area of influence of the projects.

Prospector deeds and mining

The survey of prospector deeds and mining allows verification of river uses that could conflict with the waterway. Data made available by the Mining Geographic Information System (SIGMINE, 2012) were used and the following regimes of the mining processes contained in the DNPM were selected for characterization of mineral resources:

- Mining request
- Mining concession
- Prospector mining request
- Prospector mining concession;

Speleology

Cavities are federal assets, considered national heritage and specific legislation (Decree 99.556/90 and CONAMA Resolution 347/04) establishes, among other matters, an area of influence of 250 m in horizontal projection for the effect of licensing projects that are potentially degrading until the licensing agency defines them based on an assessment of their importance. Their mapping was made through consultation of the ICMBio/CECAV database.

Supplementary data

In addition to the variables selected for the already described social-environmental vulnerability analysis, other data were also considered to allow qualification of the municipalities inserted in the river basins and/or study area of the waterways considered by the plan.

Information on the number of inhabitants was used, according to the data made available in the demographic census conducted by the Brazilian Institute of Geography and Statistics (IBGE, 2010) to indicate the demographic size of the studied municipalities.

The results of the FIRJAN Index of Municipal Development (IFDM, 2010), which analyzes official public statistics for employment & income, education and health care, provided by Ministries of Labor, Education and Health, were considered. The statistics combined result in a municipal ranking that ranges from 0 to 1. The closer the index gets to 1, the higher the development of locality. This index is calculated by the Federation of Industries of the State of Rio de Janeiro – FIRJAN, on an annual basis, to all municipalities in the country. For this study, the index was used in order to compose an initial characterization of municipalities and regions studied, with regard to its development. The index itself was not used as a criterion/variable in the linear analysis, which will be further detailed. Its purpose was to provide information that would allow a more qualifyed data on the municipalities involved in the study in order to encourage additional studies that should undertake further studies in an integrated manner to stimulate local development.

In short, the basic data were obtained from selection of the pertinent variables and the information gathered was distributed by waterway and corresponding stretch to allow further processing. The major sources of consulted data were:

- National Water Agency - ANA
  - Coded hydrographic network
  - Technical reports
  - Data from the river stations of the Hydrological Information System (Hidroweb)
- National Agency of Electric Energy - ANEEL
  - Geo-referenced data bases
  - Documentation center
  - Studies on the hydroelectric inventory of the rivers: Tocantins, Araguaia, Uruguai, das Mortes, Taquari, Parnaíba, São Lourenço, Tibagi and Guaporé.
- National Operator of the Electrical System - ONS
  - Historical series of natural flows
  - Inventory of the operation restrictions of hydroelectric projects
- Brazilian Navy;
  - Technical reports
  - Nautical charts;
- Meetings held with the major stakeholders (waterway administrators, shipping companies)
- National Department of Mineral Production - DNPM
  - Cartographic base of mining deeds
- National Indian Foundation - FUNAI
  - Cartographic base of indigenous lands

- Brazilian Institute of Geography and Satistics - IBGE
  - Integrated cartographic base of Brazil to the Millionth
- Chico Mendes Biodiversity Conservation Institute - ICMBIO
  - Conservation units cartographic base
- Chico Mendes Biodiversity Conservation Institute – ICMBIO/CECAV
  - Cartographic base of the potentiality and occurrence of natural cavities
- National Institute of Colonization and Agrarian Reform - INCRA
  - Cartographic base of rural settlements and maroon communities
- Ministry of Fishing and Aquaculture
  - Register of artisan fishermen[2]
- Ministry of the Environment – MMA/ PROBIO
  - Cartographic base of biodiversity conservation priority areas
- Ministry of the Environment - PMDBBS
  - Cartographic base of natural and anthropized areas
- Ministry of Transport
  - Transport Logistics National Plan (PNLT)
- NASA
  - Elevation Digital Model (SRTM)

c) Information Processing and Analysis

The spatial distribution of the collected data was performed through implementation of a geospatial database (BDG). This database concentrates the set of information gathered in the previous step and the respective resulting mappings form an important work tool for the steps after the WSP since they enable rapid and detailed analyses of the variables inserted into the BDG.

[2] Data on fishing colonies were obtained from the Ministry of Fisheries and Aquaculture, referring to the General Register for Fisheries (RGP). Initially these data would be used to analyze fishermen colonies who could be negatively impacted by the consolidation of the waterway (in the case of the infrastructure needed, as well as its use – the waterway - does not come to contemplate the possible impacts on these fishing colonies). It was noted however that the records could not be geocoded as the information was mostly linked to the municipality where registration was obtained which may differ from the municipality where fishing itself is exercised. This was observed by the recurrence of great records in more urbanized counties. Thus, it was decided not to present these data in the analysis, but these make up the database that will be delivered later.

Aiming at drawing up a consistent and easy to manage BDG, the tabular and geospatial information were processed and standardized by biotic, physical and social-cultural means.

Navigability diagnosis

The survey of the variables referring to navigability conditions was conducted in accordance with the methodology described in section B) Selection of variables of interest and data survey. Classification criteria and valuing of the respective variables were defined for every river stretch from the calculated values, which are presented in the next sections.

Minimum depth

The analysis of the minimum depths available in the rivers remits directly to the degree of accessibility of the various vessel types with different drafts. Moreover, vessel drafts determine the loading capacity of commercial convoys. Based on the calculations of the transport cost models described in chapter X, this relation is demonstrated in the figure that follows, prepared for 3 different scenarios.

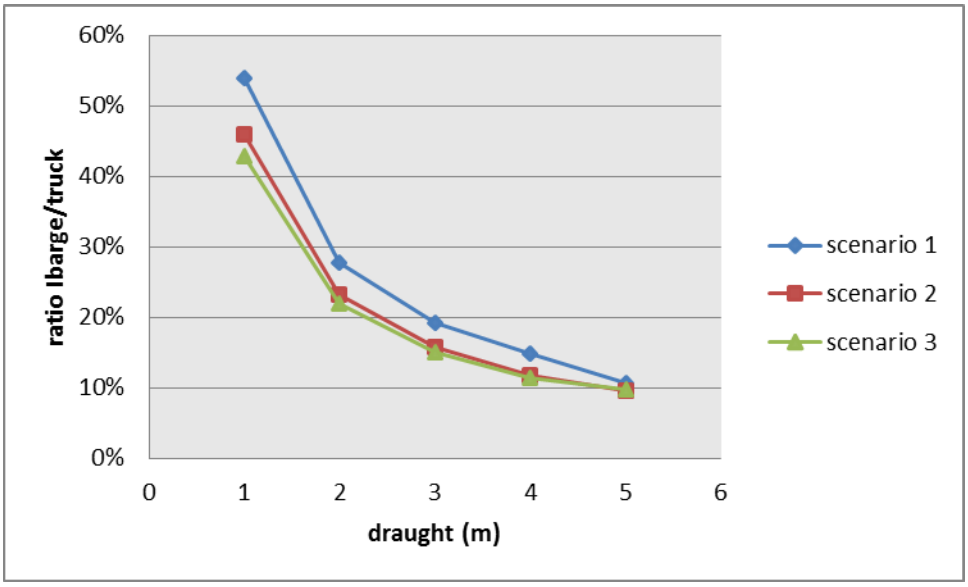

Figure 1.3.7: Convoy draft x Operation cost

In order to be competitive and deal with the additional loading and unloading costs of commercial convoys, in addition to the potential logistic complications inherent in the waterway transport system, it is estimated that the transport cost of the concoys should be around 20 to 30% of the highway cost (by truck).

Consequently, based on the illustrated figure, it can be noted that the competitiveness of transport via commercial convoys is neutral for drafts between 2 and 3 m and doubtful for convoys with drafts between 1 and 2 m. Convoys with drafts lower than 1 m are not competitive. However, competitiveness is assured for drafts above 3 m.

Thus, based on these criteria, the following values for the minimum depth attribute were adopted

From the mapping of the minimum depths verified along the rivers and in every stretch under study the following valuing criterion was applied:

Table 1.3.4: Classification and valuing of the minimum depth variable

Stretch with minimum depth	Navigation potential	Value
Greater than 4 m	Very good	1
Between 3 and 4 m	Good	2
Between 2 and 3 m	Medium	3
Between 1 and 2 m	Bad	4
Smaller than 1 m	Very bad	5

Minimum width

The criterion adopted for valuing the minimum width attribute was to classify the river stretches in order to identify where there are funnels and passages too narrow for commercial convoy navigation. The dimensions of a commercial convoy is/are? A function of the way barges are grouped together, and this study adopted a typical convoy of 2 x 2 about 23 m wide and 120 m long.

Besides the dimensions of the convoy, incremental widths should be considered between the vessels and the river banks so as to ensure safety for the maneuverability conditions. Thus, the classification obtained is shown in the table that follows.

Table 1.3.5: Classification and valuing of the minimum width variable

Mininum width of the river stretch	Navigation potential	Value
Lmin > 100 mm	Very good	1
75 < Lmin ≤ 100 m	Good	2
50 < Lmin ≤ 75 m	Medium	3
Lmin < 50 mm	Very bad	5

Sinuosity

The classification of the sinuosity attribute was obtained by setting sinuosity values greater than 2 as the more critical and undesirable scenario, when the potential of the maneuverability conditions of the convoys can be dramatically impaired and the distances to be navigated are too long in relation to the straight line alignment.

Sinuosity values between 1 and 2 were classified in a scaled way, as in the tables that follow.

In a supplementary way, the assignment of weights to the sinuosity values took into account the width of the corresponding river segment, defining the following criterion:

- Condition I – If the river width is smaller than or equal to 100 m

Table 1.3.6: Classification and valuing of the sinuosity variable (Condition I)

Sinuosity	Navigation potential	Value
Sin ≤ 1.25	Very good	1
1.25 < Sin ≤1.50	Good	2
1.50 < Sin ≤ 1.75	Medium	3
1.75 < Sin ≤ 2	Bad	4
Sin > 2	Very bad	5

- Condition II - If the river width in the stretch is greater than 100 m

Table 1.3.7: Classification and valuing of the sinuosity variable (Condition II)

Sinuosity	Navigation potential	Value
Sin ≤ 1.33	Very good	1
1.33 < Sin ≤ 1.66	Good	2
1.66 < Sin ≤ 2.0	Medium	3
2.0 < Sin ≤ 2.5	Bad	4
Sin > 2,5	Very bad	5

Energy

The table below summarizes the classification of the energy variable adopted. These values were defined as a function of the average declivities verified in the rivers under study and based on hydraulic conditions known as harmful to navigation, according to the Navy.

Table 1.3.8: Classification and valuing of the energy variable

Declivity (Decl.)	Energy	Navigation potential	Value
Decl. ≤ 0.025%	Low	Very good	1
0.025 < Decli. ≤ 0.05%	Average	Medium	3
Decl. > 0.05%	High	Very bad	5

Natural barriers

The table below synthesizes the criteria and the valuing used for the classification.

Table 1.3.9: Classification and valuing of the natural barriers variable

Category	Navigation potential	Value
Absence of relevant natural barriers	Very good	1
Existence of natural barriers making navigation difficult, such as: river islands, sandbanks and spot rock outcrops (stone outcrops).	Reasonable	3
Existence of barriers impeding navigation or making it impossible, such as: waterfalls, rapids, extensive rock outcrops	Very bad	5

This classification was defined considering the impact that these barriers can represent for the navigability conditions of commercial convoys. Thus, natural elements such as stone outcrops, rapids and rock outcrops that can prevent navigation were defined as critical.

Physical impediments

The definition of the criteria for valuing this attribute, per stretch, was based on the degree of impediment to navigation that each element represents and on the financial effort needed in case this impediment is to be overcome. The table that follows illustrates the criteria adopted.

Table 1.3.10: Classification and valuing of the physical impediments variable

Physical impediments to navigation class	Navigation potential	Value
Absence of physical impediments	Very good	1
Presence of dam with non-limiting lock OR non-limiting bridge	Good	2
Presence of dam with limiting lock OR limiting bridge OR bridge with no information	Medium	3
More than one limiting bridge	Bad	4
Dam without lock	Very bad	5

Type of bed

The definition of the criteria for valuing the type of bed is presented as follows.

Because it is an attribute with a very qualitative aspect, it was established that the most critical scenario (corresponding to a rocky bed condition) corresponds to the maximum value of 3.

Table 1.3.11: Classification and valuing of the type of bed variable

Type of bed	Navigation potential	Value
Sedimentary	Very good	1
Mixed	Good	2
Rocky	Medium	3

Silting

The interrelation of the factors was considered so that terrain with high erosive potential in the vicinity of a low energy stretch was classified as highly susceptible to silting, while stretches with low erosive potential in their vicinity and greater energy were classified as having low susceptibility to silting.

Moreover, the impact of susceptibility to silting on navigability conditions is variable as a function of the conditions of other attributes in the same stretch. Thus, the silting attribute was interconnected to the minimum depth attribute and two major cases are defined:

- Case 1: River stretch with minimum depth more than 1.5
- Case 2: River stretch with minimum depth less than 1.5

The more critical depths from the commercial navigation and intermodal competitiveness points of view are those with values less than 1 m. Thus, the classification proposed to distinguish the scenarios with minimum depths less than 1.5 m aims at identifying river stretches that are highly susceptible to having small depths due to silting thereby affecting commercial navigation conditions.

The table below synthesizes the criteria used and the respective valuing.

Table 1.3.12: Classification and valuing of the silting variable (Case 1 or 2)

Erosion in the vicinity	River energy	Suceptibility to silting	Navigation potential	Value
Low	Medium	Low	Very good	1
Low	Low	Medium	Good	2
High	Medium	Medium	Good	2
High	Low	High	Medium	3 or 5

Social-environmental vulnerabilities

A count of the occurrences was made using the maps algebra tool available in the Geographic information System (SIG, in Portuguese) software for the identification and quantification of the social-environmental conditions, whether considering units or percentages, as presented below in Table 1.3.13.

Occurrences of the social-environmental variables identified per stretch were compiled and are presented in the occurrence matrix attached to this report (CD attached).

The one-line diagram was used as a means of presentation, in order to provide a more simplified and integrated reading of the occurrence matrix. Among the major benefits of using this graphic feature, flexibility for consulting occurrences, variables coverage and topic integration should be stressed, emphasizing stretches with occurrence overlapping of different variables.

A list of the variables used to analyze the social-environmental vulnerabilities to potential interventions is presented as follows and grouped by the analysis:

- Biotic means
  - Integral protection conservation unit (UC-PI);
  - Sustainable use conservation unit (UC-US);
  - Priority areas for biodiversity conservation (APCB);
  - Plant coverage percentage.

- Physical means
  - Mining – mining and prospecting;
  - Speleology.

- Social-cultural means
  - Maroon communities;
  - INCRA settlements;
  - Indigenous land;

A metric range from 1 to 5 was adopted aiming at standardizing the comparable results, according to the intensity of the occurrence of every variable, with classes ranked in an ascending manner. Thus, the value 1 corresponds to no occurrence of the variable and metric 5 indicates stretches with many occurrences. The variation of occurrences corresponding to each metric and the formulation of the final result of each variable are presented in Table 1.3.13.

After these metrics were established, weights were assigned to each variable considering its importance in the impact evaluation processes, keeping the licensing and authorizations issued by the competent agencies in mind. The weight of each variable is presented in Table 1.3.14. It should be noted that variables relating to conservation units, indigenous land, maroons, and plant coverage received the greatest weights because they represent topics that determine greater restrictions in the licensing and project implementation processes.

Table 1.3.13: Number of occurrences and corresponding metric of the variables analyzed

Metric	Physical means				Biotic means					Social-cultural means		
	Mining		Speleology		Conservation unit		APCB					
	Mining	Prospection	Potential of cavity occurrence	Cavity occurrences	Integral protection	Sustainable use	Extremely high and very high	High and insufficiently known	Plant coverage	Maroon communities	INCRA settlements	Indigenous land
	occurrence	occurrence	% in the stretch	occurrence	occurrence	occurrence	occurrence	occurrence	% in the stretch	occurrence	occurrence	occurrence
1	0	0	0	0	0	0	0	0	0	0	0	0
2	1 - 8	1 - 20	1 - 30	1 - 12		1	1	1	1 - 30		1 - 2	
3	9 -17	21 - 53	31 - 50	13 - 30	1	2	2	2	31 - 50	1	3 - 4	
4	18 - 28	54 - 77	51 - 70	31 - 76	2	3	3	3	51 - 70	2 - 3	5 - 7	1
5	29 - 50	78 - 148	71 - 100	77 - 228	3	4	4	4	71 - 100	4 - 5	8 - 12	2

Table 1.3.14: Attribute weights used for composition of the variables

Physical means				Biotic means					Social-cultural means		
Mining		Speleology		Conservation unit		APCB					
Mining	Prospection	Potential cavity/occurrence	Cavity/ occurrence	Integral protection	Sustainable use	Extremely high and very high	High and insufficiently known	Plant coverage	Maroon communities	INCRA settlements	Indigenous land
0.4	0.6	0.6	0.4	1	1	0.65	0.35	1	1	1	1

d) Composition of the indicators

The construction of the indicator sought to synthesize the results obtained in the interpretation of the occurrences of each variable in the waterway stretches analyzed, considering their intensity and importance in two contexts:

- Navigability diagnosis
- Social-environmental vulnerability to potential interventions

Navigability diagnosis

During the valuing of the weights of the variables, the purpose of Step C – Information Processing and Analysis, the criterion to give weights to the variables with values between 1 and 5 was defined, so that the greater the value, the greater the negative impact of the variable on navigability conditions. Thus, variables with a weight of 5 correspond to situations that impede navigation or make navigability conditions in the stretch very critical.

For the purpose of analyzing all the variables related to navigability conditions with the same focus, a navigability condition indicator that summarizes the current physical condition for implementation of a waterway in every river stretch was defined. This condition should reflect the partial navigability conditions defined for each variable.

This indicator is calculated as the greatest value, for each stretch, among the marks of every variable under study.

Since the attributes (minimum depth, minimum width, sinuosity, energy, natural barriers, physical impediments, bed and silting) have values ranging from 1 to 5, the final result will always be a value between these two extremities.

The following table is an example of the calculation of the navigability condition indicators for an imaginary waterway. In the table the value of the result for each stretch corresponds to the greatest value among the eight variables analyzed for the corresponding stretch.

Table 1.3.15: Example of calculation of the navigability condition indicator

	Waterway						
Attribute	**Stretch 1**	**Stretch 2**	**Stretch 3**	**Stretch 4**	**Stretch 5**	**Stretch 6**	**Stretch 7**
Minimum depth	1	2	3	5	3	3	1
Minimum width	2	3	2	2	2	2	4
Sinuosity	1	1	2	2	2	3	4
Energy	2	1	1	1	1	2	1
Natural bottlenecks	1	3	3	3	3	3	3
Physical impediments	1	1	1	1	1	5	1
Type of bed	2	2	2	2	1	1	2
Silting	1	2	2	2	3	3	3
Navigability condition	2	3	3	5	3	5	4

Social-environmental vulnerability to potential interventions

The concept for this indicator arose from the principle of sampling and categorizing the levels of potential conflicts resulting from the implementation of support works (construction of terminals, ports, rock blasting and dredging, etc.) in the waterways demanding attention and actions relating to environmental management in the implementation and operation steps.

For the preparation of the social-environmental vulnerability indicator (VS) five ascending categories of potential conflict were adopted, considering the results of the previous step. The value 1 corresponds to the inexistence of conflicts and the value 5 represents the variables that demand greater attention when dealing with environmental licensing.

It is worth stressing that the assignment of values to the categories described below was based on the hierarchy of the typologies of the potential conflicts, where the more restrictive is always selected to compose the synthesis, as shown in the sequence below (Figure 1.3.8).

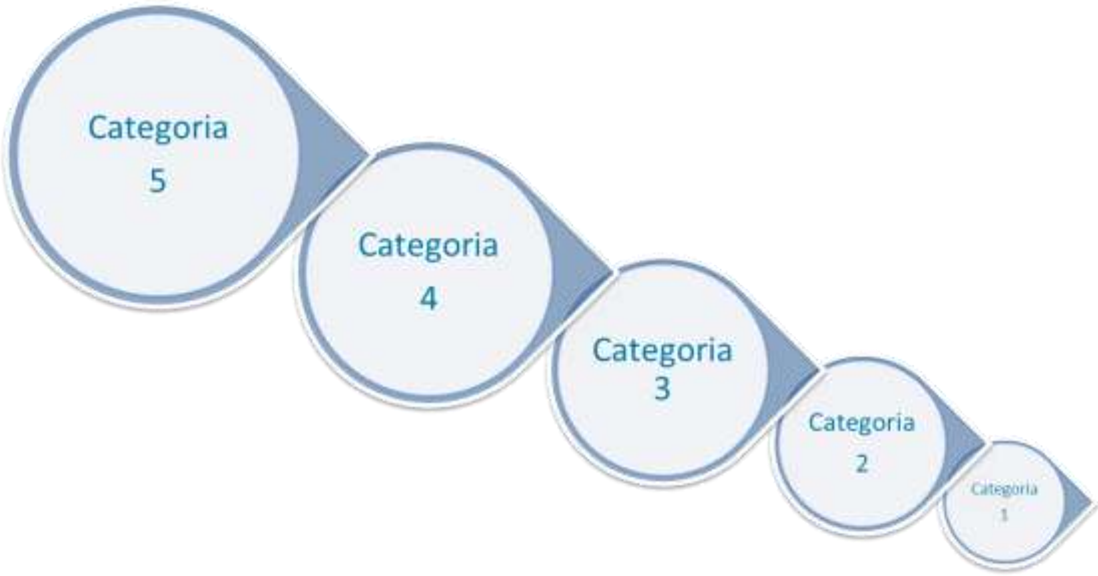

Figure 1.3.8: Typologies of the potential conflicts

The five categories used for the formulation of the VS indicator are better detailed below:

Category 5

Presence of an Integral Protection Conservation UNIT (UC-PI) and/or indigenous land in the waterway stretch; the variables that determine greater complexity of the licensing and project implementation process were considered.

Category 4

Presence of a sustainable use conservation unit (UC-US) and/ or maroon community.

Category 3

Presence of INCRA settlements, stretches vulnerable to deforestation and/or natural cavities.

Category 2

Presence of Priority Areas for Biodiversity Conservation (APCB) and/ or mining/prospecting Mining deeds.

Category 1

Absence of occurrences of the social-environmental conditions analyzed.

1.3.3 Economic aspects

1.3.3.1 Introduction

The main goal of the economy part of the PHE study is to determine the potential future cargo flows on inland waterways in Brazil. A number of aspects need to be defined.

The **future** is defined as the years 2015, 2023 and 2031, while 2011 is the year on which the calculations are based.

Potential stands for the cargo flow over water that is achievable under certain conditions:

- The waterway should have a basic navigability. This means in most cases that a convoy of 2x2 barges is able to use the waterway. For a number of waterways this is not the case in 2011. The Tocantins River, the Tapajós River, the Parnaíba, the São Francisco River and the Uruguay River do not fulfill this requirement. From this it follows that the forecasted transport flows will not be realized if no navigability improvements will be made in these rivers.

- The commodities have to be suited for inland waterways. In general transport flows should be big, the transported commodities liquid or solid bulk and the distances preferably long, as inland water transport will become more competitive over long distances.We have chosen the commodities that are transported by IWT in the base year (2011) and have added a number of flows that may be transported by IWT according to information from interviews and other sources. A good example of the latter is the transport of ethanol in the São Paulo region (on the Paraná-Tietê River). In the base year this transport flow does not exist. In the forecast years a relative large flow is expected.

- The location of the production areas in relation with the waterway is also very important. The distance between the production area and the waterway by road should be less than 500 to 600 km. It should be added that we assume that an inland waterway port of terminal is present. At the moment this condition is not met on every waterway involved.

- Planned investments are expected to be implemented according to plans (PAC). For a number of investments is is not certain that they will be implemented or that they will be implemented according to the original time schedule. It goes without saying that if investments are postponed, the IWT flows that rely on these investments will not take place. The best example is the ALPA steel plant in Marabá. According to the plans this project will be realized before 2015 and will generate large IWT flows between Marabá and Vila do Conde. However if these investments are postponed, the IWT forecasts are no longer valid.

- Doublecounts: a number of waterways have overlapping influence areas (hinterland). An example is the Madeira River, which has (almost) the same influence area as the Tapajós. In the forecasts IWT flows from Mato Grosso (mostly exports of soy and corn) have been assigned to the Madeira River and the Tapajós River. The same holds for the Tocantins and Araguaia rivers for a number of commodities. In the Strategy phase of the project an assessement for either options will be made. The consequence is however that the total flows may not be added because in that way doublecounts will appear.

The forecasts in this part of the project have to be regarded as the total potential for a certain waterway under the assumption (condition) that the waterway has a basic navigability, functioning terminals and or ports and roads available for the transport of the commodities to the terminals and ports.

The potential is demand orientated. This means that (physical) production, imports and exports have been the basis for these forecasts.

Especially forecasts for the year 2015 should be treated with caution because it is unlikely that all required investments will be realized before 2015. On the other hand it is important to realize that the potential for IWT is present. If some investments are realized after 2015 this will "only" delay the potential for IWT a couple of years. The forecasted IWT flows for 2031 are more important because they depend less on investment decision in the near future and give a long term vision.

1.3.3.2 Procedure

The procedure to determine future transport flows consists of three steps:

1. Analyze the current (year 2011) transport flows over water;
2. Determine the economic and logistic developments between 2011 and the forecast years (2015, 2023 and 2031) and derive future transport flows;
3. Check current and future transport flows with PNLT-data.

1.3.3.3 Current year transport Flows

In step 1, the current transport flows (2011) are obtained from a number of publications by Antaq. In yearbooks on inland waterway transport an overview is given of the transport by inland waterway per commodity and origin-destination. This gives a good insight in the current transport. From the interviews a small number of other flows emerged. This information was added to the Antaq information.

1.3.3.4 Economic and logistic developments / future transport flows

The second step is to determine the developments that are important for the future transport flows. For the most important commodities, special commodity studies were made.

a) Agricultural commodities

Concerning agricultural products, soy, soy meal, corn, sugarcane, sugar and ethanolare produced in Brazil in vast quantities. The forecasts are based on a recent study by FIESP / ICONE in 2012. These forecasts were made using the BLUM-model (refer to Economy Working report B).

The exports[3] per state have been connected with the trade information from Aliceweb[4]. Aliceweb makes it possible to construct a matrix with states on the on axis and ports on the other. In this way the percentage share of ports for the exports of states has been constructed. These initial shares are also used in the forecast years with new (mostly higher) exports.

Finally the share of IWT in the flow from state to port has been determined. From the IWT flow (Antaq) and the total flow from state to port (Aliceweb) we can derive the share of IWT. Where possible, ports of destination have been linked to one or more specific inland waterways, e.g. Santos / Tietê-Parana; Manaus / Madeira; Rio Grande / Lagoa dos Patos. Subsequently the modal share and associated volumes of inland waterways per river in 2011 is assigned for the export volumes per port of destination.

For the base case forecasts the modal share is assumed to remain unchanged for the years 2015, 2023 and 2031. In forecast simulations the modal share can be changed, influenced by specific measures, stimulating inland waterways. This way of forecasting makes it possible to change the shares of the ports and analyze the effects of port change (e.g. influenced by the shift of production and transport to the North). In this way the commodity forecast models can also function as simulation models in the scenario phase of the PHE project.

b) Ores

The FIESP ICONE outlook provides information on the most important agricultural commodities. For IWT other commodities are important too. For these we used other sources. For ores (iron ore, bauxite and manganese) we used the PNM, the National Plan for Mining[5]. This Plan gives production and import / export forecasts for a large number of ores for the period 2008 – 2030. In a similar procedure as described for agricultural commodities a matrix

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[3] A major part of all produced agricultural commodities is exported. Sugarcane is processed to sugar or ethanol and (partly) exported. Fertilizer is the only commodity imported in large quantities.

[4] Aliceweb provides very detailed official trade information. Per exported commodity the state of origin, the port and the destination can be determined. This determines the possible routes within Brazil.

[5] Plano Nacional de mineração (PNM 2030) Brasília novembro de 2010

with production, exports and logistics is constructed for iron ore. The forecasts for bauxite and manganese are directly used, because the number of mines is limited.

c) Other Commodities

For other commodities (e.g. oil products, chemical products) the development of GDP between 2011 and 2031 is taken as the basis for growth. For the period 2011 – 2023 the growth is assumed to be 5% per year and for the period 2023- 2031 the growth is assumed to be 3%. The percentages are based on the macro-economic scenarios in PNM. For the transport of containers we assumed an extra 1% per year. This means a growth of 6% in the period 2011 – 2023 and 4% in the period 2023-2031.

In some cases additional information was available. If this was the case the additional information was used. For example for the port of Rio Grande forecasts for the transport of containers were made. The growth of container handling in the port between 2010 and 2030 will be about 200% (0.66 million TEU in 2010; 1.93 million TEU in 2030). This implies a yearly growth of 5.5%. This is slightly higher than the assumed growth of containers (5.2% in the period 2011-2031).

The interviews are another important source of information. New developments like plans for new plants or logistic systems that are not implemented in the used information sources are added to the results. A few examples:

- Transpetro implements a new logistical system for the transport of ethanol in São Paulo (SP). A part of this transport will use IWT on the Paraná – Tietê River;
- The ALPA steel factory in Marabá (PA) will use IWT for the import of coal and the export of steel and iron ore;
- Eldorado has built one of the biggest pulp factories in the world in Tres Lagoas. The supply of wood (partly) and the export of pulp will be done by IWT on the Paraná – Tietê;
- CMPC announced that it has approved the expansion of the company's Guaíba mill, in the state of Rio Grande do Sul. The expansion of industrial plant in Guaíba provides an increase in production capacity from 450 thousand tons per year to 1.75 million tons and is expected to begin producing pulp by the first quarter of 2015 (Press release 2012-12-7).

These new developments are very important for IWT because the transport flows involved are big.

d) Passengers

For passengers no forecast for Brazil as a whole has been made, as demand is lacking because of relatively good alternatives by road. Except for some cross-river and cross-lake movements in several large metropolitan areas, passenger transport by boat exists only in regions without good road access like the (vast) Amazon region. The growth of passenger transport depends on the transport purpose. For working and school the development of the population is the basis.

For tourism a higher growth is expected. It is not expected that new lines will appear, as the current system already consists of a dense net of lines.

Only in the Amazon region passenger transport by waterway is an important mode of transportation. The forecasts for passenger transport are estimated as a linear function of the expected increase of the population in the respective states. We assume that the number of river crossing highways will remain very limited.

1.3.3.5 PNLT

The third step in determining future transport flows consisted of comparing for a number of commodities, the forecasted exports of the ARCADIS model with the forecasted PNLT export data. Only export and import data (transport flows from state to port) are used because most of the interesting larger transport flows in the context of PHE are transported to ports and directly exported further or processed into export products.

The export forecast of commodities – in terms of volumes most relevant - show similarities between PNLT and those of the ARCADIS model; the range of both forecasts is plausible. The import commodities however, show a bigger differences. This may be due to missing commodities and links in PNLT.

1.3.4 Transport System

1.3.4.1 General

The inland waterway transport system is composed by the integration of its elements, such as, terminals and its access infrastructure (roads/railways/pipelines), vessels, locks and bridges, aiming at transporting cargo and passengers. This transport is the result of the complex co-operation between public and private parties. Not only the shipping lines with their fleet of inland vessels, but also the logistic organization enabling this transport, the service providers to the transport industry, the road and rail transporters that provide the pre- and end-haulage to and from the final destinations and origins of the cargo and the public parties involved in port and waterway development and maintenance.

This complex cooperation results in an inland waterway transport system that competes with the other modes of transport, primarily road and rail. Competition between modes of transport can be characterized by:

- Low operating costs
- Good access to the market
- High reliability

The successful further development of inland waterway transport will be dictated by the competitiveness of the system. As a consequence, the above factors will be the guidelines in analyzing the system performance. As it has been stated in chapter **Erro! Fonte de referência não encontrada.**, the analysis will be made on two different levels: a macro analysis (on a national level) and an analysis on the level of the different waterway systems. The market accessibility and the reliability issues will be treated on a macro level. The river basin analysis will focus on the modal choice (the choice between the competing modes of transport). As a consequence the determining factor in the river basin analysis will be the transport cost.

1.3.4.2 Macro analysis of the transport system

a) General

To analyze the quality of the transport system at a macro level, a number of issues will be analyzed. These issues are derived from the stakeholder analysis and dealt on a national level with the factors determining the competitive position of inland waterway transport: legislation and regulations.

The overall performance of the inland waterway system will also be influenced by the performance of the Brazilian sea-ports and the cabotage navigation. These influences will be described in the macro analysis.

b) Stakeholder analysis

The stakeholders addressed five topics at the macro level regarding transport system that hamper the development of IWT in Brazil: reliability, market accessibility, transport costs, fleet and infrastructure. For an analysis on a national level reliability and market accessibility are the major items.

c) Reliability

According to the interviewed stakeholders there is a lack of reliability in IWT compared to other modes of transportation, although costs are possibly lower. Due to the current navigability conditions, on-time delivery cannot be guaranteed. Navigability conditions are not regularly monitored and some of the available nautical charts are out-dated. Waterway administrations claim to have good knowledge of the actions necessary to improve the reliability of the waterway system in the region, but in some cases, they have little knowledge about the current hydrology of rivers and few resources to invest in the infrastructure. The waiting times at locks can be long and hydro-electric dams also cause variations in water levels, making IWT an unreliable mode of transportation.

d) Market accessibility

It is perceived as difficult for new entrants to start operating or using IWT as a means of transportation. There are few shipping companies operating on the river and, generally, the companies that do use IWT have their own support infrastructure (terminals, fuel stations, shipyards, etc.). Some stakeholders mentioned that in general, private terminals do not consider usage by other parties and public terminals do not have good operating conditions.

Larger storage areas and more terminals are needed to improve the accessibility. However, the current licensing and authorization process for new private terminals is rather unclear. There is a scarcity of specialized manpower for navigating barges and port operation. Navigation highly depends on the experience of the crew (due to the lack of updated nautical charts) but qualified crew is hard to find due to high demand from the off-shore market (which pays higher salaries). Some shipping companies and port operators are investing in the training of crew. For shipping companies, rigid employment laws are a problem. The unions have a lot of power which puts pressure on the companies.

Shipyards should be able to increase their production and they receive support from the federal government, but it is being perceived that there are no big players in the inland shipyard market. As a consequence, if there is a high demand on barges there will be no quick response to that. There are restrictions on importing second hand vessels and the operation of imported new vessels is heavily taxed.

1.3.4.3 Methodology Transport system for waterway system analysis

a) General

The analysis of the Transport system on the waterway system level is focused on the following four aspects:

- Existing infrastructure: ports/terminals connected to IWT, locks, roadways and railways;
- Transport costs and intermodal competition;
- Fleet analysis; and
- River information systems.

The first activity of this analysis consisted in data collection; the main sources for it were ANTAQ statistical report of 2011 (Fleet and Ports throughput), PNIH dated from 2013 (terminals/ports location and status), official Navy documents (signaling, monitoring, availability of nautical charts), MoT maps, PNLT database and PNLP.

Throughout the analysis, two steps were carried out: data checking and addition, for the latter, stakeholder interviews were the main source. Whenever the information obtained from the official source (e.g. ANTAQ) diverged from the stakeholders, the first was considered. However, if there was no information available regarding a certain aspect, the addition was mainly made based on the stakeholder interviews.

While all those aspects are important, the major focus on the analysis of the competitiveness of inland waterway transport will be on total transport cost. The question to be answered for each river basin will be: “Could inland waterway transport be competitive for a specific commodity with a specific origin and destination?” If not, development will not materialize.

Although the actual cost per tonkilometer of inland waterway transport is low as compared to road and even rail transport, the disadvantage of inland waterway transport (and of rail transport as well) is the fact that the infrastructure network (the waterways and the rail network) is not as dense as the road network. Therefore, the inland waterway transport requires pre- and end-haulage. By truck (or, in some cases, like the Tiête-Paraná, a combination of truck and train) the cargo needs to be transported from its origin to an inland port or terminal. Afterwards transport is needed from an inland terminal to the final destination. These operations involve additional loading and unloading activities and consequently additional cost.

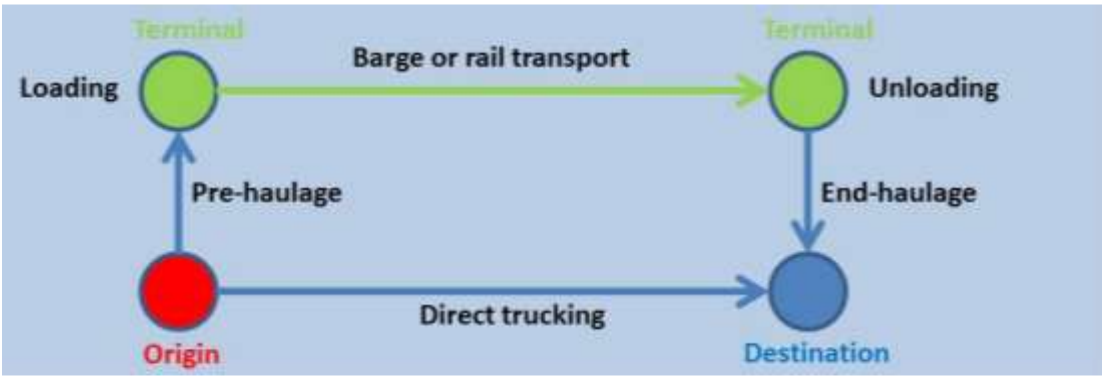

Figure 1.3.9: Transport Chain between Origin and Destination

For this study a transport cost model has been developed by the University of São Paulo (see Appendix IX).

This model presupposes that a certain river stretch will be navigated by the optimal convoy. So, in a way, it supposes that certain river improvement works have been carried out to upgrade the river. For that situation the model determines the transport cost. If in this optimal situation inland waterway transport cannot be competitive, it is not interesting for the companies. In that case it can be concluded that upgrading the river will not be worthwhile, Giving the development of that specific waterway system a low priority.

The model has been applied to determine the transport cost for specific commodities with specific origins and destinations. The base year for the cost calculations is 2031, to indicate the potentials of the river basin for future intermodal competition. For instance, the export of soy from a specific region. The origin of the cargo is the center of the production area. A number of different sea-ports can be chosen as the destination of the inland transport chain. For each of these sea-ports a number of road/rail and inland waterway transport options between the production area and the port can be selected. The cost associated with these options is calculated and the cost-differences of these options is the input for the analysis of the competitiveness. In some cases an inland terminal had to be selected for these calculations in areas where no terminals were available yet. A preliminary choice has been made on the basis of road accessibility to the production areas and the location of dams without locks. During the next step of the project these assumptions will be verified and the location of inland terminals will be optimized.

b) Cost Models

As presented earlier, a comparison of the transport costs was made for different routes and different modes, through the development of a Cost Model, whose methodology is presented below. The table of cost composition was used for the calculation of the costs of water transportation and can be found in Appendix IX. The values in the yellow cells correspond to reference information, and can be changed.

Highway Costs

The proposed methodology is based on the composition of unit costs and on consumption coefficients / factors of use.

It was initially defined the relevant cost categories to ensure it to be representative and sufficiently detailed for the purpose of PHE.

The following costs were considered for the transport of loads:

- Variable costs: fuel, tires, oils and lubricants, vehicle maintenance, ARLA32 and washes;
- Fixed costs: depreciation and capital return rate of vehicles, salaries and expenses with drivers and assistants, licensing / property taxes / compulsory insurance and vehicle insurance.
- Administrative costs: 8% of the sum of the variable and fixed costs, to cover the indirect costs of operation.
- Apportionment factor: It was considered a proration factor of 100% of the costs of the complete cycle for journeys with empty return, while in the case of travelling with return cargo from another shipper this factor ranged between 55% and 70%, depending on the type of vehicle / load, due to the difficulty in finding such return cargo.

For road transport were developed spreadsheets for the following categories of cargo: grain and dry bulk, liquid bulk, containers and general cargo (trunk).

About the vehicles sizes, it was developed spreadsheets to analyze the followings vehicle sizes at road transport: carts with 5 and 6 axes, 'bitrem' and 'rodotrem'.

These methodologies were applied in spreadsheets in Excel, properly parameterized in order to allow calculation of costs for any route, path or transport chain, once it is known the operating parameters, such as:

- Origin and Destination;
- Distance;
- Average velocity, and journey time, by direction and total;
- Time of loading and unloading in terminals, including delays;

The proposed methodology does not consider the following costs:

- Facilities costs of any nature (administrative, operational support) besides personnel and support equipment;
- Transshipment costs and terminal loading and unloading activities;
- Toll Expenses;
- Additional costs related to differentiated type/condition of the highway, pavement type and condition;
- Costs of taxes and fees on the transported load, including, in particular ICMS;

- Traffic Costs.

Waterway Cost

Similarly to road transportation, the proposed methodology of waterway costs is based on the composition of unit costs and consumption coefficients/factors of use, considering the vessel characteristics (barge, pushboat and train formation, in terms of number of rows and columns of barges), and the route.

The hourly costs considered are divided into stopped train costs and the navigating train costs, so that, multiplying these values to their stopped and navigating time, you get the total cost.

The methodology is based on the division of the transport costs between fixed (that are independent of the operation of vessels), and variables (directly linked to the operation of ships and administrative staff).

It was selected the costs of each category, in order to ensure that they were representative and sufficiently detailed for the purpose of the PHE:

- Fixed costs: capital cost, insurance, maintenance, maintaining, docking, crew expenses;
- Variable costs: cost of fuel and lubricants, whose costs were calculated according to the vessel cycle operation time in each direction.

These costs calculations were made by means of the operational characteristics of a particular vessel, route characteristics, vessels and the terminal characteristics (origin and destination).

Such methodology was modeled in spreadsheets in Excel, properly parameterized in order to allow the determination of the cost per ton and per transported kilometer, according to an existing demand in the origin and destination of the vessel. Furthermore, it is also possible to determine the fleet of vessels needed to meet these demands.

As stated in the proposal approved by Arcadis, the proposed methodology does not consider the following costs:

- Costs for loading and unloading in terminals;
- Expense rates and taxes due to the use of the waterway

c) Interactions with economic forecasts

The multi-modal competition analysis is basically focused on the competition within a specific river basin. As stated in the previous paragraphs, the question to be answers is: “Could inland waterway transport be competitive for a specific commodity with a specific origin and destination?” During the next phase this analysis will be expanded for the selected river basins. For each production region a port selection analysis will be made. This analysis will determine the most competitive route to a port (be it either multi-modal, IWT, rail or direct trucking).

For the present economic analysis a port selection has been assumed for each specific region. For instance, 50% of the agricultural cargo in the Matopiba region is assumed to go to Vila do Conde via Rio Tocantins and 50% to go to São Luis via the Parnaiba and rail. The port selection analysis in the next phase may have an effect on this division of flows and consequently on the economic forecasts for the different river basins.

1.3.5 Governance and institutions

Besides the characteristics of the river itself and of its surroundings, navigation depends also on the institutions that make feasible, support, regulate and guide waterway transport.

An understanding of the institutional-legal panorama where river navigation is inserted helps to portray waterway governance in Brazil and reveals bottlenecks and strategic points that allow, further on, suggestion of structuring actions for the enlargement of the waterway modality in the country.

1.3.5.1 Analysis of official documents and specific studies

The first step of this work involved the analysis of official documents, such as laws and policies that compose the legal-institutional framework where waterway management is inserted. Thus, the main guidelines and instruments contained in national policies, plans, programs and projects concerning waterway transport were identified. Besides official documents, technical studies, research and academic works connected to the thematic object of this study were also reviewed.

All the most important legislation related to the issue was surveyed and analyzed for characterization of the entire legal environment[6] pertaining to the topic, as well as the national environmental law principles that give these norms flexibility and whose understanding is vital to lay out the entire set of actions intended.

This entire search and understanding process was necessary to compose a basic referential that contributed to understanding the nature and objectives of these policies and the possibilities and limitations that the legal–institutional structure regarding environmental matters imposes on completion of the various actions intended within the scope of a strategic waterway plan.

1.3.5.2 Description of the public institutions linked to waterway and port management in Brazil

From the survey and characterization described above it was possible to identify the institutional actors participating in inland navigation, ports and intermodal integration. With this, their competence and formal attributions were surveyed, as well as the organizational structure (Appendix II) in order to allow an analysis of the intra and inter-institutional relationships.

[6] The legal universe considered in this study refers solely to the main relevant standards to inland navigation issue, object of this study, in the constitutional and legal levels. Some “infralegal” standards, like decrees and resolutions are only cited when their inclusion are fundamental to the understanding of the different commands and legal mechanisms, as well as the powers of the institutions involved.

It was decided to analyze institutions acting at the federal level, since the competence over the cargo and passenger waterway transport service belongs to the Union. In a supplementary way, given the regional importance of waterways, some institutions were also analyzed at the state level in order to further permeate the analysis. Eventually/In the end, 25 institutions were consulted al the federal level and 225 at the state level, encompassing the Tiete-Paraná, Parnaíba, Paraguai, Uruguai, Southern, Teles Pires - Tapajós, Amazonas, Madeira, São Francisco and Tocantins – Araguaia waterway systems, resulting in a total of approximately 250 institutions. Among these institutions are included some Hydrographic Basin Committees, as well as the DNIT, ANTAQ and IBAMA regional offices.

All the institutions analyzed were organized in an institutional matrix where their formal assignments, a brief history and the legal base that supports them were described and contact data was provided.

1.3.5.3 Selection of institutional actors to be interviewed

The survey of the institutions related to waterway and port management permitted some of them to stand out as central institutions, since they had greater involvement in the waterway topic. Clearly, those acting at the federal level were directly considered central due to their competence with regard to the waterway transport services provided, whether cargo or passenger.

It was necessary to acquire a deeper knowledge of the institutions considered central. Thus, the outstanding institutions in terms of competence and action with regard to waterway management were selected for in person interviews.

The institutions objectively participating in the current waterway management structure were considered central, so all waterway administrations and CODOMAR, DNIT and ANTAQ were interviewed. Besides them, some port management actors were also interviewed for the purpose of obtaining an overall panorama. For such, the Port Secretariat (SEP), the Dock Company of Pará (CDP) and the Port Authority of East Amazon (CPAOR) were interviewed. It was also decided to interview representatives from the IBAMA and the Secretaria de Fomento para Ações de Transportes (fostering transport actions) of the Ministry of Transport to understand, in the first case, relevant questions referring to the environmental licensing process for infrastructure connected to waterways, ports or terminals and maintenance works and, in the second case, to understand the concept of more macro planning in the ambit of transport. Finally, some regionally important actors were also interviewed, such as transport and environment state departments or secretariats (DH-SP, CPH-PA, SOPH-RO, SEDAM-TO).

When contacted by electronic means, these institutions received a semi-structured questionnaire (see Product B: Stakeholder Analysis) containing some of the questions to be discussed during the interview. The option for this type of questionnaire turned out to be very convenient to the extent that a free interview and analysis of the results would be difficult to systemize and, on the other hand, an interview with a closed script would leave little room for disclosing more subjective, though no less important, aspect concerning management experience.

Most of the meetings took place in person, excepting some held by telephone and, from them, minutes were drawn up and presented in a supplementary report of the Stakeholder Analysis Product. The information obtained from the interviews helped compose the analysis of waterway management at the regional and national levels presented in this study.

1.3.5.4 Analysis of waterway governance at the regional and federal levels

After the survey of the information obtained was concluded, whether by collecting it via secondary sources or through interviews, a matrix was prepared crossing some major assignments against institutions operating in waterway and port management to check the occurrence of institutional overlapping or even gaps.

The analysis was made at two levels: federal and regional. In both cases an attempt was made to make the operational area of every institution and how they interact with each other and with the other institutions, whether at federal or regional level, explicit.

In this phase international organizations involved with the topic were also incorporated, having their interactions with management in Brazil as the main focus.

From this analysis of governance it was possible to view the institutional and organizational differences between the administrative regions.

2 "BENCHMARK" INTERNACIONAL: EUROPE AND THE UNITED STATES

To gather inspiration for the strategic plan for inland waterway transport (IWT) in Brazil, a benchmark was carried out as a part of the PHE project in the Assessment and Diagnoses phase (Product 3). This chapter contains a summary of this benchmark report. The full report can be found in Appendix I. A benchmark is a research method in which, for instance: processes, products and/or performances from different organizations or areas are compared. In this project, the inland waterway transport (IWT) in Europe (EU) and the United States (US) have been chosen as a benchmark for Brazil.

2.1 INTRODUCTION

IWT has a long history in the EU and the US. Because of that, IWT is well developed and lessons can be learned from both positive and negative experiences. The results of this report can be valuable to Brazil to improve its governance, processes and performances with regard to IWT.

The information in this report is based on a literature review and interviews with several experts. To create the best link with the other elements in the Analyses and Diagnoses, this report is based on the four research pillars:

- Physical river system, social and environmental aspects
- Economy
- Transport system
- Governance and institutions

To give a general impression of the differences between the EU/US and Brazil, some numbers are presented below:

Table 2.1.1: System Overview Waterways in Europe, U.S. and Brazil

Aspect	Europe	United States	Brazil
Size in km^2	10,180,000	9,826,675	8,514,877
Length of waterways in km	51,668	41,009	41,994
Length of navigable waterways (used for commerce) in km	EU25: 37,200 EU27 2008: 40 929	19,312	20,956
IWT cargo per year	Rhine: 310 million tons	Mississippi: 483 million tons	Brazil total: 25 million tons
Fleet size (amount of vessels)	17,679	40,512	857

IWT has played an important role in the development of the EU and the US and could play an important role for Brazil as well. The main industrial areas in Europe are located near waterways. Some examples are: Amsterdam, Rotterdam, the Ruhr Area, Antwerp, Hamburg, Basel-Mulhouse-Freiburg. Strasbourg, Rhine-Neckar, Frankfurt-Rhine-Main, Vienna and the agricultural areas of the Balkan Peninsula. The growth of the United States is also closely linked to the development of infrastructure, and in particular, the inland navigation system.

Although the characteristics of the countries are different (in terms of cargo flows, geographical spread of economic activities), the numbers above indicate that if the right circumstances can be created in Brazil, there might be potential to increase the amount of IWT. Advantages of IWT are that it can be significantly cheaper than road or rail transport, it is a cleaner mode of transport and it can help reducing congestion on roads.

2.2 CURRENT EXPERIENCE WITH IWT IN EUROPA AND UNITED STATES

This sections provides an overview of the main characteristics of the IWT systems in the US and Europe. They are divided into the research pillars.

2.2.1 Physical river system, environment and social aspects

- A classification of the waterway system proved to be elementary. This enables looking at the waterway system as a network. From there, a well-balanced and uniform network can be created.

- The conditions and characteristics of the waterway system support a rapid and scheduled IWT service that is reliable. These include minimum depths, locks, and manageable distances. The experience in Europe shows that frequency and level of service are the most important means for competing with trucking services. This means that maintenance of the waterway should not be underestimated. Continuous maintenance of the waterway and fleet is important as well as education of personnel/crew.

2.2.2 Economy and Transport system

- Large companies/shippers (=the amounts of cargo) mainly determine trade on the waterway systems. They have the power and the money to invest (in quays, ships, facilities). Small privately owned transport companies can offer low transport prices but cannot support a transport chain.

- In Europe, there is a focus on developing several main sea ports for large amounts of cargo, especially for containers. Significant volumes are necessary to make IWT affordable. Bulk cargo is usually transported in large quantities.

- Inland ports are focal points for loading and unloading cargo from many destinations. It is important to develop large hubs to create economies of scale. Clustering can offer more facilities and will attract bigger ships, companies can cluster around the hubs and strengthen each other and hubs offer the opportunity for inter-modality (railway construction to one large hub is easier than to several locations)

2.2.3 Governance and institutions

- Navigation on the rivers is free along the whole river course: no taxes at borders of states, countries etc, no toll or other charges. However, channel costs or service charges sometimes apply. By not charging taxes on fuel (in the EU and parts of the US), IWT is given an advantage over other transportation modes.

- Any decisions and measures by the authorities are always taken in the interest of public safety and freedom of navigation. These values are none negotiable.

- The role of the government/institutions is relatively small, but important. Most important responsibilities are: inspections of ships, safeguarding the reliability of waterways (safety and maintenance), defining standards, developing legislation and create funding.

- Managing waterways is based on the entire waterway system, to make sure all interests of stakeholders are involved. If a waterway system covers several countries: a supranational commission based on the waterway system has been established (if a river only covers 1 country than the federal government has the authority over interstate commerce). This commission makes the important decisions and has its own competence. Examples are the Central Commission for the Navigation of the Rhine and The Danube Comission. The latter can be seen as a 'light' version as it does not have competence. All riparian states or countries have representatives and equal votes in this commission. In order to make decisions, all members must reach consensus.. Decisions are taken based on mutual interests.

- River management uses a holistic approach. There are many different interests related to the river. By looking at navigation it helps to look at win-win situations and combining interest. Some good examples can be found where navigation, water management and generation of electricity have been combined. An example of this integration can be found in Europe, where companies are only allowed to build dams if they construct and maintain locks for navigation purposes.

Many of these characteristics can be taken as an example for IWT development in Brazil. In the next chapter, the strengths and weaknesses of the current Brazilian IWT system and the opportunities and threaths for IWT development are described. Chapter four provides a list of suggested measures for IWT development in Brazil. These measures are partly based on the international benchmark with Europe and the United States.

3 ANALYSIS OF THE CURRENT SITUATION

3.1 MACRO ANALYSIS OF IWT

3.1.1 Physical aspects of the rivers and socio-environmental characteristics of their surroundings

The Brazilian rivers studied in the present plan show different characteristics from the point of view of the physical and navigability conditions, resulting from the different topographic, geomorphologic, and hydro meteorological conditions existing along the river basins. The present study, as detailed in the methodology, analyzed these characteristics for each river that composes what has been defined as the waterway system, for the purpose of providing inputs to the preparation of the strategies and fostering the integrated planning of future interventions required to make feasible or maintain the navigation conditions in the rivers. For this same purpose, the socio-environmental characteristics of the area around the rivers were also analyzed. A deeper and more thorough analysis[7] will be shown later on in chapters dedicated to each of the waterway systems[8]. This section is provided to show a scenario on a national scale of the main characteristics observed in each of the waterway systems, from the point of view of both physical and social and socio-environmental aspects.

The rivers most favorable for navigation are generally those with low course or plain characteristics, featuring a smooth and regular slope, and reasonably wide, having some silted points as main obstacles. Within the national scenario, the main plain rivers that show long sections with more favorable characteristics for navigation, without the need for major interventions are the Amazonas, Solimões, Trombetas, Madeira, Paraguai, Jacuí Rivers, and Lagoa dos Patos (lake), which currently have active waterways. It is worth mentioning that the rivers within areas of major importance for the conservation of biodiversity, such as those of the Amazon (Amazonas, Solimões, Trombetas and Madeira Rivers) and the Pantanal (Paraguai river) biome, are already, to a large extent, used as means of transportation between local communities and even for cargo transport. The waterway is considered a means of transport of relatively low impact on the environment and the surrounding communities, when compared to highways and railways. However, in order to ensure minimum impact is caused by the possible adequacy to infrastructures or the execution of maintenance works, it is necessary to develop planning in an integrated manner, so as to reconcile the multiple interests that exist around these areas.

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[7] Range of 10 km from each side of the river banks

[8] It is worth mentioning that, since this is a strategic study, the degree of detail and depth is compatible with the type of study, and it is expected that studies even more detailed are performed at the time of the execution of each project.

There are also medium course rivers, or plateau rivers, which show more restricted conditions for navigation, including sections with natural obstacles such as steps, rapids, rock outcropping steps, rock outcrops, and low depths alternating with sections having more satisfactory navigability conditions. In the sections of rivers with these characteristics, commercial navigation is possible, in most of the cases, during the flood season, when the depth is deeper. During drought seasons, however, navigation conditions are too restrictive when the natural barriers crop out on the river surface.In these rivers, the need for works and hydraulic interventions is considerable.

In Brazil, the main plateau rivers that show navigable sections are: the Paraná, Tietê, Paranaíba, São Francisco, and Madeira, since they underwent different interventions to enable navigability conditions. Plateau rivers, which are worth mentioning in the national context, with potential for the implementation of waterways, if interventions are carried out, are the Tocantins, Araguaia, Tapajós, Teles Pires and Parnaíba rivers.

The rivers within the semi-arid region (São Francisco and Parnaíba) need special attention so as not to limit water availability for local population. This way, dams and flow regulating projects, which help to make the waterway feasible, need to be evaluated together with further uses of water resources so as to ensure that their feasibility does not harm the availability of water to the surrounding regions.

Therefore, in the context of Brazilian waterway navigation, in spite of the existing large river basins, only a small fraction of the rivers is used for commercial water transport, especially with regard to those with plain characteristics, together with plateau rivers which have undergone interventions for the maintenance of navigability conditions.

Please find below the maps that summarize the obstacles to navigation and the areas of special interest that can foster integrated planning with regard to the social and environmental characteristics of the areas around the rivers.

CONVENÇÕES CARTOGRÁFICAS

Referências Locacionais
- Capital Federal
- Capital Estadual
- Limite político adm.
- Limite Municipal
- Massa d'água

Escala de ponderação dos temas
1 - 5 (baixa - alta)
- IN - Insignificante
- BA - Baixa
- ME - Média
- AL - Alta
- MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionésimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 120 240 480 km

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGNÓSTICO DE NAVEGABILIDADE

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:17.000.000	- BRASIL -	MAI/2013

CONVENÇÕES CARTOGRÁFICAS

Referências Locacionais

- Capital Federal
- Capital Estadual
- Limite político adm.
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REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 120 240 480 km

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

LOCALIZAÇÃO DA FOLHA

Oceano Pacífico
Oceano Atlântico

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

VULNERABILIDADE SOCIOAMBIENTAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:17.000.000	- BRASIL -	MAI/2013

The paragraphs below summarize the main characteristics of the navigability conditions for the Brazilian rivers analyzed by the present plan.

Amazon waterway system

The navigability conditions along the Amazon basin rivers are conditioned by the presence of the Amazon depression. This is, in general, an area with an extremely flat surface, dissected by extended and prolonged river erosion processes, creating a modeled landscape of low hills and low altitudes in relation to sea level. The figure below shows the borderlines of this depression.

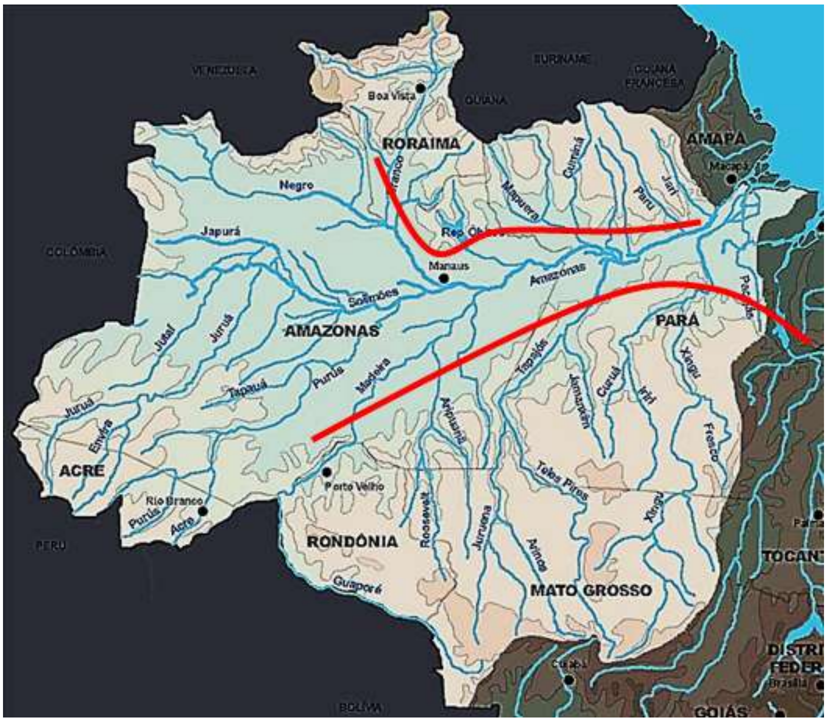

Figure 3.1.1: Amazon Depression Borderlines

The Amazon depression enables the low slopes of the Solimões and Amazonas rivers. The border of the geological formation is located at the same elevation as that of the various cities/locations whose navigation is reached under a natural regime, such as the case of Tucuruí, Altamira, Itaituba and Humaitá, on the Tocantins, Xingu, Tapajós and Madeira rivers, respectively. Within the limits of this depression, the rivers have good commercial navigation conditions throughout the year. Navigation encounters some obstacles in the areas upstream of these points because of a transition zone between the depression and the plateau regions. In these sections there are more slopes and rock outcrops.

Due to the large hydroelectric potential existing in these transition sections, these segments have been focus areas for studies of various hydroelectric power plants (UHE) such as the Belo Monte (Xingu River), Marabá (Tocantins river), Santa Isabel (Araguaia river), São Luís do Tapajós (Tapajós river) and Santo Antônio and Jirau plants (Madeira river).

The rivers on the right bank of the Amazon and Solimõe rivers, more specifically the Purus, Acre, Juruá, Japurá, Tarauacá, Envira and Içá, consist of rivers of low slope, with a high number of meanders, arms, islands, in addition to an intense sedimentation process, represented by the numerous existing sand banks. These rivers are the main connection routes between many cities located on the banks due to the absence of land routes. With regard to commercial navigation, the best physical conditions can be noticed during the flood months when the water level goes up significantly and enables the passing of larger convoys. However, during drought time, the high number of natural obstacles combined with the low depths restrict the passing of commercial vessels.

The rivers on the right bank of the Amazon river share common characteristics, such as lower sedimentation processes and a lower sinuosity rate. The Negro, Branco, Uatumã, Trombetas, Paru and Jari rivers have good navigation conditions up to the point where they meet the Amazon depression borderline.In these transition areas, the presence of rapids, falls or steps can be noticed. The rapids of Santa Isabel do Rio Negro (Negro river), Bem Querer falls (Branco river), Morena falls (Uatumã river), Porteira falls (Trombetas river) and Santo Antônio falls (Jari river) stand out. Upstream of theses points, navigation is not possible without new interventions.

It is worth mentioning that the presence of areas of conservationist interest and traditional communities, as well as dense vegetation cover in the vicinities of the rivers of this region, should encourage integrated planning for the innervations which may be necessary so as to encourage the setup/establishment/strengthening of a means of transportation that would have less impact on the environment.

Madeira River system

Madeira river stands out among the affluents of the Amazon river. It consists of a waterway already in operation with proper navigability conditions from its mouth to Porto Velho with only a few seasonal and punctual obstacles.

The annual variation of Madeira river water depths is on the order of 12m. During flood periods, the Madeira river is influenced by the Amazon river, and this generates large flood areas, inundating the existing rapids in the most upstream section of the Madeira river. The more critical sections correspond to the segment between Humaitá and Porto Velho, where there are rapids and rock outcrops during the drought period.

It is also worth mentioning the bank erosion processes present in long sections of the river causing localized silting problems, which appears mostly during the drought period when the depths are lower.

Due to the absence of lock systems in the Santo Antônio and Jirau UHEs, navigation becomes unfeasible upstream of Santo Antonio dam.

In the same way as observed in the surroundings of the rivers of the Amazon waterway system, the Madeira waterway system surroundings include legally protected areas and indigenous lands, in addition to the presence of conservation units and other areas of conseravationist interest. Waterway transport could be the most adequate option for this type of area because it would cause less impact on the surroundings, but for this, it is necessary that the planning of the projects required for supporting the growth of this mode of tranport be carried out in a way so as to take the location of these areas into consideration, respecting the way of life of the traditional inhabitants, and trying to generate as little impact as possible on the environment.

Tapajós waterway system

The Tapajós river basin enables the creation of one of the most advantageous and strategic routes from the point of view of geographical position, connecting the main agricultural production complex of Mato Grosso to the Santarém port on the Amazon river, through the Teles Pires-Tapajós waterway. As previously mentioned, the Tapajós river is currently navigable from its mouth to Itaituba, covering a length of approximately 400km. From this point heading upstream, the Tapajós River runs within the transition zone between the Amazon depression and the Central Plateau, with a series of rapids where some hydroelectric power use has been anticipated.

The erosion and sedimentation processes are not so intense as those seen in other affluents of the right bank of the Amazon river. This is so due to the geological characteristics of the basin, composed of crystalline basalts. The main natural obstacles refer to the rock outcroppings and steps. Due to the presence of the forest over most of the course of these rivers, loading/unloading at intermediate river points may be a problem.

If the hydroelectric power plants anticipated for the Tapajós and Teles Pires rivers are built with lock systems, in addition to the interventions required between the plant reservoirs, then the Tapajós-Teles Pires waterway will be feasible. The electric sector planning could contribute to the feasibility of navigation along the waterway. In this region, among other areas of conservationist interest, is Jurena National Park, and its surrounding area is populated by traditional people. Therefore, this planning should contemplate not only the interests of inland water transport, but also the multiple interests that occur in the areas that surround the rivers.

Tocantins-Araguaia waterway system

Even though they occupy the same hydrographic region, the Tocantins and Araguaia rivers feature very different characteristics.

The Tocantins river, in the plateau section upstream of the Tucuruí river, is the channeled type, with a narrow flood plain, and it features a series of elements that need solutions and interventions to enable navigation from its mouth to the Peixe region. Along its entire course there are many rapids which are being used for the generation of hydroelectric power (Lajeado and Estreito UHEs – without lock systems) or which will serve as a means of implementing future power generation (Marabá, Serra Quebrada, Tupiratins and Ipueiras UHEs). Another major impediment is Pedral do Lourenço (São Loureço rock croppings), with an approximate length of 45 km, which hinders large-scale commercial navigation between the end of the Tucuruí reservoir and the city of Marabá during drought time. According to the division of steps (falls) anticipated for the Tocantins river, even with implementation of the reservoirs of these UHEs, occasional interventions will still be necessary.

The Araguaia river has characteristics associated with its geomorphology, with sandy sections on its bed where deposits of sediments are represented by sandbanks, and rocky sections by rock croppings and steps (travessões), which limit waterway navigation. It is worth mentioning the presence of ilha do Bananal (Bananal island), the largest river island in the world, delimitating two Araguaia river arms, where the smallest arm is know as the Javés River. This island, a transition strip between the Amazon biome and the Cerrado (savanna), concentrates a great biodiversity, in addition to areas legally protected, such as indigenous lands, and it was established by UNESCO as a Biosphere Reserve. The Araguaia River does not have adequate conditions for river navigation due to the large number of obstacles and the large flood plain, which prevents the implementation of level regulating dams.

Paraguai waterway system

The Paraguai river basin currently consists of one of the waterways with the best navigation conditions in Brazil. It runs through the Pantanal (tropical wetlands) of Mato Grosso and within the largest flood plain on the planet Its hydrologic behavior depends on the complex combination of the meteorological regime with the various plains whose lakes and bays work as flow regulators, accumulating water, lowering elevations during floods, and supplying water during the recession. The Paraguai river bed consists of sedimentary and non-consolidated material.

The Paraguai river, even when under free current conditions could be considered very satisfactory for navigation, with signaling, and could be divided into two different sections:

- From Corumbá to the mouth of the Apa River, navigation is feasible for convoys with a maximum draft of 2.6 m, having reduced bend radii and the presence of two bridges which require barges to be split up.
- In the section between Cáceres and Corumbá the layout is more sinuous and narrow and navigation may be difficult at certain points, due to the moving bed of the river, in addition to the existence of some very reduced bend radius curves. This section allows convoys with drafts up to 1.50 m.

Due to the presence of this waterway in an area of importance for the preservation of biodiversity, the studies for carrying out projects which may be required to improve cargo transport conditions along the waterway should take the environmental characteristics of the surrounding areas into consideration, as well as the population of traditional inhabitants who live nearby the rivers. Project planning should also consider the interests of neighboring countries because the river between Cáceres and the mouth of the Apa river borders Bolivia and Paraguay.

São Francisco and Parnaíba waterway systems

The main rivers with navigation potential in the Northeast region of Brazil are the São Francisco and Parnaíba rivers, with the first having twice as much drainage area as the second. The main difficulties involved with both rivers are the intense erosion processes on the banks and the recurrent silting problems, in addition to rock outcrop sections, which result from the geological characteristics of this region. These basins are the most prone to climate changes, with forescasts for a reduction of up to 40% of the outflow volume over a period of 100 years.

The São Francisco River crosses a long depression located between the Atlantic Plateau and the Central Brazil Highlands (Chapadas do Brasil Central), with rainfall rates varying from 1,800mm, at the headwaters, to 600mm near Cabrobó, with its water deficit being gradually accentuated as it runs downstream. The soils have low cohesion and vary from fine sand to gravel. The upstream sections are exposed to erosions which, combined with bank erosion processes, result in major river channel silting.

The São Francisco river is currently navigable by commercial convoys (draft up to 2 m) from Ibotirama to Juazeiro, passing through the Sobradinho reservoir (the only power plant equipped with locks) with, however, localized problems of sandbanks and rock outcrops. This navigation could be extended to Pirapora, requiring a number of interventions along the river, consisting of dredging and rock clearing, in addition to bank retention and beaconage. Downstream of Juazeiro/Petrolina conditions are inappropriate/inadquate and very precarious, with sections of extensive rock outcroppings, in addition to various hydroelectric power plants without locks, and fitted located in canyons. In order to ensure waterway operability, it is important to have an integration between what is in the interests of agencies responsible for waterway administration and the ONS, responsible for the operation of the Interconnected National System since the effluent flows from the Três Marias and Sobradinho hydroelectric power plants affect the navigability conditions along sections of the São Francisco river.

The Parnaíba river runs over a plateau with a semi-arid climate, with low water contribution and Cerrado (savanna) type of vegetation. The soil conditions, as occurs in the São Francisco river basin, are predominantly sandy and prone to erosion. Currently, the Parnaíba river, does not have favorable navigation conditions, and its main impediments are the intense erosion and sedimentation processes, in addition to rock outcroppings, which create many sections with minimum depths, improper for safe river navigation. Additionally, the river has segments with bottlenecks and accentuated curves, making maneuvering conditions difficult. The navigation possibilities are very limited, considering the current river conditions.

The non-completion of the projects to build the locks of Boa Esperança UHE (which has a length of only 50 m) prevents vessels from transposing this plant, and this caused an interruption of the incipient navigation existing until the middle of the 20th century. In addition to this plant, the implementation of new hydroelectric power plants has been anticipated along the Parnaíba river, and, if they are built with lock systems and the various relevant physical obstacles among the future reservoirs are solved, navigation in long sections of the river will be possible, especially in areas close to Teresina and up to Santa Filomena. In the section between Teresina and the mouth of Parnaíba river, the natural obstacles mentioned above are more critical, and no construction of hydroelectric power plants has been anticipated.

Since these two rivers are within a semi-arid region (São Francisco and Parnaíba river), special attention should be given to them, so as not to limit [the] water availability for the local population as previously mentioned.

Tietê-Paraná waterway system

In some rivers, like the Tietê and Paraná, since the first studies for interventions in these rivers, there was concern with regard to integrating the multiple uses of water resources, considering, in addition to the generation of hydroelectric power, the needs of navigation, irrigation, flood control, and human supply. For the main hydroelectric power plants built along the Tietê river, in addition to the Jupiá and Porto Primavera plants in the Paraná river, the lock projects were integrated into the designs, and, consequently, into the rock clearing works. This integration, in its initial planning and design phases, brought advantages and agility with regard to multiple use of the Tietê river water resources. Today, nonetheless, the existing locks operate at maximum capacity and could be seen as bottlenecks to the efficiency of the waterway.

Currently, the Paraná-Tietê waterway is navigable from São Simão, on the Parnaíba river, up to the hidroelectric power plant of Itaipu on the Paraná river, in addition to the Tietê river section from its mouth to Anhembi. This waterway system has an installed infrastructure, and it is currently operating with special focus on the section between São Simão and Anhembi, without any evident physical difficulty. The navigation could be extended, in the Tietê river, to the city of Salto, if the hydroelectric power plants with locks under study are built.

The Paraná river basin also has various affluents which enable, if occasional interventions are carried out, small-size commercial navigation only, as occurrs on the Ivaí, Ivinheima, Amambaí and Tibagi rivers; in addition to affluents such as those of the Paranapanema and Grande rivers, which have various hydroelectric power plants in cascade, all of them without locks.

South waterway system

The South Atlantic basin has an installed waterway infrastructure and capacity for the navigation of medium-sized convoys. This system covers Lagoa dos Patos (Patos Lake) and the Guaíba, Jacuí and Taquari rivers. There are five locks installed (Amarópolis, Anel de Dom Marco, and Fandango on the Jaruí river, Bom Retiro on the Taquari river, and Cinturião, in São Gonçalo Channel) which enable navigation in long sections of this system.

River navigation is possible primarily between Rio Grande, in the connection of Lagoa dos Patos to the Atlantic Ocean, up to the capital city of Porto Alegre, by sea vessels. Navigation is also possible on the Jacuí river up to Cachoeira do Sul, showing difficulties due to silting and rock outcropping/outcrop areas, mostly upstream of the Amarópolis lock, and in the Taquari river, up to the city of Estrela, with seasonal and occasional depth problems downstream of the Bom Retiro lock.

Lagoa dos Patos and the Jaguarão river, on the borderline with Uruguay, do not have proper conditions for commercial navigation, they lack delimited nautical routes and show generalized silting problems.

Uruguay waterway system

The Brazilian section of the Uruguai river is navigable only in occasional sections and during certain periods of the year. The river is wide, with rock outcroppings and steps in various sections, in addition to insuperable rapids. Commercial navigation is conditioned on the implementation of dams with locks, and dredging and rock clearing activities along the entire course.

3.1.2 Economic Aspects

3.1.2.1 Introduction

In this part a short description is given of the Brazilian economy. We start with the macro-economic developments. After that the focus will be on international trade (imports and exports). The last part is dedicated to the relation of IWT and international trade. It describes why is international trade important for IWT and what commodities are especially important.

3.1.2.2 Macro Economics

a) A short history

Brazil's economic history is marked by a succession of cycles, each of them based on the exploitation of a single export commodity: timber (brazil wood) in the first years of colonization; sugar cane in the 16th and 17th centuries; precious metals (gold and silver) and gems (diamonds and emeralds) in the 18th century; and finally, after a series of inland expeditions, coffee in the 19th and beginning of the 20th centuries. Slave labor was used for production, a situation that would continue until the last quarter of the 19th century. Paralleling these cycles, small scale agriculture and cattle tailing were developed for local consumption.

Small factories, basically textile factories, started to pop up in the mid-19th century. Under Emperor Pedro II new technologies were introduced, the fledgling industrial base was enlarged, and modern financial practices were adopted. With the collapse of the slave economy (it was cheaper to pay wages to new immigrants than to maintain slaves), the abolition of slavery in 1888, and the replacement of the monarchy by the republican regime in 1889, Brazil's economy suffered severe disruption. The endeavors by the first republican governments to stabilize the financial environment and revitalize production had barely succeeded when the worldwide effects of the 1929 depression forced the country into new readjustments.

A first surge of industrialization took place during the years of World War I, but it was only from the 1930's onwards that Brazil reached a level of modern economic behavior. In the 1940's, the first steel factory was built in the state of Rio de Janeiro at Volta Redonda.

The industrialization process from the 1950's to the 1970's led to the expansion of important sectors of the economy such as the automobile industry, petrochemicals, all steel, as well as to the initiation and completion of large infrastructure projects. In the decades after World War II, the annual Gross National Product (GNP) growth rate for Brazil was among the highest in the world averaging, until 1974, 7.4 percent.

Huge capital inflows were directed to infrastructure investments and state enterprises were formed in areas that were not attractive for private investment. The result of this capital infusion was impressive: Brazil's Gross Domestic Product (GDP) increased at an average rate of

8 percent per annum from 1970 to 1980 despite the impact of the 1970's world oil crisis. Per capita income rose fourfold during the decade.

In the early 1980's however, a sudden, substantial increase in interest rates in the world economy coinciding with lower commodity prices precipitated Latin America's debt crisis. Brazil was forced into strict economic adjustment which brought about negative growth rates. The unexpected suspension of capital inflows reduced Brazil's capacity to invest. The burden of its debt affected public finances and contributed to an acceleration of inflation. In 1987, the government suspended Brazilian interest payments on foreign commercial debt.

The 1980's crisis signaled the exhaustion of Brazil's import substitution model and it contributed to the opening up of the country's economy. In the early 1990's, Brazil's economic policies were centered on economic stabilization, opening up the economy to international trade and investment, and normalizing relations with the international financial community. In 1992, Brazil reached an agreement with both public and commercial creditors to reschedule its foreign debt payments, exchanging old debt for new bonds. This rescheduling marked Brazil's return to the international financial markets.

The turning point in the stabilization process came with the launching of the Real Plan in June 1994. The Real Plan has three main objectives: (1) keeping inflation under control; (2) obtaining a steady and substantial reduction of social imbalances; and (3) achieving long-term sustainable growth of GDP, investment, employment and productivity.

In 1998, price increases have been the lower in four decades, around 2 percent, down from more than 2,100 percent in 1993 before the launching of the Plan. Since inflation constitutes a form of tax on the poor, price stabilization represented a significant redistribution of income in favor of the most needy. In the period 1995-97 cumulative GDP growth was 17 percent, an average of 4 percent per year, while per capita income average growth was 2.6 percent. The increase of industrial productivity, which has averaged 7 percent a year in the 1990’s, is very important to ensure sustained growth in the future.

b) Short term developments

In recent years the Brazilian economy seems to have done better than a lot of other economies in the world (especially Europe is not doing very well). In table 3.1.1 the expectations for 2011 and the forecasts for 2012 and 2013 are given[9].

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[9] Source Country report Brazil (Rabobank april 2012)

Table 3.1.1: Short term forecasts for Brazilian economy

	2007	2008	2009	2010	2011e	2012f	2013f
Key Risk Indicators							
GDP (% real change pa)	6.1	5.2	-0.3	7.6	2.7	3.3	4.5
Consumer prices (average % change pa)	3.6	5.7	4.9	5.0	6.6	5.5	5.2
Current account balance (% of GDP)	0.1	-1.7	-1.5	-2.2	-2.1	-2.6	-3.1
Economic growth (% real change pa)							
GDP	6.1	5.2	-0.3	7.6	2.7	3.3	4.5
Gross fixed investment	13.8	13.6	-6.8	21.5	4.8	6.0	8.0
Private consumption	6.1	5.7	4.4	6.9	4.1	4.0	4.9
Government consumption	5.1	3.1	3.1	4.2	1.9	3.0	4.0
Exports	6.2	0.5	-9.1	11.5	4.5	5.9	6.4
Imports (% real change pa)	19.8	15.3	-7.7	35.9	9.9	13.8	13.6

Still in 2011 and 2012 the growth was a lot lower than expected as became clear in February 2013:

> The growth of the Brazilian economy has dropped significantly last year. That became clear from figures from the Brazilian statistical agency (IBGE). The gross domestic product (GDP) rose by only 0.9 percent. In 2011 came the growth still reached 2.7 percent a year earlier and was even an increase by 7.5 percent.
>
> The decline in growth was mainly due to the disappointing developments in the agricultural sector, which shrank by more than 2 percent. The industrial activity went down by nearly 1 percent. The only sector giving hope was the services sector. This sector grew by nearly 2 percent in 2012.
>
> Source Country report Brazil (Rabobank april 2012)

This shows how hard short term forecasts are. It also shows one of the threats for the Brazilian economy. At the moment the dependence on exports is very high.

c) Long term perspectives

Background

For the long term perspectives more fundamental assets are important. On the one hand population is very important. Brazil has a growing dynamic population. Especially the middle class is becoming stronger and larger in the coming years. The education level will be higher, which is important for the labor market. Another important factor is formed by the natural resources of Brazil. Three (partly interdependent) resources are important in this respect:

- The large resources of raw materials like iron ore, manganese ore, copper, gold and a number of other minerals. This will stay the backbone for the Brazilian industry, especially if more value can be added (exports of steel instead of iron ore)

- The very fertile soil, especially in the Cerrado area. This makes a very rich harvest of a large number of crops possible. An example is the safrinha (little harvest).

Safrinha is a farming strategy whereby the farmer takes advantage of a long tropical growing season to produce two crops in a single growing season, thereby maximizing revenue per acre. The main crop is usually an early-maturing soybean variety, which is closely followed by the production of a second crop of corn. Yields of each crop are below maximum yields obtainable with a single season crop, this is offset by increased revenue. This strategy has proven so successful that seed companies are developing special varieties tailored to the strategy.

- The various energy resources. Brazil was one of the first countries to use bio fuel in the form of ethanol, made from sugarcane. Hydro-electric power is very important as an energy source and last but not least Brazil is increasing the domestic production of crude oil with the development of the pre salt project.

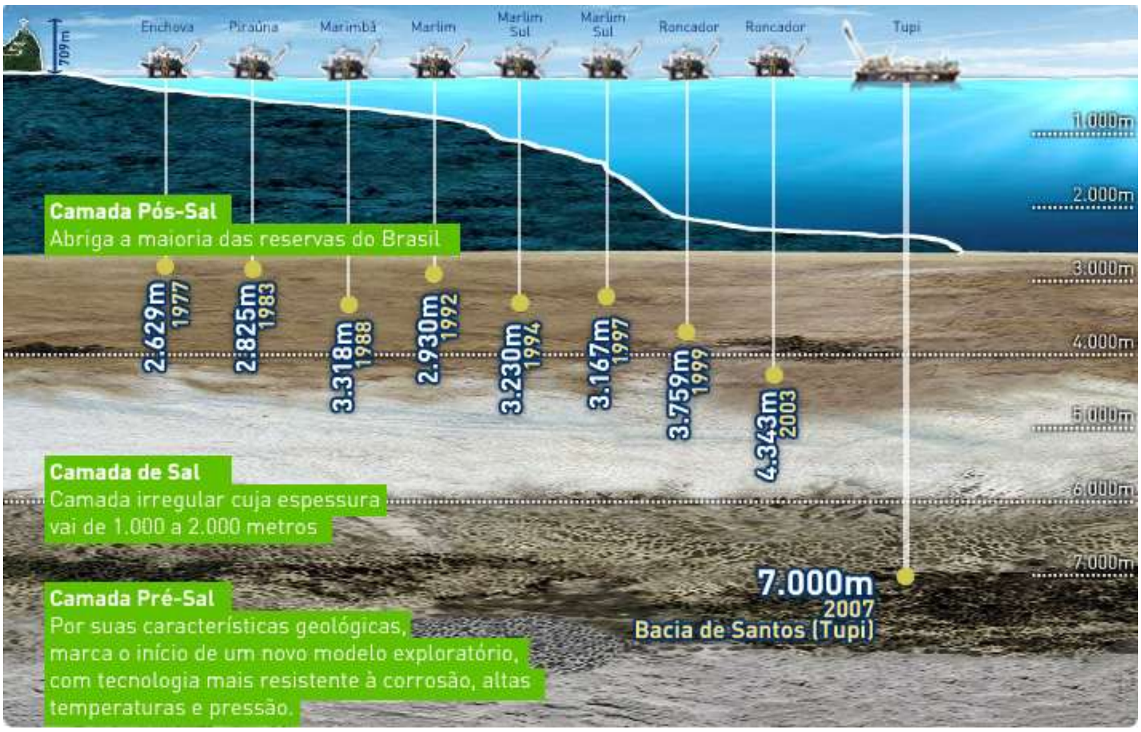

Figure 3.1.2: Pre Salt project[10]

[10] Figure taken from: http://www.petrobras.com.br/en/about-us/profile/activities/oil-and-gas-exploration-and-production/

The basics all look very good. However, the complex institutional framework with cumbersome procedures combined with a weak infrastructure network result in high transaction costs, a major impediment for economic development.

Long term scenario's

In recent years a number of scenarios have been developed. In the economic part of PHE two different scenario studies have been used:

The FIESP / ICONE scenario study for agricultural products. This study is used for the forecasts of agricultural products like soy, corn sugarcane and fertilizers. The main macro-economic assumptions of this study are similar to the macroeconomic scenarios to the ones used by FAPRI-ISU World Agricultural Outlook 2012 (http://www.fapri.iastate.edu/). FAPRI expects an annual growth of 4.4% in Brazil in the period till 2025.

The scenario's in the National Mining Plan (PNM). Most important assumptions for the scenarios A till D are given in figure 3.1.3.

INCERTEZAS CRÍTICAS	Cenário A: NA TRILHADA SUSTENTABILIDADE	Cenário B: DESENVOLVIMENTO DESIGUAL	Cenário C: CRESCIMENTO INTERMITENTE	Cenário D: AMEAÇA DE ESTAGNAÇÃO
População	210,0 milhões	212,1 milhões	214,2 milhões	216,4 milhões
PIB Nacional	US$ 4.473,6 bi	US$ 4.942,5 bi	US$ 3.049,8 bi	US$ 2.485,8 bi
Taxa anual do PIB nacional	5,1%	5,6%	3,2%	2,2%
PIB •••••••••••••	US$ 21,3 mil	US$ 23,3 mil	US$ 14,2 mil	US$ 11,5 mil
Crescimento do PIB •••••••••••••	4,6%	5,1%	2,6%	1,6%
Demanda Nacional	Crescente e diversificada	Crescente	Instável	Em queda
Demanda Mundial	Levemente crescente e diversificada	Crescente	Instável	Levemente decrescente
Oferta de bens minerais	Crescente e com agregação de valor	Crescente mas sem agregação de valor.	Instável	Levemente decrescente
Gargalos de Infraestrutura	Superação razoável	Superação	Persistência	Persistência

Figure 3.1.3: Assumption scenarios PNM

In the PHE we assume a growth of 5% in the period till 2023 and 3% for the period 2023 – 2031.

d) The Brazilian economy: some conclusions

In the previous chapters we have highlighted the history, short term developments and long term perspectives of the Brazilian economy.

Strong points of Brazil are mainly the natural resources, including the agricultural production. Partly relating to the strong agricultural sector is the energy production. Brazil is a frontrunner in using non-fossil based fuel (hydropower, biomass / ethanol). Furthermore the population of Brazil will turn out to be a strong asset. Not only because the quality of education will further improve, but also because this will create a powerful base for domestic demand, providing for a possible shift towards a less export driven economy with larger shares of manufacturing industry and services, thus broadening the economic basis.

As weaknesses should be pointed out the bureaucracy, inefficient logistic, banking and tax systems, all bottlenecks in improving the competitive position of Brazil.

3.1.2.3 International Trade

a) Introduction

In this chapter we focus on the imports and exports in tons. We present four characteristics for imports as well as exports. The first is the commodity. This determines to a large extend whether IWT can play a role in transporting these commodities to the final destinations (in case of imports) or can play a role in the transport to the ports (in case of exports). The second is the port for import or export. The choice of the port is important because of hinterland infrastructure. If a port has no direct or indirect connection with IWT then IWT can hardly play a role in the transport to and from the Hinterland. The third characteristic is the state in Brazil the exports come form or the imports go to. The last aspect discussed is the trading partner in imports and exports. We start with imports. After that exports are presented.

b) Imports

Commodities

Table 3.1.2: Imports Brazil by commodity (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Coal; briquettes	16.749	18.467	14.082	17.692	20.020	16.833
Petroleum oils	8.692	9.717	7.810	15.871	17.759	16.338
Crude oil	21.747	20.309	19.529	16.848	16.421	15.451
Petroleum gases	8.728	10.071	7.999	11.295	9.969	11.269
Fertilizers (potassic)	6.805	6.795	3.492	6.185	7.742	7.104
Wheat and meslin	6.638	6.034	5.446	6.323	5.740	6.580
Fertilizers (nitrogenous)	5.437	4.651	4.521	5.458	6.890	6.172
Petroleum coke	3.262	3.681	3.447	4.288	4.719	3.967
Fertilizers (packed <10 kg)	3.452	2.982	1.758	2.481	4.338	3.914
Portland cement	426	456	747	2.033	2.813	3.016
Caustic soda	1.567	1.868	1.820	2.163	2.388	2.281
Sulfur of all kinds	2.073	2.159	1.508	1.901	2.089	2.058
Fertilizers (phosphates)	1.572	1.370	1.085	1.305	1.741	1.692
Coke of coal	1.626	1.902	435	1.802	2.165	1.591
Other commodities	30.176	34.033	30.221	42.552	43.874	43.498
Total	**118.950**	**124.494**	**103.897**	**138.195**	**148.668**	**141.765**

The most important imported commodities can be divided in two main groups. The first is solid and liquid energy related commodities (e.g. oil, coal). The second group consists of fertilizers in different forms. Oil, coal and fertilizers are in principle suited for Inland waterway transport.

Ports

Table 3.1.3: Imports Brazil by port (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Santos	19.209	21.230	18.176	24.416	25.962	23.336
Vitoria	15.645	16.928	11.417	15.007	15.595	12.450
Sepetiba	9.097	9.672	9.126	10.784	12.644	12.119
Paranagua	10.137	9.488	6.809	10.396	12.760	11.412
Sao Luis	4.375	5.035	3.682	7.013	8.655	9.232
Sao Sebastiao	9.852	8.807	7.687	8.251	10.096	7.847
Corumba – Airport	7.453	8.688	6.277	7.403	7.537	7.297
Porto Alegre	7.560	7.032	6.976	7.772	6.970	5.986
Rio De Janeiro	2.838	3.025	2.848	5.200	3.974	5.601
Rio Grande	5.334	4.956	4.081	5.751	5.490	5.462
Suape	1.530	2.143	2.159	3.127	4.369	5.341
Sao Francisco Do Sul	3.879	4.993	3.723	5.100	4.876	5.190
Other Ports	22.041	22.495	20.937	27.975	29.739	30.491
Total	**118.950**	**124.494**	**103.897**	**138.195**	**148.668**	**141.765**

The East coast ports like Santos, Vitoria and Paranagua dominate imports. A number of surprising ports appear. In the first place Sao Sebastiao. This port in the state of Sao Paulo receives mainly crude oil and petroleum oils. The second surprise is Corumba Airport. The imports are petroleum gases from Bolivia by pipeline. Perhaps less of a surprise is Porto Alegre. This also is mainly crude oil and petroleum oil.

The growth of Sao Luis is remarkable. The imports grew with over 100% in five years.

State of destination

Table 3.1.4: Imports Brazil by state of destination (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Sao Paulo	28.583	28.443	24.762	30.989	34.067	28.569
Rio De Janeiro	11.001	11.346	10.983	14.824	15.192	16.404
Rio Grande Do Sul	14.335	13.423	12.293	15.120	13.785	12.685
Parana	10.644	12.135	9.056	10.893	11.891	12.384
Minas Gerais	10.648	11.447	8.033	10.733	11.620	10.197
Maranhao	4.282	4.955	3.606	6.743	8.442	8.952
Mato Grosso Do Sul	8.408	9.530	7.142	8.581	8.812	8.466
Santa Catarina	3.797	4.552	4.847	7.257	7.573	7.466
Espirito Santo	8.249	9.195	6.474	8.091	8.893	6.631
Pernambuco	2.926	3.102	2.860	4.040	4.974	6.188
Bahia	4.620	4.835	3.943	5.235	5.177	5.112
Ceara	2.057	1.562	1.614	3.360	3.040	3.748
Para	2.133	2.703	2.612	3.555	3.587	3.256
Mato Grosso	2.695	2.098	1.312	2.416	3.132	2.862
Amazonas	1.100	1.430	1.178	1.771	2.191	2.497
Goiás	1.470	1.615	1.154	1.632	2.159	1.944
Other states	2.003	2.123	2.028	2.955	4.132	4.405
Total	**118.950**	**124.494**	**103.897**	**138.195**	**148.668**	**141.765**

Total imports in 2012 were about 142 million tons. This was below 2011 which was a top year. The biggest states, from an import point of view, were Sao Paulo, Rio de Janeiro, Rio Grande do Sul and Paraná. It is however remarkable that the imports to these states were barely higher than in 2007. Some Northern and Northeastern states, with modest imports in 2007, showed high growth figures. Examples are Amazonas, Pará, Maranhão and Pernambuco.

Table 3.1.5: Imports Brazil by country (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
United States	16.368	17.643	17.409	23.040	25.469	23.349
Argentina	13.111	11.289	10.955	10.678	11.760	11.698
China	5.929	6.911	4.494	8.392	10.366	9.380
Nigeria	9.272	8.324	9.662	9.725	9.410	9.059
Bolivia	7.861	8.924	6.411	7.570	7.718	7.676
Russian Federation	5.358	5.258	3.736	4.775	6.708	6.272
Canada	5.450	5.756	2.573	4.734	6.065	4.730
Saudi Arabia	3.506	3.672	3.645	3.544	3.943	3.864
Algeria	3.890	3.098	2.894	3.959	3.553	3.598
Colombia	1.011	1.960	1.693	2.993	3.503	3.475
Australia	6.606	6.228	3.726	5.621	4.796	3.427
Germany	2.442	2.212	1.941	2.633	2.724	3.191
India	2.169	2.432	1.469	3.688	4.523	3.135
Chile	1.956	2.246	2.192	3.008	2.906	2.928
Other Countries	34.019	38.541	31.097	43.836	45.222	45.985
Total	**118.950**	**124.494**	**103.897**	**138.195**	**148.668**	**141.765**

The United States are the most important trade partner as far as imports is concerned. Argentina and China are second and third. The trade partners reflect the commodities in table 3.3. The Russian Federation and Canadá are important for fertilizers, Australia for coal and Nigeria and Saudi Arabia for oil.

c) Exports

Commodities

Table 3.1.6 Exports Brazil by commodity (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Iron ores	269.448	281.684	266.040	310.931	330.830	326.529
Soya beans	23.734	24.499	28.563	29.073	32.986	32.916
Crude oil	21.974	22.588	27.367	32.928	31.258	28.648
Cane or beet sugar	19.359	19.473	24.294	28.000	25.359	24.342
Corn	10.933	6.433	7.782	10.819	9.487	19.802
Soy meal	12.474	12.288	12.253	13.669	14.355	14.289
Chemical wood pulp	6.484	7.040	8.229	8.375	8.478	8.514
Petroleum oils	9.316	7.879	7.427	6.223	6.479	7.907
Artificial corundum	3.898	4.641	5.558	6.594	7.297	7.501
Aluminum ores	5.784	6.221	3.037	6.789	6.887	6.861
Semi-finished products of iron	4.403	5.361	4.518	4.949	6.101	5.458
Poultry meat	3.092	3.365	3.344	3.541	3.644	3.658
Pig iron and spiegeleisen	5.953	6.300	3.158	2.309	3.247	3.027
Undenatured ethyl	2.824	4.095	2.647	1.524	1.574	2.479
Wheat and meslin	103	644	385	1.324	2.350	2.405
Kaolin	2.364	2.753	2.044	2.295	2.217	2.096
Other commodities	59.510	53.680	48.805	50.775	51.696	49.835
Total	**461.655**	**468.942**	**455.452**	**520.117**	**544.244**	**546.266**

Exports are far higher than imports. In 2012 total exports were 546 million tons. Iron ore is by far the biggest exported commodity. Agricultural products like soy, corn, soymeal and sugar are also important. Between 2007 and 2012 the exports of these commodities together grew from 66.5 million in 2007 to 91.4 million tons in 2012. Other important products are crude oil, pulp and aluminum ore.

d) Ports

Table 3.1.7: Exports Brazil by port (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Vitoria	130.722	130.497	114.382	144.515	147.718	141.754
Sao Luis	87.450	93.276	91.775	102.457	111.200	112.580
Sepetiba	89.100	91.230	97.228	105.172	113.125	109.489
Santos	45.958	46.377	51.805	55.528	53.292	61.053
Paranagua	23.960	20.409	21.413	24.420	24.699	27.705
Rio Grande	13.237	11.912	12.228	12.597	16.522	13.755
Macae	6.734	8.407	10.164	10.058	10.119	10.018
Santarem	6.652	7.224	4.091	7.599	7.737	8.264
Barcarena	6.388	7.862	7.947	8.525	7.962	8.048
Sao Francisco Do Sul	5.889	5.075	4.706	5.218	5.671	7.395
Macapá	207	683	2.612	4.013	5.595	6.904
Rio De Janeiro	7.275	7.086	5.505	5.135	5.530	6.178
Aratu	3.908	5.625	3.531	4.278	4.147	4.542
Corumba	2.308	4.247	2.663	4.070	5.473	4.310
Other Ports	31.869	29.030	25.402	26.533	25.453	24.271
Total	**461.655**	**468.942**	**455.452**	**520.117**	**544.244**	**546.266**

The ports reflect the commodities. Vitoria, Sao Luis and Sepetiba (Rio de Janeiro) are export ports for iron ore. Santos, Parnagua and Rio Grande are the agricultural ports.

The headquarters of Petrobras are located in Macaé.

e) Exporting States

Table 3.1.8: Exports Brazil by State (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
Minas Gerais	155.625	162.772	156.881	175.781	182.644	178.101
Para	90.381	98.042	99.459	93.411	116.099	117.474
Espirito Santo	50.367	48.601	37.439	54.640	57.168	53.161
Sao Paulo	40.851	37.436	37.260	38.896	34.627	36.904
Rio De Janeiro	26.363	25.698	31.090	34.033	35.699	35.093
Mato Grosso	14.931	16.288	20.936	21.315	21.288	26.253
Parana	20.795	19.118	17.453	20.322	21.285	23.013
Rio Grande Do Sul	16.435	14.596	15.203	15.035	18.468	15.470
Bahia	9.141	9.642	9.982	10.851	11.222	11.662
Mato Grosso Do Sul	5.740	6.863	5.916	8.978	10.618	10.815
Goiás	5.430	5.440	5.373	5.862	6.399	9.892
Maranhão	10.658	10.001	3.378	24.300	9.562	9.225
Amapá	658	1.130	2.821	4.409	5.785	7.007
Santa Catarina	5.720	4.656	3.770	4.099	5.004	4.890
Alagoas	2.115	2.879	2.168	1.976	2.097	1.748
Other States	6.444	5.781	6.322	6.210	6.279	5.555
Total	**461.655**	**468.942**	**455.452**	**520.117**	**544.244**	**546.266**

In the order of states the commodities can be recognized. Minas Gerais and Para are the main producing states of iron ore. Espirito Santo is a main processing state for iron ore.

f) Destination countries of export

Table 3.1.9: Destinations of exports Brazil (in 1.000 tons)

	2007	2008	2009	2010	2011	2012
China	120.866	117.441	194.834	188.026	203.509	209.069
Japan	34.787	39.322	28.707	41.453	41.705	37.757
Netherlands	18.929	19.594	14.728	19.317	28.710	27.451
United States	31.384	28.005	19.307	22.858	25.020	27.135
South Korea	14.054	16.659	14.104	16.242	17.636	20.894
Germany	29.162	30.798	14.938	24.840	16.917	13.639
France	18.805	16.135	8.625	12.745	11.808	12.648
Italy	16.476	15.006	7.618	11.144	14.204	12.544
Argentina	12.463	13.356	7.625	13.635	15.638	12.258
Oman	63	89	115	261	4.597	10.061
Taiwan	5.449	6.034	4.742	7.770	8.370	8.894
Spain	11.857	10.260	6.724	9.029	9.442	8.362
United Kingdom	9.870	10.188	10.711	10.784	9.701	8.304
India	1.359	1.017	7.737	5.941	3.808	7.519
Canada	4.884	5.196	4.966	6.541	6.648	7.289
Philippines	4.377	4.522	1.309	2.660	3.148	6.836
Egypt	4.016	4.186	4.746	4.863	5.593	6.805
Provision Of Ships And Aircraft	5.681	6.127	5.775	6.107	5.888	5.612
United Arab Emirates	1.965	1.257	2.693	3.233	3.800	5.468
Belgium	12.386	12.795	4.613	6.858	4.853	5.277
Malaysia	2.859	3.609	3.668	4.651	4.052	5.107
Other Countries	99.962	107.345	87.167	101.158	99.198	87.337
Total	**461.655**	**468.942**	**455.452**	**520.117**	**544.244**	**546.266**

China is already a number of years the most important importer of Brazilian products. The dominance of China is growing fast. In 2012 38% of all exports went to China. Other important countries are Japan, The Netherlands and the United States.

g) Conclusions

Exports are a lot bigger than imports. Total exports in 2012 were about 546 million tons. Imports about 142 million tons.

Exports have two main types of commodities: ores and agricultural products. Iron ore is by far the biggest flow.

3.1.2.4 IWT and international Trade

a) Current transport

Commodities

Total inland water transport in Brazil in 2011 was about nearly 25 million tons. Table 3.1.10 gives an overview of the volumes per river.

Table 3.1.10: Current inland waterway transport in Brazil

	Total (mln. tons)
Amazon	5.766
Madeira	4.043
Tapajós	9
Tocantins	(3.125)*
Parnaíba	0
Sao Francisco	50
Paraná – Tietê	5.774
Hidrovia Do Sul	3.719
Rio Uruguay	0
Rio Paraguay	5.442
Total	**24.803**

* The figures between brackets (Tocantins) mean that the tons mentioned are also registered on other rivers (in this case the Amazon River).

The main commodities transported by IWT are agricultural products, especially soy, soy meal and corn. In some cases also ores are important. In the *Amazon river basin* (Amazon, Madeira and Tapajos), Ro-Ro trailers, chemical products, and oil products are important. Total transport in tons in 2011 was 9.8 million tons. On the *Parana – Tietê River* at the moment soy, corn and some sugar is transported over long distances (over 500 km). Some commodities like sugarcane and sand however are transported over short distances (10 to 20 kilometers). The main commodities transported in the *Rio do Sul* are fertilizers, soy, soymeal and wheat. On the *Rio Paraguay* mainly iron ore and manganese ore is transported over a long distance from Corumbá to San Nicolas (Argentine).

By far the majority of the flows has a seaport as origin (for imports) or as destination (for exports). Some flows by IWT are part of a logistic chain. The main example is transport to Pederneiras by IWT for export via Santos. Only a small number of real domestic flows exist. An example is the transport of coal on the Rio Jacuí or the transport of cottonseed on the São Francisco. Approximately 95% of total IWT transport is related to exports or imports.

The main exported commodities are in principle very well suited for IWT. Most of these commodities are solid bulk products (iron ore, steel, soy, corn). The reasons IWT has not gained a strong position are:

- The strong competition with dedicated rail tracks for iron ore (an example is the Carejás line to São Luis);
- The competition with road transport for soy and corn;
- The lack of navigability of important rivers.

Passengers

Passenger transport on waterways is only a small part of total passenger transport in Brazil. Apart from the Amazon region, this type of passenger transport only occurs under special conditions, such as traffic congestion in rush hours. Furthermore the distances between urban areas are big. Waterways can hardly play a role in work and business trips because the trip time is too long, compared to other transport modes. The car and the airplane are the dominant modes of transport outside the Amazon region.

In the Amazon region passenger transport over water still is very important. The main reason is the extensive water system and the limited number of roads in this vast area. For a large number of destinations transport over water is the only means of transport.

In 2011 around 5.4 million people used long distance passenger routes between the main cities in the Amazon region: Manaus, Belém, Santarém, Macapá and Porto Velho.[11] Another 6.6 million passengers used ferries to cross the rivers in the Amazon Basin.

In general, Work and Business are the most important journey purposes (35%). Personal (family visit) and leisure reasons account for 50% of the IWT passengers trips. Finally health and education are important reasons for people from the countryside to visit the major cities in the Amazon region.

b) Future transport flows

Commodities

The forecasts show a Strong potential increase of IWT from 25 mln. tons (2011) to more than 110 mln. tons (2031). The main driving force behind this growth is the growth of the economy based on agricultural products like soy, corn and sugar on the one hand and basic materials on the other hand. Table 3.1.11 gives an overview of future transport flows per river.

[11] University of Pará, June 2012, Caracterização da Oferta e da Demanda do Transporte Fluvial de Passageiros na Região Amazônica

Table 3.1.11: Forecasts inland water transport Brazil (in 1.000 tons)

	2015	2023	2031
Amazon	3.170	4.684	5.933
Madeira	7.619	9.907	11.954
Tapajós(*)	6.063	7.666	9.122
Tocantins	16.626	32.261	50.521
Parnaíba(*)	2.711	5.526	9.139
Sao Francisco	53	58	61
Paraná – Tietê	7.482	15.338	17.954
Hidrovia Do Sul	5.250	7026	9367
Rio Uruguay	0	0	0
Rio Paraguay	7.702	10.871	14.883
Total	**47.902**	**80.145**	**110.673**

(*) The IWT potential for Tapajos is included in the Madeira River and the volume mentioned under Parnaíba is included in the potential for the Tocantins River. In the totals presented these flows are not counted twice. For a number of River basins local transport, over very short distances, is not included in the forecasts.

In 2031 total transport on Amazon and Madeira River is estimated at 18 million tons.

The transport forecasts for the Tocantins River show two main groups of commodities. The first group is related to the steel plant in Marabá. The commodities are steel. Coal, iron ore, and manganese ore. The second group of commodities consists of agricultural commodities like soy, corn and fertilizers (as an input). Total transport over the Tocantins River in 2031 may reach as much as 50 million tons

On the Parana – Tietê River in the future a number of new flows will appear. The first is ethanol. Transpetro has developed a logistical system for collecting and distributing ethanol. A combination of pipeline and IWT will collect the ethanol and transport it to Paulina. The amount transported over water can reach 8.5 million tons in 2031. Another important new flow is eucalyptus wood as input for the pulp factory in Três Lagoas. The pulp will be transported back by IWT to Pederneiras and from there to Santos for export. Total transport (excluding short distance flows) can reach 18 million tons in 2031.

The main commodities transported in the Rio do Sul, fertilizers, soy, soymeal and wheat, will remain important in the future. Other commodities like chemical products, oil products wood and pulp are expected to show higher growth rates. Containers are also expected to be transported by IWT in 2031. Total transport by IWT is expected to grow from 3.7 million tons in 2011 to 9.4 million tons in 2031.

On the Rio Paraguay the volume of iron ore and manganese is expected to almost triple between 2011 and 2031.

In the forecast years the dependence of IWT on exports and imports is not different from the base year. Most notable is the forecasted growth of the Tocantins River. This can be attributed to the imports /exports of agricultural products (fertilizers, soy, and corn) and imports / exports of steel related products (coal, steel, and iron ore). The expected growth of transport on the Paraná Tietê is due to ethanol (partly for export) and pulp (fully exported).

The general conclusion is that the exports and imports of commodities that are well suited for IWT are expected to grow in volume considerably in the coming 20 years. A number of new markets for IWT can be added like ethanol transport and the transport of pulp.

Witin the IWT market a more prominent place is expected for the northern river basins, due to the anticipated shift of logistic chains towards the northern sea ports. Reasons for this shift are improved inland transportation networks (road and rail) and logistic bottlenecks in the southern export sea ports. The northern Brazilian sea ports are also expected to further improve their competitive position as a result of the expansion of the Panama Canal, enabling the use of larger ships and thus lowering total logistic costs, especially for the Asian export markets.

Passengers

Passenger transport by waterway in Brazil is not limited due to lacking waterways capacity. Apart from the Amazon region, the demand however is missing because of relatively good alternatives by road and air.

Passenger transport by inland waterways is expected to increase, especially in the Amazon Region. This is due to the economic and population growth of the region and the investments in waterways by the Brazilian Government (especially in the Tapajós river). Until 2015 an increase of 11% of the number of passengers is foreseen. This is an annual growth of 3%. Between 2015 and 2023 the growth is expected to be 7.5 % per four years and until 2031 the yearly average growth in passengers is estimated at 4.5%.

Passenger fleet and superstructure in the Amazon region however are already considered as obsolete, leading to present and future problems concerning safety and comfort as well as maintaining regular and fast services outside the main population centres.

3.1.3 Transport System

3.1.3.1 General

As it has been earlier stated, legal issues will have an effect on the market accessibility, reliability, safety and operational cost of IWT. The legislation and regulations will be analyzed with regard to the following subjects and, in addition to checking whether they are helpful or potentially harmful to achieve the goals:

- Possibility to meet new market demands in a flexible and responsive way:

- the market, both for shipping lines and terminal operators, is easily accessible;
- the demand for new equipment can be met at reasonable prices;
- availability of qualified personnel.

These issues will be described in chapter 3.1.3.22

- Taxes and, whenever applicable, subsidies, that support the development of IWT. Chapter 3.1.3.22 will also touch upon this subject.
- Reliability is very strongly dependent on the way in which the waterways are being managed.
- Monitoring of river conditions, providing navigability information (electronic charts) and balancing the management of hydro-power and navigability requirements. These issues will be described in chapter 1.1.3.

Besides, in this chapter a brief description of the general seaport situation is madethe cabotage navigation and the passenger transport, focusing on their role on the IWT.

3.1.3.2 Transport legislation

a) Methodology

The methodology used for the development of this activity consisted, throughout Step A of the work, of the study of the legislation related to waterway transport, so as to obtain an overview of the current situation.

So that, in Step B – Consultation of interested parties, regulatory restrictions could be discussed with the interviewed companies and entities.

Based on the analysis of these interviews, the main restrictions were identified; which served as guidelines for the diagnosis of the transport system with regard to its regulatory aspects.

b) Market accessibility

Shipping lines/barge operators

Waterway transport, to which art. 178 of CFRB/1988 refers, has been currently regulated by Law 10.233 of June 5, 2001, that sets forth the creation of the ANTAQ regulatory agency, including its sphere of operation and competences, which were changed by Provisional Measure 595 of December 6, 2012, and Law 9.432, which provides its ordinance. With regard to inland navigation, Law 9.432 regulates, among other aspects, the conditions under which vessels have the right to hoist the Brazilian flag; the requirements as to the nationality of the crews for these vessels; under which assumption national and international sections of inland navigation could be exploited by foreign vessels. Additionally, it regulates the cases in which foreign vessels could be chartered, as well as when authorization for chartering is required, and institutes the Registro Especial Brasileiro (REB) (Brazilian Special Registry), which is regulated by Decree 2.256 of June 17, 1997.

Vessels which will have the right to hoist the Brazilian flag are those enrolled with the Registro de Propriedade Marítima (maritime property registry), whose property which is owned by individuals resident and domiciliated in the country or Brazilian companies, or then, those that are under bare boat charter contracts signed by a Brazilian navigation company, provided the flag of the country of origin is temporarily suspended (Law 9.432, Art. 3º, subparagraphs I and II).The Registro de Propriedade Marítima (maritime property registry) mentioned above is regulated by Law 7.652 of February 3, 1988.

In what refers to possibilities of exploitation or operation of inland navigation through international sections by shipping companies and vessels from other countries, Law 9.432, art. 6 establishes that this could take place solely under agreements signed by the Union, respecting the reciprocity principle.With regard to the participation of foreign vessels in the transportation of goods through national sections, the same law, in its art. 7, provides that this could take place only when the vessels are chartered by a Brazilian shipping company, or when international agreements are signed, allowing chartering by foreign companies, respecting the reciprocity principle.

Law 9.537, known as the Lei de Segurança do Transporte Aquaviário (LESTA), (waterway transport safety law), regulates waterway traffic safety and provides responsibilities to the maritime authorities, in this case, the Brazilian Navy. Among these, there is the preparation of standards for the regulation of various activities; determination of the security crew; establishment of limits for inland navigation and the requirements for safety conditions; execution of the naval inspection;and execution of other pertinent inspections.

Within the sphere of the Brazilian Navy, the Normas da Autoridade Marítima (NORMAM) (maritime authority standards), were prepared, and those of major interest to inland navigation are shown below:

- NORMAM 02 - Normas da autoridade marítima para embarcações empregadas na navegação interior (Maritime authority standards for vessels employed in inland navigation);

- NORMAM 04 - Normas da autoridade marítima para embarcações estrangeiras em águas jurisdicionais brasileiras (Maritime authority standards for foreign vessels in Brazilian jurisdictional waters);

- NORMAM 07 - Normas da autoridade marítima para inspeção naval (Maritime authority standards for naval inspection);

- NORMAM 11 - Normas da autoridade marítima para obras, dragagens, pesquisa e lavra de minerais sob, sobre e às margens das águas jurisdicionais brasileiras (Maritime authority standards for works, dredging, research, and mining of minerals under, over, and on the banks of Brazilian jurisdictional waters);

- NORMAM 13 - Normas da autoridade marítima para aquaviários (Maritime authority standards for waterways);

- NORMAM 16 - Normas da autoridade marítima para estabelecer condições e requisitos para concessão e delegação das atividades de assistência e salvamento de embarcação, coisa ou bem, em perigo no mar, nos portos e vias navegáveis interiores (Maritime authority standards for the establishment of conditions and requirements for the concession and delegation of activities necessary for the assistance and salvage of vessels, assets or goods, in danger at sea, in ports, and in inland navigable waterways).

ANTAQ has also enacted standards applied to inland navigation, and within its sphere of operation, it should observe the specific prerogatives of the Navy Command and will act according to its guidance in matters concerning the Merchant Marine which are in the interest of national defense, safety navigation, and the saving of human life at sea, and it should also be consulted at the time safety standards and procedures with repercussions in the economic and operational aspects of the provision of waterway transport services are established (Law 10.233, art. 27, paragraph 1).

The ANTAQ standards which should be followed by shipping companies are:

- Resolution 1.864 – The attachment of this resolution shows the standard that regulates the chartering of vessels to operate in inland navigation;

- Resolution 1.558 – The attachment of this resolution shows the standard that grants authorization for the provision of cargo transport services in inland navigation of interstate and international longitudinal routes;

- Resolution 1.274 – The attachment of this resolution shows the standard that grants authorization for the provision of passenger, vehicle and cargo transport services in inland crossing (ferry) navigation;

- Resolution 912 – The attachment of this resolution shows the standard that grants authorization for the provision of passenger and combined transport services in inland navigation of interstate and international longitudinal routes;

Port/terminal operators

Exploitation of port facilities is regulated by Provisional Measure 595, which still has to be approved by the National Congress. The main changes provided by this provisional measure are described in Chapter 3.1, and, in this item the aspects considered relevant to inland transport will be discussed.

During the interviews, a shortage of waterway terminals was identified, since the majority of the existing terminals is privately-owned, prioritizing the handling of their own cargo, and are currently close to their working capacity.

Therefore, there is a market for companies interested in investing in new installations inside and outside the organized port areas[12]. However, there is legal uncertainty for investors, primarily for those interested in exploiting port facilities outside an organized port (private use terminal, cargo transshipment station), leading to smaller investments.

This uncertainty is caused mostly by some uncertainties in the Provisional Measure, namely:

Uncertainty as to the period for which the terminal will be authorized (the Provisional Measurement establishes up to 25 years), and this may have an impact on the economic and financial modeling of the undertaking, as well as the maintenance of the port activity, since, due to changes in the economy, the type of activity to be developed in the area could also change. This way, the terminal will lose its initial characteristics, and the corresponding areas and goods will be revert to Union public assets, without any burden;

(Art. 8, paragraph 2. The port installation authorization will have a validity term of up to twenty five years, extendable for the following successive periods, provided:

I – the port activity is continued; and

II – the authorized party makes the investments necessary for expansion and modernization of the port installations.

Paragraph 3 If the port activity is stopped at any [given] time due to initiative taken by or under the responsibility of the authorized party, the area and goods associated with the works will be revert, without any burdens, to the Union's assets, (according to the regulation provisions).

- Absence, up to the present time, of new standards compatible with the Provisional Measure for the application of the authorization request;

- Absence of definition for projects already in underway waiting for authorization, primarily with regard to those located within the area of an organized port, since the structuring for the enterprise has already taken place based on the previous legislation, which demands various requirements for the delivery of the application for authorization, among which are the property ownership certificate, project description, and environmental licensing. And, due to the fact that the new legislation only takes the warranties referring to terminals located inside an organized port, which have already been authorized, into consideration, this has created uncertainties with regard to property ownership, since it has been defined as a public asset.

[12] According to Provisional Measure 595, the organized port is a public asset built and equipped to meet the needs of navigation, movement of passangers, or movement or storage of goods, and whose traffic and operations are under the port authority jurisdiction. De acordo com a Medida Provisória 595, o porto organizado é um bem público construído e aparelhado para atender a necessidades de navegação, de movimentação de passageiros ou de movimentação e armazenagem de mercadorias, e cujo tráfego e operações portuárias estejam sob jurisdição da autoridade portuária.

In addition to these problems, it was pointed out that in order to obtain authorization for private terminals, it is not clear which entities should be contacted, and that there are many, such as the Marinha do Brasil (Brazilian Navy), Secretaria do Patrimônio da União (Union's Assets Department), ANTAQ, and SEP, among others (the authorities of these institutions are described in Appendix II).

c) Demand for new equipment

Ship building

The Brazilian large vessel ship building industry was set up during the Juscelino Kubitscheck administration, with the creation of the Metas (goals) plan. During this time the Fundo de Marinha Mercante (FMM)[13] (Merchant Marine Fund) was instituted, a fund of an accounting nature, whose main purpose was to foster and stimulate the modernization and expansion of the Brazilian fleet. The resources for this purpose are obtained by means of the Adicional de Frete da Marinha Mercante (AFRMM)(Additional freight for the renewing of the Merchant Marine) .

With this incentive there was the establishment of shipyards using Japanese, German, Dutch, and English technologies, and, this way, starting a process for the qualification of labor and development of a chain of local producers.

Nonetheless, during the 1980s and beginning of the 1990s, due to the world economic crisis, the lack of financing control mechanisms, and the opening to foreign competition, the Brazilian shipbuilding industry stagnated.

In the second half of the 1990s, with the ending of the monopoly of exploration activities, the production and development of oil and natural gas was intensified, generating an increase in demand for supporting vessels and platforms.

In order to stimulate this market, in 2000, the Navega Brasil (Navigate Brazil) program was established, which set new rules for the financing of the Merchant Marine and shipbuilding, increasing the limit and payment term on the part of shipowners and shipyards.

This program was not enough for structuring the sector since the demand was still insufficient to obtain economies of scale. The intensification would only take place in the middle of the 2000s due to oil exploration in the Campos Basin.

Based on this demand, some programs developed by Petrobrás and Transpero have driven the shipbuilding market, namely:

- EBN (Empresa Brasileira de Navegação) (Brazilian Navigation Company) 1 and 2: A program set up by Petrobrás, including contracting for 15 years of support ships for

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[13] The FMM was created by Law 3.381, of April 24, 1958. This Law was revoked, and, currently is governed by Decree-Law 1.801, of August 18, 1980

offshore activities (29) in the time-charter modality to be built in Brazil and operated by Brazilian Shipping Companies;

- PROMEF I and II: A program launched by Transpetro, including ship orders (49) directly to shipyards for the transportation of oil products and ethanol.

The Brazilian government, for the purpose of fostering the naval industry, implemented some measures, including:

- Regulation of Waterway Transport, which ensures the preference for Brazilian vessels (Law 9.432 de 1997, mentioned previously in this report);

- Concession of benefits to Brazilian vessels that are registered with REB, such as exemption from collection of charges for the maintenance of the Fundo de Desenvolvimento do Ensino do Profissional Marítimo (Fund for the Development of Maritime Professional Education);

- Facilitation of financing conditions for the sector, with an increase of the FMM (Merchant Marine Fund) from 85% to 90% in operations referring to the naval industry, and a maximum amortization term of 15 to 20 years, considering new equipment;

- Establishment of differentiated interest rates and participations in financing with FMM resources whose contracts ensure national content rates higher than 60% or 65% (CMN Resolution 3.828, 2009);

- Creation of the Fundo de Garantia à Construção Naval (FGCN) (Guarantee Fund for Shipbuilding), whose purpose is to guarantee the credit risk for financing operations for the building or production of vessels and the risk of Brazilian shipyard performance (Law 11.786/2008);

- Reduction of the IPI (Imposto sobre Produtos Industrializados) (Industrialized Product Tax) tax burden falling upon parts and materials provided for building ships in national shipyards, and reduction to zero of the PIS/Pasep and Cofins (Social Integration Program/Program to Form the Property of the Public Server, and Contribution to Finance Social Security) rates on equipment necessary for the naval industry, encouraging the ship parts sector (Decree 6.704/2008 and Law 11.774/2008).

These measures were beneficial for the development of the industry, nonetheless, some problemas concerning the transfer of resources are still found, such as the slowness of project analysis, which will be explained below.

The FMM is administered by the Ministry of Transportation through the Conselho Diretor do Fundo da Marinha Mercante (FDMM) (Merchant Marine Fund Director's Council), and has the following banks as financing agents (ratified by MT): BNDES, Banco do Nordeste, Banco do Brasil and Banco da Amazônia, Banco do Brasil, and Caixa Econômica Federal.

The financial risk of the operations is assumed by the financial agents which have one year to grant the credit after the FMM's approval. However, the agents have carried out this process for analyzing the granting of credit too slowly, taking more than a year. This way, the validity of the credit expires, even though the resources exist.

Despite having these incentives, some companies say that there are no major players in the Brazilian river shipyards, and that many of them face financial problems to expand production, leading to difficulties to building a large number of vessels which might be demanded.

In order to supply the market with river vessels, the possibility was mentioned of importing them, however, due to the existence of the market reserve for the Brazilian shipbuilding industry, as a function of the high taxes falling upon import operations and the loss of lines of credit, such as financing from the Merchant Marine Fund, the Brazilian shipping companies prefer to buy them from Brazilian shipyards.

In an general manner, all companies that import vessels and carry out the transport of goods in the national territory are those whose vessels do not hoist the Brazilian flag. This occurs mainly in the Paraguai-Paraná waterway, since, due to the agreement for river transport among the countries (Brazil, Argentine, Bolivia, Paraguay and Uruguay), foreign vessels of these nations may operate between the port of Cáceres, in Brazil, and Nova Palmira, in Uruguay.

Investments – Shipbuilding

The graph below shows the distribution of investments from the Merchant Marine Fund by type of navigation, including the shipyard construction. This data was obtained from the Secretaria de Fomento para Ação de Transportes (Transport Action Fostering Secretariat), and it conveys information referring to the contracts signed from 2002 to 2012, contracts already delivered and approved.

This graph only shows contracts whose situation is: “Delivered,” “Under Way” and “Contracted”; and with investments starting in 2005, because those previous to this year were not very representative (only 4 and 7 million).

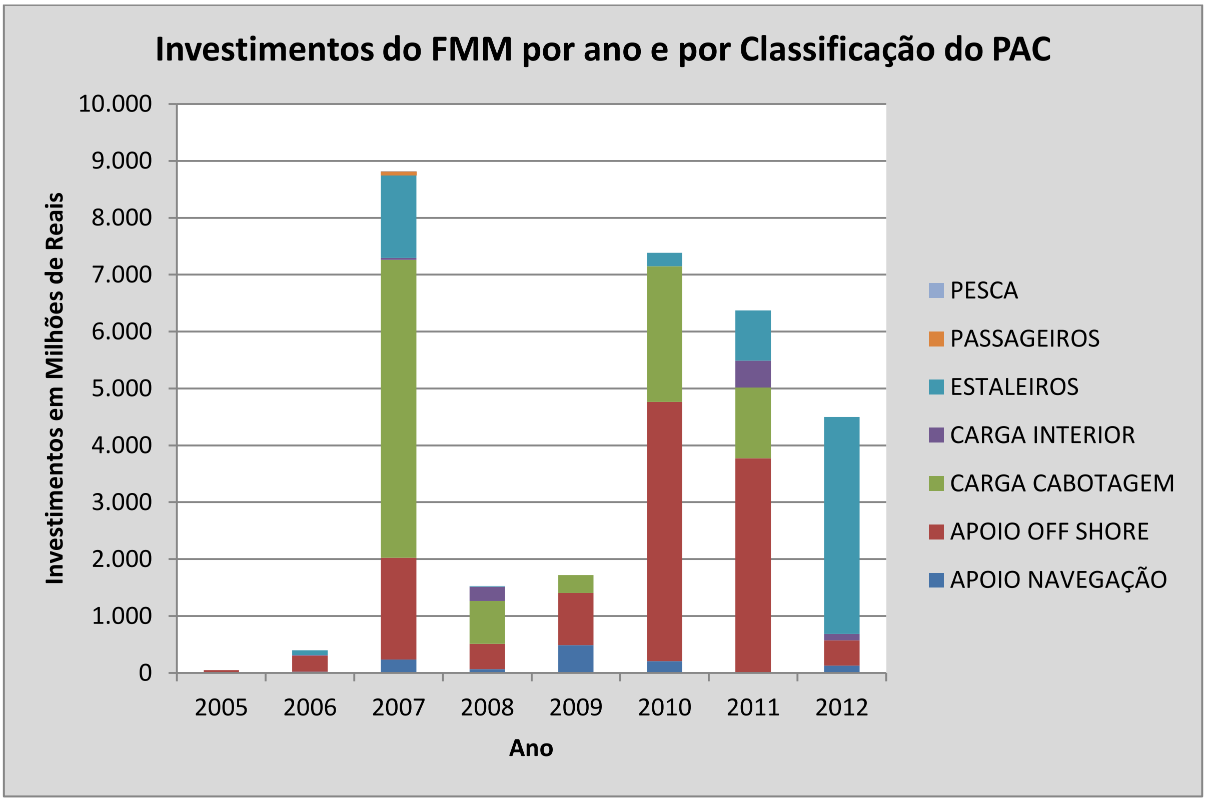

Figure 3.1.4: FMM investments per year and classification of PAC (Growth Acceleration Program)

It can be noticed that the shipbuilding segments that receive more investments are those of cabotage and offshore support navigation, which added up to approximately, 9 and 12 billion since 2002.

The graph below shows the investments per year and per financial agent for the inland navigation segment. In 2011, due to the purchase of twenty convoys for the transport of ethanol in the Paraná Waterway System, a peak can be observed. The contracts for building these vessels added up to a total of 205 million, whose financing agent is Caixa Econômica Federal (Federal Savings Bank).

Figure 3.1.5: Investments per year and per financial agent for the inland navigation segment.

d) Qualified personnel

Education of the maritime professional is the responsibility of the Ministry of the Navy and for the purpose of certifying and qualifying personnel for the Merchant Marine, according to the provisions of Law 7.573, art. 1 of December 23, 1986. Decree nº 94.536 of June 29, 1987 regulates the provisions of this law.

The maritime professional education system is funded with resources from the Fundo de Desenvolvimento do Ensino do Profissional Marítimo (Fund for the Development of Maritime Professional Education). The courses could be conducted by organizations not recognized by the Navy with the resources already mentioned, however, it is important to stress that the curriculum of these courses should be approved by the Diretoria de Portos e Costas (Directorate of Ports and Coasts), in line with the Conselho Consultivo do Fundo de Desenvolvimento da Marinha Mercante (Board of Advisors of the Fund for the Development of Maritime Professional Education).

(Art. 8 Maritime Professional Education courses could be conducted, at the discretion of the Órgão Central do Sistema (System Central Agency) - Diretoria de Portos e Costas (Directorate of Ports and Coasts), in orgnizations not recognized by the Navy, education-specific or not, with resources from the Fundo de Desenvolvimento do Ensino do Profissional Marítimo (Fund for the Development of Maritime Professional Education).

The Brazilian Navy holds the monopoly on education of Merchant Marine professionals and the courses are offered in only two schools: the CIAGA (Centro de Instrução Almirante Graça Aranha) and the CIABA (Centro de Instrução Almirante Braz de Aguiar), which are focused on maritime professional education. Extras courses are set up according to the existing demand.

One example is the course started by FATEC-Jaú in partnership with the Navy, which could generate manpower for the Tietê-Paraná Waterway System, since new cargos are being introduced and vessels built, such as, for example, ethanol which will be transported by Transpetro barges.

It has been identified that there is waterway transport demand in the northern region of Brazil, but manpower is not available. This led to the creation of an institution composed of seven companies for the training of professionals, called ATAP.

This association is considering a partnership between the Brazilian Navy and private institutions, in which the private institutions would provide the equipment for training professionals, such as simulators, and the Navy, the training. Even though it is possible for the courses to be offered outside Navy institutions, the Navy itself shows some resistance to allow this, aggravating the situation.

The lack of labor to operate Brazilian vessels is not restricted only to the waterway sector, but to cabotage and maritime support as well. According to a Schlumberger[14] study, currently there is a deficit of 906 Merchant Marine officers.

This is a function of the high evasion rate, due to non-adaptation to life at sea and the shifts Particularly, in the case of waterways, the retirement and migration of professionals to offshore activities was pointed out.

e) Taxes and subsidies

During the interview step, some companies mentioned that the ICMS (Tax on Consumption of Goods and Services in Brazil) is a tax that restricts waterway transportation owing to the fact that many waterways do not have a direct connection with the export/import ports, and this could lead to a double tax charge resulting from transshipments.

This problem was stressed for the case of the Tietê-Paraná Waterway System, because the transportation starts in the state of Goiás or Mato Grosso do Sul, where this tax is charged for the first time, and when changing the transport mode, it is charged again.

Some companies also mentioned the possibility of being certified as transport multimodal operators (OTM), which, according to Law 9.611, of February 19, 1998, art. 5, are the corporations contracted as the main entities for Multimodal Cargo Transport from the origin to the destination, by its own means or through third parties and for which an application should be submitted to ANTT.

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[14] Statistic study on the current and future supply and demand of officials, submitted at the end of 2011, contracted by Transpero, coordinated by the Diretoria de Portos e Costas (Ports and coast Directorate) with the participation of SINDMAR, SYNDARMA e da Transpetro. Estudo estatístico sobre a atual e futura oferta e demanda de oficiais, apresentado no final de 2011, contratado pela Transpetro, coordenado pela Diretoria de Portos e Costas, com a participação do SINDMAR, SYNDARMA e da Transpetro

Even though this possibility exists, Araújo and others (2012) point out some tax and operational difficulties, some of which are shown below:

- Tax:
  - The acceptance of ICMS credit between two different federated units (states): There is a possibility of rejection by some states of the credits generated by debitting tax payers from other states;
  - Definition of credit and debit procedures when the OTM carries out its own transport: Lack of a clear definition as to credit procedures when the OTM is also a transporter of a section and should issue a bill of lading for the section;
- Operational
  - Impossibility of knowing the relative number of containers or tucks at the time of issuing the invoice;
  - Identification of the consignee to whom is charged the Adicional ao Frete para Renovação da Marinha Mercante (AFRMM) (Additional freight for Merchant Marine renewal) on the multimodal bill of lading when the OTM is also a waterway transporter.

Also, within **this ICMS context, some states (ex: Pará) do not grant exemption of the tax falling upon the provision of interstate and intermunicipal cargo transport services regarding shipments for specific export purposes**. This ends up adding to the costs of export goods that go through some logistical corridors.

3.1.3.3 Waterway management system

An adequate organization of waterway management is one of the most important conditions for the development of inland waterway transport. It is the essential requirement to change inland waterway transport into a more reliable mode of transport.

The organization has the responsibility to guarantee a minimum water depth, both throughout the year and during a specific journey on the river. The depth throughout the year determines the fleet characteristics for a shipping line. The depth during a journey tells the operator how deep the barges can be loaded during a specific trip and optimizes the capacity of the vessels.

Guaranteeing minimal water depths asks, amongst others, for:

- Monitoring of river conditions,
- Maintaining of the river in case of sedimentation,
- Providing navigability information (electronic charts) and
- Balancing the management of hydro-power and navigability requirements.

The general situation with respect to the waterway management system has been described in item 3.1. The specific situation in the various river basins is described in chapter 3 (the river basin analysis).

3.1.3.4 Seaports

a) General

The total performance of the inland waterway transport system as a stimulus for exports of Brazilian products is obviously dependent on the performance of the Brazilian seaports. At a first glance the performance of the ports does not cause a specific competitive advantage for any of the modes of transport. Every mode starts in the port and inefficiencies in the port will have their effects on all modes of transport. If, however, a port is extremely inefficient cargo owners may choose another port as for their exports. We observe a tendency in Brazil for a north shift of the cargoes due to the waiting times and efficiency problems in the port of Santos. This north shift may strongly benefit inland waterway transport, as the northern ports are easily accessible by barge. In this way port performance may affect the [position of inland waterway transport. This chapter presents a brief overview of the Brazilian seaport system structure.

b) Structure

The Brazilian port sector has a complicated structure and is subjected to bureaucracy. Amongst others, this is shown in the fact that the Brazilian Special Secretary for Ports (SEP) is not part of the Ministry of Transport and is formally not a ministry, but does have the same properties as a ministry. At the same time, the Ministry of Transport does have significant delegation and administrative powers when it comes to federal waterway structure. On the other hand, ANTAQ is responsible for the regulation and supervision of the port system. The three aforementioned organizations all directly report to the Brazilian Government.

Out of the 34 public maritime ports under the management of SEP, 16 are administrated by state or municipal governments. The other 18 are controlled directly by the "Comapanhias Docas", which are joint stock companies, whose major shareholder is the Federal Government. Therefore, they are still directly linked to the Secretariat of Ports.

Furthermore, there are also 42 more terminals and 3 complete port complexes that are operated by the private sector on the basis of a concession agreement.

c) Performance

In 2007, the World Economic Forum performed a study on the attractiveness of private investments in the Latin American infrastructure sector. In that study, the contemporary infrastructure problems of Brazil were described as private investment opportunities. The Infrastructure Quality Gap Index represents the relative attractiveness of the different infrastructure sectors of Brazil. The port sector here comes in second, just behind the road sector. To reduce the operational costs of transport in Brazil, the Brazilian Competitiveness Report states that ports, after highways, are the second priority for elimination of logistic bottlenecks. With one of the longest coastlines globally and the presence of ports in almost every coastal state, Brazil has the opportunity to take advantage in international trade flows.

However, due to the structural critical weaknesses in the port structure, these geographical advantages are not used. Among the structural weaknesses are: "equipment obsolescence, inefficiencies in labor development and allocation, lack of capacity in harbors, and inadequacies in port administration” (World Economic Forum, 2009). The logistics system, in terms of efficiency, would be much improved by investing in port equipment, labor skills and harbor capacity.

Business Monitor International’s Brazil Infrastructure Report Q4 2010 refers to a report of the Brazilian Institute for Applied Economic Studies (IPEA), in which it is stated that the Brazilian government has invested only US$ 4.7 billion in the last ten years in the Brazilian public ports, which does not make it surprising that current port infrastructure is lacking behind (Business Monitor International, 2010). The investments in port infrastructure in the 10 biggest ports in the Hamburg-Le Havre range in 2010 alone amounted to the same order of magnitude. The result is that Brazil’s port infrastructure is ranked 123rd out of 139 in the Global Competitiveness Report 2010-2011.

Every ship that arrives in the country waits at least 5.5 days to have the goods delivered by agencies such as IRS (“Receita Federal”), the National Sanitary Surveillance Agency (ANVISA), the Ministry of Agriculture and the Docks. The world average is three days.

In Brazil, the government institutions responsible for clearance of goods run only during business hours. It is the only country among the world's major economies, which does not have these services available 24 hours a day.

d) Government Programs

An important program for the Brazilian port sector is the National Plan for Port Logistics (PNLP). This plan was developed by the SEP in cooperation with the University of Santa Catarina in agreement with a benchmark by the Port of Rotterdam. This national plan underpins the most important problems in the Brazilian port sector and aims at forecasting future cargo growth. By diagnosing the current and forecasting the situation this plan aims to provide a structural basis, from where future investments are to be planned. The goals of the plan will involve actions aimed at expanding and upgrading the national capacity of the port, the clear definition of institutional roles and responsibilities of the entities involved in port activities and improvement of management efficiency of national ports. In the end, the plan will include a Master plan for the 12 most important ports together with the most relevant policies and strategies for the whole sector.

Although, as has been stated earlier, the performance of ports is of the utmost importance for the overall chain performance of the transport system, an analysis of port performance is beyond the scope of the present study.

3.1.3.5 Cabotage

Cabotage, defined here as the transport by sea-going vessels between Brazilian ports, can be seen either as competitive or complementary to inland waterway transport. In the majority of the situations cabotage and inland waterway transport play a very similar part: increasing the efficiency of the transport within Brazil resulting in lower transport cost and lower emissions. Cargo transported on the Amazon by barge can be transshipped in sea-going vessels for further transport along the Brazilian coast. IWT and cabotage can be seen as complementary modes of transport serving the same goal.

The only area where competition between inland waterway transport and cabotage plays a part is along the Amazon river. Between Manaus and any downstream port cargoes can either be transported by barge or by sea-going vessel.

There is significant potential for Brazilian coastal navigation or cabotage. Brazilian foreign trade of goods and services only represents 22% of GDP. This means that quite a lot of inland production is consumed within the country. Brazilian cabotage could take care of the transport of inland production, as long as the cabotage regulations are less severe.

Currently, freight transported between Brazilian ports is restricted to domestic flag vessels operated by a Brazilian individual or a Brazilian shipping company (called Empresa Brasileira de Navegação - EBN), in accordance with Law 9.432/97. Foreign vessels are only allowed to engage in cabotage, inland navigation, offshore support navigation and navigation within ports when chartered by an EBN, for which authorization is required. Authorizations may be granted if a Brazilian flag vessel of the required type is not available, there is declared public interest, or if the foreign vessel is substituted for one that is under construction in Brazil.

Brazilian flagged vessels are not competitive as regards international shipping companies and as a consequence, cabotage activities in Brazil could be optimized and expanded. This can be achieved by increasing the competition of Brazilian shipping companies against other flags by the reduction of Brazilian vessels' operating costs and increasing capacity of naval construction, among other measures. A future improvement of cabotage activities certainly will contribute to decrease maritime freight costs in Brazil.

In addition, given the policy of changing the current transport matrix, it would be prudent to relax the cabotage regulations, in order for international shipping lines to take care of Brazilian internal transport. There are huge possibilities, especially given the fact that most Brazilian economic activity takes place along its coastal zone.

Once the problems on the level of the cabotage regulations have been solved, the remaining problems hampering the efficiency of coastal transport can be tackled. One of the main problems faced by cabotage is the lengthy delays in clearing the cargo at the ports. Compounded by longer travel, loading and unloading times, these delays place cabotage at a disadvantage when compared to road transport, despite the lower tariffs.

Within the framework of the present study the possibilities of cabotage will not be analyzed. Although coastal (or short sea) navigation offers a perfect and competitive alternative for road transport throughout the country, an analysis of the requirements for specific cabotage connections would request for a port analysis of all 36 Brazilian seaports. Such port analysis is beyond the scope of the present project.

3.1.3.6 Passenger transport

In general passenger transport by inland waterway transport does not play a decisive role in the selection of the promising rivers for further development of waterwyas. In most rivers, passenger transport is limited to cross-river ferries. Only in the North region of the country, more specific in the Amazon region, passenger transport by inland waterway transport play a significant role in the passenger transport in the region, being the only way to access some small settlements.

Most of the long trips are concentrated in the Amazonas, Solimões, Madeira and Negro Rivers, where passenger and commercial navigation faces few restrictions. There routes are considered already consolidated and no major civil works are required to ensure navigability. In general investments to improve the navigation safety may be necessary, by means of improving signaling for example. On the other hand the quality of the service offered need significant improvements. The transport is not regular and fast enough to meet the minimum service standards and to enable, consequently, economic prosperity.

Despite the importance of IWT for transporting passenger and goods in the Amazon region connecting the various communities and centers of production and consumption, information of the activity are little known and systematized. Therefore ANTAQ released recently a specific study[15] about this transport mode in the Amazon region (Amazonas (AM), Pará (PA), Amapá (AP) e Rondônia (RO) states), which involved 2 years of research by the Universidade Federal do Pará (UFPA) and presents its main characteristics.

The weaknesses of the current transport and opportunities for enhancing the IW passenger transport, based on the findings of the ANTAQ study are itemized below in three main topics:

a) Infrastructure: inland terminals for passengers

The inland terminals are in general inefficient, not offering the minimum infrastructure and equipment required for their safety operation. The inadequate design of the terminals and the inexistent or poor integration of the waterway system with other transport modes, in the majority of inland terminals for passengers in the Amazon region, for example, have a significant impact on the operation and consequently affects directly the reliability of this transport system.

From the 106 inland terminals analysed (64 in the Para state, 30 in the Amazonas state, 11 in the Amapá State and 1 in the Rondônia state), it was concluded that 81% of the terminals have a low standard of service, 15% a medium standard and only 4% presented a higher standard.

b) Characteristics of the existing fleet and operating companies

Most lines in the Amazon region are still served by vessels of outdated technology. The great majority is made of wood (63,5%), mainly because they are easy to build using relatively low cost material, followed by those made of naval steel (22%). The average age of the operating vessels is of 11 years and the percentage of vessels with more than 20 years of use reaches

[15] AGÊNCIA NACIONAL DE TRANSPORTES AQUAVIÁRIOS - ANTAQ - SUPERINTENDÊNCIA DE NAVEGAÇÃO INTERIOR. Caracterização da Oferta e da Demanda do Transporte Fluvial de Passageiros na Região Amazônica. Brasília, 2013. P. 99-100

16.6% of the fleet. It is important to mention that information about the building year of one quarter of the vessels analyzed was not known by the interviewees.

It was observed that vessels for passenger transport in the Amazon region present problems of comfort, hygiene and safety. Increasing the capacity of the vessels, for example, has caused stability problems. The vessels in general combine passenger and cargo transport, playing a key role in the trade along Amazon River.

c) Operational costs and fares

The low quality of service, comfort and safety can be a consequence of the low fares charged. The Amazon region is still underdeveloped and IWT is practically the only means of low cost transport, playing a relevant social role for many riverside settlements served by this transport mode. The trips, in some lines, are established according to the owner interests, and that means the trip only occurs if it is profitable. It seems unlikely to support investments in modern technologies without state grants and subsidies.

3.1.4 Governance and institutions

3.1.4.1 Contextualization

This chapter looks at the existing institutional legal system that is in conformity, not only with the national waterway sector, with emphasis given to the main regulatory benchmarks, and to its institutional matrix, where there is a large diversity of players, in view of their legal responsibilities or institutional interests, but also with the highway and port sectors with which they are integrated, having national water resources policy and national environmental policy, which drive the search for social and economic development models, plans, programs, and projects under the cloak of the multiple uses of the water and sustainability, as a backdrop.

Its purpose is to compose a basic reference capable of contributing to an understanding of the nature and goals of these transverse policies and the possibilities and limitations that the institutional legal system, in matters related to the environment, imposes implementation of the various actions intended in the content of a strategic waterway plan.

Its essential to understand its importance since it will guide, not only the conception and strategic evaluation of the project groups interested in each waterway, and the corresponding river basin, but also its implementation and regional insertion, in the face of the consecrated principles and documents of the Federal Constitution (art. 170, VI and art. 225) which subordinate social and economic development to defense of the environment, eliminating the traditional evaluation means incapable of absorbing the environmental costs (such as cost-benefit and opportunity cost), as well as projects and investments that would not be seen as sustainable or which could induce, on a macro scale, forms of land occupation and natural resources use that could lead to environmental degradation.

a) The importance of the environmental institutional legal universe

Even though the sustainability of economic development is conceptually defined as that which “satisfies the needs of current generations without compromising the capacity of future generations to satisfy their own needs,” its implementation is difficult due to the unbalance in favor of the present benefit and immense difficulties in determining the value of consumption standards and future damage, in view of the scientific uncertainties that are opposed, being certain that, neither the socio-economic, nor the ecological valuations and forecasts admit assurances that enable the establishment of completely safe guidelines for the development process.

Nonetheless, it is worth mentioning that the Federal Constitution of 1988, in its article 225, did explicitly assume the paradigm of sustainable development, even if as a challenge, when it established that: “Everyone has the right to an ecologically balanced environment, an asset of common use of the people and essential to a healthy quality of life, imposing on the public power and the collectivity the duty to defend and preserve it for present and future generations;

In effect, if there is a syntheses possible for the end of the XX/20th century and beginning of the 21st century, it may be characterized by the exhaustion of an economic development style that turned out to be ecologically predatory (in the use of natural resources), socially perverted (in the generation of poverty and inequality) politically unfair (in the concentration of power), culturally alienating (with regard to man and nature) and ethically censurable (with relation to the rights of both human and other species), and by the beginning of some actions and policies which, even though tenuous, intended to change this style to sustainable development.

In this scenario, the characterization of the environmental institutional legal universe, which stands in the background, at the three different political levels, guiding the conception and implementation of investments, limiting or expanding possibilities and opportunities, is extremely essential not only for the updating and adequacy of the projects considered in the core or as a consequence of this PHE (waterway strategic plan) with regard to the legal premises of sustainable development, but also, if necessary, to point out the need for institutional adjustments that should imply new prioritization and regrouping criteria for the intended actions in each phase of the plan, or in each waterway administration, accomplishing its programs and projects.

This way, and since this is a study aiming at instrumentalizing the other disciplines, as support for understanding and analysis of the legal and institutional factors that influence the anthropic activities already existing or intended in the different water basins considered, it expresses a character of interaction and thoroughness with other environment studies that have been developed.

b) Premises Adopted

Nonetheless, before proceeding with the survey and analysis of the main pertinent statutes that form the environmental legal framework, it is necessary to set some methodological premises that should guide the reading and interpretation of the legal devices presented below:

- From the methodological point of view, the identification of the main guidelines and instruments for national environmental and water resources policies, and the main institutional players intervening in the inland navigation sectors, ports and intermodal highway integration, and their legal competencies, supports the prerogative of allowing an analysis and strategic evaluation of the needs of cargo and/or passenger waterway transport, and projection of the planned investments, in each river basin, in the navigable sections, including pointing out supplementary actions suitable for the management of PHE programs and projects.

- This way, it is worth noting that these complementary actions often already exist, provided by laws and decrees as control systems, sector programs and projects, whether within the federal, state or municipal sphere, covering portions of the national territory, which could be optimized and strengthened to ensure the correct insertion of the programs and projects intended by the PHE, and which could neutralize their impacts and optimize their benefits.
- In order to characterize the entire environmental[16] legal universe pertinent to the theme, all statutes of major importance referring to the matter were studied and analyzed, including the principles of Brazilian private law rights which articulate these standards, whose understanding should be present throughout preparation of the plan, and it is vital to coordinate and guide the entire set of actions considered.
- All items considered below include legal devices that condition and subordinate, whether in a spatial or temporal manner, methodologically or institutionally the formulation of policies, plans, programs, and, consequently, the allocation of investments and resources, guiding them according to sustainable development principles.
- 6 The legal universe considered in this study refers only to the main standards in the interest of the inland navigation theme, the purpose of this study, the constitutional and legal levels. Some non-statutory standards such as decrees and resolutions are only mentioned when their conclusion is essential for the understanding of the different legal controls and mechanisms as well as the competences of the intervenient institutions.

The flowing premises should also be established:

- The transversible nature of the PNMA - Política Nacional de Meio Ambiente (National Environmental Policy), instituted by Law nº 6938/81 and acknowledged in its main points by the Federal Constitution of 1988, present in the subordination of all other sector policies to their instruments and means of control, stressing: the protection of the environment, considered an asset of common use by the people; and the challenge

[16] The legal universe considered in this study refers solely to the main standards relevant to the theme of inland navigation, object of this study, levels thereby. Some standards infralegal as decrees and resolutions are only cited when their inclusion is fundamental to understanding the different commands and legal mechanisms, as well as the powers of the institutions involved.

of searching for a sustainable development model capable of preserving natural resources for present and future generations;

- The need for articulating water resources planning, mainly with the transport and energy sectors, and within the scope of national, state, regional, and municipal development plans, ensuring that its management does not remain isolated, since other multiple uses of waters should be taken into consideration in the different contexts of the river basin environmental zoning, and the forms of land occupation and natural resource use,as well as the physical, biotical, socio-economic, and cultural differences among the river basins;
- The forecasts regarding the waterways studied in this PHE, as well the works necessary for their accomplishment, are of strong social interest and public utility, connected with the transport sectors, which will imply, whenever adequate planning is prepared, the generation of jobs, habitation improvement of population centers, and poles of farming production, based on the integration of the regions, by means of networks already partially existing, characterized as long distance transport routes of multimodal nature, with high operational capacity and low cost, capable of contributing to facilitate access to markets and improving the competitiveness of national products and economic systems.
- The specificities of each waterway and the waterway and port sector as a whole, which demand three basic procedures within the PHE sphere:
  - Instances and mechanisms of policy negotiation and intrainstitutional and interinstitutional mediation to the voice of the main segments responsible or interested is heardand resolution of possible spatial conflicts, and the use of natural resources, under federal coordination, with an emphases given to the river basin committees;
  - Faithful compliance with the competencies and guidelines prescribed by the CONAMA – Conselho Nacional de Meio Ambiente (National Environmental Council) as a collegiate agency belonging to SISNAMA, and the CNRH - Conselho Nacional de Recursos Hídricos (National Water Resources Council), as a collegiate agency belonging to the SNRH - Sistema Nacional de Recursos Hídricos (National Water Resources System), consulting, deliberative, and normative agencies of national scope, and also the Conselho Nacional de Integração de Políticas de Transporte (CONIT) (National Council of Transport Policy Integration) as the counciling agency associated with the Presidency of the Republic, with the assignment of proposing national policies for the integration of the different modes of transport of people and goods;
  - An autonomous institutional arrangement for its management and coordination, in view of the need to ensure the congruence and synchronicity of the transport sector annual and pluriannual estimate forecasts, with emphasis given to the waterway and port sector and multimodal infrastructure, including investment portfolios which could be made available by the financing agencies, harmonizing different administrative and hierarchical guidelines among the various players and

partners who are expected to participate and not to allow isolated decisions, usurpation of competencies or duplication of resources for the same actions.

- The incidence of the legal-institutional framework referring to environmental protection at the national level of biomes, seen as national assets, and on contemplated activities, as well as state legislation, in each waterway, with emphasis given to the standards: that zone the occupation of the land and the use of natural resources; structure specially-protected territorial spaces; control atmospheric pollution and water resources; and those that structure the state environmental licensing system, and discipline the forms of management for state environmental policies; observing their setup and prerogatives for the granting of rights, even though these, due to their own nature, are interstate or even international waterways, under the competence of the federal government sphere.

For these reasons, in addition to the study, identification, and analysis of the main incident institutional legal devices, the operational outlines of the SISNAMA and SNRH were also considered, in view of the multiple uses of water resources and the imperative need to combine them, so as to ensure the insertion of the PHE within the criteria that assure absolute priority for human well-being, also considering the protection and maintenance of the environmental conditions capable of ensuring the renewal and conservation of the waters, and the preservation of biodiversity.

It is important to stress that the present study does not cover the legislation of a city complexion, understanding, therefore, that this task will be, in any case, important at the time of implementing the ports and multimodal projects and their technical detailing, in light of state and municipal environmental licensing systems, being certain that the involvement of city town halls, as well local communities, is the only guarantee that could actually ensure efficientenvironmental conservation of biomes and associated areas and the success of the undertaking.

It should also be stressed that the themes chosen for legal analysis have as a technical base the interdisciplinary forecast of the main environmental conditioners that influence inland navigation, keeping the required management and objectivity in the face of the case in question.

c) The analysis structure

This way, in view of the diversity of the themes to be covered in this chapter for the purpose of constituting a thorough institutional legal scenario directly connected with the study, capable of subsidizing the entrepreneur in the decision making processes for the best alternatives from the point of view of the environment and the corresponding investments, the most relevant statutes related with the case in question were selected and analyzed, structuring seven major themes which are worth mentioning, namely: (1.3.1) The legal nature of the plan; (1.3.2) Constitutional principles of Brazilian environmental law; (1.3.3) Main guidelines and instruments of national environmental policy; (1.3.4) Main guidelines and instruments of national water resources policy; (1.3.5) Institutional history of the port sector; (1.3.6) Institutional history of the waterway sector; (1.3.7) Cross-border river basins.

Once this legal scenario that influences waterway management is analyzed, the aspects and characteristics of the management itself on a regional and national basis will be presented for the purpose of revealing good practices and possible bottlenecks specifically related to the institution or to its governance.

For a better understanding of the institutional legal analysis, it is worth mentioning that it was subdivided into parts. This chapter provides an analysis carried out on a macro basis on the theme, including the Brazilian highway and port management regulatory legal framework, as well as an analysis of the aspects of waterway management within the national sphere.

The analysis of the aspects of waterway management within the regional sphere may be found in the subsequent chapter and it covers the waterway systems separately, taking into consideration, in addition to other characteristics, the regional waterway management.

Finally, some relevant considerations resulting from both the national and the regional analyses of current waterway management in Brazil are presented, and these considerations are stressed to provide elements for the preparation of alternatives and proposals for the purpose of overcoming possible obstacles and levering the use of waterways in the country.

3.1.4.2 Main legal and institutional aspects related to the PHE

a) The legal nature of the PHE plan / background scenario

A plan, whatever it may be, in the field of public and private policies, materializes the steps or phases of the plan, stratifying the general objectives, the available means, the required means, the sequence or simultaneity of actions and its partial purposes, its spatiality and temporality, determination of the implementation locations and schedule, and, as a mandatory guarantee, its indicators, control measures, and result verification[17]. The plan outlines the decisions of a general nature of the system, its major policy lines, its strategies, guidelines, and responsibilities.

Its structural components[18] are: “a) the syntheses of the facts and the needs that motivate its preparation and a clear establishment of its purposes; b) the various criteria for choosing the priorities; c) the chart of changes to be made for expansion of the system, either in levels or modalities, regarding the structure and sectors involved with the anticipated revenue; d) the goals to be reached upon completion and in each of its phases, including a schedule, anticipating the allocation of human resources and instruments essential for each phase; e)

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[17] Benito Silva – a general planning theory. RJ, FGV Benedito Silva – Uma teoria geral de planejamento. RJ, FGV, 1964, pg 125,

[18] Alaôr Café Alves, Metropolitan Planning and Municipal Autonomy in the Brazilian Law. *São Paulo, Bushatsky – Emplasa 1981 apud* Simon Losano e Sebastian Martin El Planeamiento de la Educacion. Chile 1968 – Instituto Latino americano de Planificacion Econômica y social. Alaôr Café Alves*, Planejamento Metropolitano e Autonomia Municipal no Direito Brasileiro, São Paulo, Bushatsky – Emplasa 1981 apud* Simon Losano e Sebastian Martin El Planeamiento de la Educacion. Chile 1968 – Instituto Latino americano de Planificacion Econômica y social

the volumes and composition of the financial inversions and costs; f) the sources or modalities of financing; g) the forecast of legal, institutional, and administrative changes necessary for its feasibility; e) the distribution of responsibilities for the execution and evaluation of results.”

Whatever may be the nature of a plan formulated by the public power, it should always be structured as a form or act subject to the limits of the Federal Constitution.

This is so because in Brazil it is particularly important to consider the planning-budgeting-program integrated system. The Union is responsible for “preparing and executing the national and regional plans for the ordering of the territory and socio-economic development” (art. 21, subparagraph IX of the Federal Constitution), without excluding, nonetheless, the possibility of state and municipal governments planning their activities provided the guidelines established by federal law are observed.

Likewise, according to the Federal Constitution, the National Congress, with the sanction of the President of the Republic, is responsible for legislating the national, regional, and sector plans and programs (art. 48 subparagraph IV of the Federal Constitution) and the annual and pluriannual budget (art. 48 subparagraph II of the Federal Constitution), which is equivalent to say that the planning process is subordinated to the principle of legality.

All in all, this means that the plan should be approved by law because it will imply public inversion programs which do not legally replace the pluriannual investment budgets or the scheduled state budgets, which have their procedures and approvals carried out according to their own procedural standards.

“A budget, in the modern conception and according to current Brazilian law, is just the same as the financial equivalent of the government action plan”. (SILVA, 1973, pp 71-72).

These principles are in force in Brazilian positive law since the issue of Decree-Law 200/1967, which determines that government action will follow planning aiming at the country’s socio-economic development and national security, directed by plans and programs prepared according to national security guidelines; the public interest; decentralization; the indirect execution by means of concessions to private parties; the convenience and opportunity of the public power provided they are properly motivated.

At this pace it is possible to observe the dynamic perspective of the integration between planning, budget, and program in a binding and continuous manner that imposes a ranking of plans, such as in the case of the Strategic Waterway Plan, currently under preparation, with the Plano Nacional de Viação (National Traffic System), enacted by Law nº/No. 5.917 of 09/10/1973 (with its numerous legal changes); with the PAC – Programa de Aceleração do Crescimento, (Growth Acceleration Program) enacted by Decree nº 6.025 of January 22, 2007; and with the 2012-2015 Pluriannual Plan, enacted by Law nº 12.593 of January 18, 2012.

Therefore, the plan is a conduct guideline that creates rights and commitments for the government and clears the way for political and legal responsibilities. In view of its indicative character to the private sector and the program-related nature of its content, it is possible to state that, in a general manner, the plan does not bind the private sector, unless it is very specific in its determinations, as occurs with municipal master plans containing specific physical-territorial guidelines. The required detailing of this PHE to constitute specific programs and projects for each waterway system selected as a priority for the development of waterway transport, which by its nature is intermodal, in a ordinate manner with further government development plans, expecting the private sector to improve production yield conditions, and management of the waterway network, observing costs and investments, as well as possible institutional rearrangement and optimization for the institutions that control and execute waterway transport policy, should be well observed and demonstrated in the next phases of this work.

b) Constitutional principles of Brazilian environmental law

Fourteen principles are rooted in the Brazilian environmental legal framework and should be present, guiding the formulation, execution, and control of the policies, plans, programs, and projects, not only public but also private.

Their observance is extremely important because they are the foundation, roots, essentials of the law. They are the background of the law that regulates duties (limitations to act) and rights (possibilities of action).

Environmental legal principles could exist in an implicit or explicit manner. Explicit principles are those actually written in the legal texts – essentially in the Federal Constitution.Implicit principles are those resulting from the constitutional system, even if they are not formally written (Antunes, 2004).

It is worth mentioning that both explicit and implicit principles are endowed with positivity, and, therefore, they should be taken into consideration by those who apply the legal standard (whether the judicial, executive or legislative power). With regard to the Brazilian legal system, the environmental legal principles should be found in our Constitution and in the basics of ethics that direct the relations among human beings (Antunes, 2004).

Namely: Cooperative federalism; dignity of the human being; equal access to natural resources; polluter-payer and user-payer; prevention, precaution, access to the judicial power and anticipated judicial protection, control, participation, information and publicity, civil remedy, penal responsibility, reverse burden of proof and international cooperation.

c) Cooperative federalism

The name Federation comes (from the Latin *foedus*, *foedera* "aliance", "pact", "contract") or federal state to a sovereign state composed of various autonomous territorial entities provided with their own government. As a general rule, states (“federated states”) that join each other to constitute a federation (the “federal state”) are autonomous, that is, they have a set of competencies or prerogatives ensured by a constitution which should not be abolished or changed in a unilateral manner by the central government. However, only the federal state is considered sovereign, including for the purposes of international law. Normally, it holds an international personality only, and the federated states are recognized by international law only to the extent that the respective federal state authorizes it.

This relation assumes a spirit of harmony and cooperation between the federated entities, present in the public policy management systems whose dissemination reaches the states and/or municipalities, including areas such as health; education; safety; sanitation; urbanism; the environment, and water resources, where there is a legislative body and common competency to act, an example being the SISNAMA - Sistema Nacional de Meio Ambiente e o Sistema Nacional de Recursos Hídricos (National Policy for Water Resources and National Water Resources System).

Dignity of the Human Being

The principle of human dignity is backed up by the international system by the Stockholm Declaration proclaimed in 1972, and also the 1992 RIO Declaration:

> *"Principle 1 – Human beings are regarded as the core of concerns related to sustainable development. They have the right to healthful and productive lives in harmony with the environment."*

This is understood as a basic principle of the República Federativa do Brasil (Federated Republic of Brazil) according to subparagraph III of article 1 of the Federal Constitution. Associated with this basic principle is the eradication of poverty and reduction of social and regional inequality.

The Política Nacional de Meio Ambiente (National Environmental Policy) – Law nºNo. 6.938 of August 31, 1981, establishes in its article 2 that its main purpose is the preservation, improvement, and recovery of an environmental quality suitable for life, intended for ensuring, in the country, the conditions for socio-economic development, the interests of national security and protection of the dignity of human life.

Equal Access to Natural Resources

The Federal Constitution adopted this principle by following the directions of the 1972 Stockholm Declaration which dealt with the subject matter: "*The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such use are shared by all mankind.*"

In its article 225, it states the following: "*Everyone has the right to an ecologically balanced environment, an asset of common use by the people and essential to a health quality of life, imposing on the public power and the collectivity the duty to defend and preserve it for present and future generations*;

An equitable position (from the local to the global) is not easy to find, requiring considerations of an ethical, scientific and economic nature by current generations and a prospective evaluation of future needs that can not always be known and measured in the present.

User-Payer and Polluter-Payer

The rarity of the resource, the polluting use, and the need to prevent catastrophes, among other factors, could lead to charges for the use of natural resources. Nonetheless, the economic valorization of natural resources cannot be allowed to exclude low income groups.

In Brazil, Law nº 6938/81 that instituted the PNMA – Política Nacional de Meio Ambiente (National Environmental Policy), in its article 4, subparagraph VII, states that its formulation and execution will be intended for "imposing on users a contribution for the use of environmental resources for economic purposes" and "imposing on polluters and predators the obligation to recover and/or indemnify the damages caused.

Law nº 9433/97, in its article 5º, while addressing the instruments of the Política Nacional de Recursos Hídricos, instituted a charge for the use of water (subparagraph IV).

Prevention

To prevent means to act in advance. However, to prevent it is necessary to know and study beforehand the risks and impacts, that is, to foresee the consequences of a given action in a given location and period of time and create mechanisms to avoid or minimize its effects.

The Federal Constitution itself adopted this principle when in its article 225, paragraph 1, subparagraph IV, it established the requirement for a previous environmental impact study, according to the applicable law, regarding the installation of a project or activity potentially capable of causing significant degradation to the environment.

Precaution

Even though, the majority of dictionaries considers a certain similarity between prevention and precaution, its use by the 1992 RIO Declaration and by some international conventions brings distinctive characteristics. Precaution means to be careful! Not only before environment impacts that are considered certain to occur, but also before those considered doubtful.

The difference seems to be in this point. Even when there is an unquestionable doubt about the damage, and a total absence of scientific knowledge of the matter, one should act in the defense of environmental conditions. It is related both to the concepts of staying away avoiding the danger and the safety of future generations, and the environmental sustainability connected with human activities.

Principle 15 of the 1992 RIO Declaration determines that "*in order to protect the environment, precautionary measures should be broadly applied by the states, according to their abilities*. *In case of risk of serious or irreversible damages, the absence of absolute scientific certainty should not be used as a pretext to procrastinate the adoption of measures intended for preventing the environmental degradation.*"

In short, based on the principle of precaution we are responsible for what we know, for what we should have known, and also for what we should have doubted.

Nonetheless, it cannot be used as an open condition, without parameters, and indiscriminately. It is necessary to define what needs to be prevented, and what the risk to be avoided is.

Access to the Judicial Power and Anticipated Judicial Protection

There are a large number of legal instruments at the disposal of society for environmental protection, in addition to the traditional ones such as an injunction or a direct challenge or claim or action brought on grounds of unconstitutionality. Through the Public Civil Action, typified by Law nº 7.347/85, the Ministério Público (Public Prosecutor’s Office), NGOs, and the Public Power could promote environmental protection.

Additionally, any citizen through an Ação Popular (Citizen Lawsuit) (art. 5, LXXIII of the Federal Constitution and Law 4.717/66), could exercise the same right. All these legal actions at the disposal of society allow an anti-suit injunction.

Control – Licensing, Inspection, and Monitoring

Control is the materialization of police enforcement. It is, therefore, a Public Administration activity, commited to limit or discipline rights, interests, or freedom, regulating the practice of an act or abstention in fact, due to the public interest concerning the environment, which depend on consent order from administrative acts.

Technical and legal standards which motivate any and all decisions made by inspecting agents, serve as the parameters for the exercise of control by the Public Power.

By means of using this procedure, it is possible to establish a /relationship between the Public Administration and the administrated interested parties in developing their activities that depends on concession, permission, authorization or license of the Public Power, since these activities could result in pollution or aggressive behavior against nature.

Control is can be divided between licensing, inspection and monitoring.

Public Participation

The public hearing is one of the means of access for the population to environmental studies conducted, and it reinstates the principle of popular participation in the decision making processes regarding the use of natural resources.

Public enquiry, in all possible ways, such as legal and administrative requirements, has been widely required by government agencies as a means of improving and legitimizing policies, plans, programs and projects.

Legislation has not been insensitive to this, because being regarded as an environmental asset, it is an asset of common use by the people, as provided by art. 225 of the Federal Constitution, and nothing is more consistent to ensure the people the ability to learn about and give opinions about studies on the environment, with emphasis given to the Zoneamento Ecológico Econômico (Economic Ecological Zoning) that imposes restrictions on the use of the territory for the creation of Conservation Units, and to the Environmental Impact Studies, considered instruments of policy to preserve, improve, and recover environment quality.

Therefore, the legislation created a system where public participation is ensured, conditioned to the decision making processes referring to the use of natural resources.

Observe that both the CONAMA – Conselho Nacional de Meio Ambiente (National Council for the Environment) and the CNRH – Conselho Nacional de Recursos Hídricos (National Water Resources Council) are composed of organized civil society representatives, without which they would not reach the required legitimacy for exercising their normative, consulting, and deliberative functions.

Previously, according to paragraph 1 of art. 11 of Resolution CONAMA n.º 001/86, the judgment of the need to conduct a public hearing for information on a project and its respective environmental impacts and discussion of the EIA/RIMA, used to be under the responsibility of the competent environmental agency.

With the publication of CONAMA Resolution nº 09, of 12/03/87, published on 07/05/90, the prerogative of the environmental agency to determine the convenience and opportunity for the holding of a public hearing was extended to a request made by a civil entity, by the Ministério Público (Public Prosecutor's Office), or by fifty (50) or more citizens.

Information and Publicity

Art. 5, subparagraph XXXIII, of the the Federal Constitution prescribes: "Everyone has the right to receive, from public agencies, information of its particular interest, or its collective interest in general, that will be rendered according to the legal timetables under penalty of responsibility, except for those whose confidentiality is indispensible to the safety of society and state."

Law 9.051, of 05/18/95, after being enacted, ended up complementing the Constitution, establishing in its art. 1 "the certifications for the defense of rights and clarifications of situations, requested from centralized or autarchic administrative agencies, public companies, corporations with mixed-capital, and public foundations of the Union, states, and Federal District and cities, should be issued within an unpostponable term of fifteen days as from the registration of the issuing agency."

Specifically, in what concerns the environment, paragraph 3 of art. 6, of the Política Nacional de Meio Ambiente (National Environmental Policy) (Law 6938/81) establishes that "the mentioned central agencies, sectors, regional offices, and local agencies should provide the results from the analysis carried out and their essential content whenever requested by those legitimately interested."In principle, all citizens are persons legitimately interested in the quality of the environment, which is a public asset to be necessarily secured and protected, considered for collective use (art. 2, I, of Law 6938/81).

It is noticeable, on the other hand, that "the assurance of the provision of information relative to the environment, obligating the Public Power to provide it, whenever not existing," constitutes an instrument of the National Environmental Policy (art. 9, XI, Law nº/No. 6.938/81).Furthermore, it is noticeable that all acts affecting environmental licensing for activities potentially degrading the environment are the object of publication in newspapers of large circulation.

Civil Remedy

Civil responsibility is the liability which imposes on the infractor the obligation to reimburse losses caused by his/her conduct or activity. It could be contractual, bound by a contract, or extracontractual, due to a legal requirement (legal responsibility), or an ilicit act (responsibility for illicit act), or even a licit act (responsibility for risk).

The legal basis for such a responsibility can be found in art. 225, paragraph 3 of the Federal Constitution which determines that *"conduct considered harmful to the environment will subjectinfractors, natural persons or legal entities, to penalties and administrative sanctions, regardless of the obligation to repair the damaged caused."*Law 6.938/81, in its art. 14, paragraph 1, establishes that "*without prejudice to the administrative penalties anticipated in the subparagraphs of the article, the polluter is obligated, regardless of fault, to indemnify or repair the damage caused to the environment and to third parties affected by his/her activity.*"Even when the activity is considered normal from the environmental point of view, that is, it has EIA/RIMA approval with licenses in force, this approval and granting of license do not exempt the undertaker from the responsibility for the damage that may be caused to the environment and third parties, and in this case, the previous assumptions remain with regard to the responsibility in question.

Administrative and Criminal Responsibility

Administrative responsibility results from the violation of administrative rules, and subjects the infractor to the following: I - penalty; II - loss or restriction of tax incentives or benefits; III - loss or suspension of participation in financing lines from official credit establishments; IV - suspension of his/her activity.

Criminal responsibility results from the commitment of a crime or violation, and the infractor is subject to penalties such as loss of freedom or a monetary penalty.

With regard to environmental issues, based on law/Law 9.605 of 02/12/98, which regulates the penal and administrative sanctions derived from conduct and activities harmful to the environment, it is clear in its art. 2 that:

> *"Whoever, in any way, endorses the practice of crimes anticipated in this law, is subject to the penalties comminated against it to the extent of its culpability, including the director, administrator, member of the council, and technical agency, auditor, manager, legal entity representative attorney-in-fact who is aware of the criminal conduct of others, and takes no action to prevent its practice, when he/she can act to avoid it."*

On the other hand, the law punishes both the natural person and the legal entity (art. 3), according to the "severity of the fact and in view of the reasons for the violation and its consequences to public health and the environment; the infractor's records as to compliance with the legislation of environmental interest; the infractor's financial standing, in case of penalty."The penalties involving the restriction of rights are: Community service, temporary loss of rights; partial or full suspension of its activities; financial penalty; house arrest.

The law considers the following circumstances that could minimize the penalty: an infractor's low level of education or scholarship; an infractor's regret sown by spontaneously repairing the damage, or significant limitation to the degradation caused to the environment; previous notification by the infractor on the eminent danger of environmental degradation; collaboration with the agents in charge of environmental surveillance and control.

The following circumstances aggravate the penalty: I - reoccurrence of crimes of an environmental nature; II - when the infractor has committed the violation under the following conditions: a) to obtain financial advantage; b) to pursue other(s) for the execution of the violation; c) to affect or expose the dangers in a severe manner, to the public health or environment; d) to contribute to the occurrence of damages to the property of others; e) to affect conservation unit areas or areas subject, by an act of the public power, to a special use purpose; f) to affect urban areas or any human settlement; g) periods of defense of fauna; h) on Sundays or holidays; i) at night; j) during drought or flood seasons; l) inside specially protected territory; m) employment of cruel methods for the killing or capture of animals; n) by means of fraud or embezzlement; o) by abusing the right of environment license, permission or authorization; p) in the interest of a legal person fully or partially maintained by public allowances or benefitting from tax incentives; q) to affect species in danger listed in formal reports of the competent authorities; r) facilitated by a public servant in the exercise of his/her function.

It is important to note the power of this law, which, when typifying environmental crimes, adopts the same punishment criteria for almost all administrative violations, giving them force theynever had before, in view of the fact that the notice of environmental infraction also serves as the basis for the opening of suits in the criminal sphere.

Reversal of the Burden of Proof

Machado (2001) focuses on the importance of the reverse of the burden of proof in cases where there are scientific uncertainties:

> *"In certain cases, in face of scientific uncertainty, a causality relationship is presumed for the purpose of avoiding the occurrence of damage. Then, a strict application of the precaution principle reverses the normal burden of the proof and imposes on the potential author the burden of proof, in advance, that his/her action will not cause damages to the environment" (KISS and SHELTON apud MACHADO, 2001).*

International Cooperation

The environmental crimes law recommends that

> *"once national sovereignty, public order, and proper practices are safeguardeded, the Brazilian government will provide, with regard to the environment, the necessary cooperation with other countries without any burden, when requested for: Production of proof; examination of objects and places; information on people and facts; temporary presence of arrested persons whose declarations are relevant for the decision of a cause" (Art. 77, Law 9.605/98).*

However, it is not only in the penal sphere that international cooperation is necessary.

Issues capable of affecting public health, control of ports and airports; cross-border traffic of deteriorated or dangerous cargo; contamination of waters used by two or more countries; elimination of poverty; an illegal market of forest products and wildlife animals; genetic biopiracy; bilateral or multilateral agreements anticipated by MDLs - Mecanismos de Desenvolvimento Limpo (Clean Development Mechanisms) for the reduction of greenhouse effect gases, according to the Protocol of Kyoto, are, for exellence, issues of a international nature.

Additionally, it is worth mentioning that the international development financing agencies, such as BID and BIRD, always keep in their procedures respect for the environmental legislation of the country in which they operate, and the fostering of activities to employ precautionary techniques to avoid environmental and social damage as a condition for the approval of loan or donation projects. BNDES follows the same guidance.

d) Main Points of the National Environmental Policy

> *"With regard to the environment, the intervention of the public power has a double meaning: - Direct development in a manner so as to preserve the environmental ecological balance, seen as of common use, for this and future generations; - and prevent damage. As a matter of fact, the defense of the environment by the public power is not an optional, but a constitutional duty (art. 225 of the Federal Constitution)" (Machado, 2001).*

This should be extended to public agencies and private parties, especially to those which, as concessionaries, licensees or authorized parties may take over the provision of essential, large-sized services and public projects, such as in the case of the large majority of projects seen as structuring work, namely, transportation, sanitation, and energy generation projects, in the concrete case of the PHE and its implementation in the river basins previously selected as adequate for the scope of this work.

In effect, the Brazilian Constitutional System, when imposing, among other demands, the licensing of potentially environment-degrading activities by means of an Environment Impact Study, according to article 225, paragraph 1, subparagraph IV of the Federal Constitution, conferred a larger status to the standards in force that regulate the subject matter since the inaction of Law No. 6938 de 31/08/81 which instituted the PNMA - Política Nacional de Meio Ambiente (National Environmental Policy) and Resolution Nº/No. 001 of 01/23/1986 (recently changed to 237/97), of the CONAMA - Conselho Nacional do Meio Ambiente (National Environmental Council).

This council - CONAMA – extracted its competence to address studies and reports of environmental impact from the aforementioned Federal Law Nº 6.938 of 08/31/81, National Environmental Policy (regulated by Decree nº 99274/90 and changed by Law nº 8.028/90), which, when instituting the SISNAMA - Sistema Nacional de Meio Ambiente (National Environmental System), made the CONAMA its consulting and deliberative agency, entrusting it, among other matters, with the competency to "*determine, whenever deemed necessary, the* *preparation of studies on the alternatives and possible environmental consequences of public or private projects.*"

The composition of the SISNAMA is given by article 6 of the PNMA, which prescribes the following:

> *"The agencies and entities of the Union, states, Federal District, territories and municipalities, as well as the foundations instituted by the Public Power, responsible for the protection and improvement of environmental quality, will constitute the Sistema Nacional do Meio Ambiente (National Environmental System) – SISNAMA".*

Note that this system grouped, in line of cooperation, all public agencies (on vertical and horizontal lines) with an assignment and/or responsibility for environmental protection, giving CONAMA, through article 8 of the aforementioned law, normative, deliberative and consulting competencies, among which it is worth mentioning the following:

> *"determine, whenever deemed necessary, the conducting of studies on alternatives and possible environmental consequences resulting from public and private projects" (subparagraph II) and the "establishment of standards, criteria and guidelines relative to the control and maintenance of environmental quality, with aims at the rational use of environmental resources, mainly water" (subparagraph VII).*

Table 3.1.12: SISNAMA Structure – Sistema Nacional do Meio Ambiente (National Environmental System)

I – Higher Level Agency	Government Council
II – Consulting and Deliberative Agency	Conselho Nacional do Meio Ambiente CONAMA – (National Environmental Council)
III – Central Agency	Ministério do Meio Ambiente – MMA (Ministry of the Environment)
IV – Executive Agency	Instituto Brasileiro do Meio Ambiente – IBAMA (Brazilian Environment and Natural Resources Institute)
V – Regional Agencies	Direct or indirect agencies of the Federal Public Administration as well as the state agencies and entities responsible for environmental control.
VI – Local Agencies	Municipal agencies responsible for environmental control within their respective jurisdictions.

Source: MMA, 2012.

It is worth mentioning that the difference caused by the constitutional status brought to the PNMA devices and instruments, particularly for the following questions: zoning planned for preservation; the promotion of educational and environmental awareness; licensing based on the evaluation of the environmental impact; as well the entire set of standards issued by

CONAMA, lays in the fact that the legal framework available on the part of society conferred to this instruments and standards a greater importance, determinant of the execution of projects or activities potentially harmful to the environment, almost a precondition for the other aspects.

In this scenario, the PNMA devices and instruments are instituted based on collective and diffuse interests, also driven in the background by the power of procedural institutes such as public civil action, popular action[19], collective writ of mandamus, or injunction, and the direct action of unconstitutionality, which could take activities, projects, undertakings, conclusions of the EIA/RIMA, and even the official licenses granted, including plans, programs, and public or private projects, to the Judicial Power.

This legal insertion scenario has been experienced by the Union itself and by the various stated-owned companies (concessionaires of all sectors), since the state or federal Ministério Público (Public Prosecutor's Office), in its turn, and in various regions of the country, has requested the opening of civil inquiries and Public Civil Actions to determine possible damages to the environment, based on complaints of the press, environmental NGOs, and different social segments environmentally troubled by their projects.

These experiences are significant for the indirect administration agencies and concessionaires, licensees, or authorized parties, while proceeding with equitable relief required in all planning and execution strategies, in view of the express possibility of Concession Contract termination or revocation of permission or authorization in cases of environmental damage and violations which may provide procedural grounds.

As well as major losses which could occur (penalties; seizure/ban; interdictions; suspensions; convictions; termination of concessions, etc) in cases of environmental violations caused by the party in question, in view of the objective responsibility imposed by paragraph 1 of article 14 of the National Environment Policy – Law nº 6938/81, *in those exact terms*:

> *Paragraph 1 – Without disregarding the application of the penalties anticipated in this article the polluter is obligated, regardless of the existence of fault[20], to indemnify or repair the damage caused to the environment or third parties affected by its activity. The Ministério Público (Public Prosecutor's Office) of the*

[19]Law 7.347/85 – Known as the diffuse and collective interest law regulates the public civil action for damages caused to the environment, the consumer, artistic, aesthetic, historic assets and rights, tourism, and landscaping (changed by Laws 8.078/90 and 9.494/97; regulated by Decree 1.306/94). Confers legitimate to the Ministério Público (Public Prosecutor's Office) to propose civil and criminal actions. Establishes that the legitimate agencies to file a petition could sign with the degraders the Term of Commitment for Adjustment of Conduct according to the legal requirements, as an out-of-court enforced collection instrument (art. 5, § 5).

[20]Law 6938/81 introduced in the Brazilian environmental legislation sphere the Objective Responsibility Theory, by which the polluter civil responsibility may be configured by means of establishing a reference nexus between his/her conduct and the environmental damage found, without any need of any discussion about intention or fault (negligence, malpractice or imprudence).

Union and states will have legitimate grounds to propose the civil and criminal responsibility for damages caused to the environment.(gf)

Additionally, the publicity and all further conditions established by CONAMA Resolutions (especially nº. 001/86, 09/87 and 237/97 pertinent to the subject matter), do not allow that such instruments and procedures function as mere paper work and technical parts capable of making conclusions based on the unconditional feasibility of undertakings and/or activities, possibly controversial, from the ecological point of view.

It is worth mentioning that the judicial control of administrative acts (among them the acts affecting environmental licensing; zoning with imposition of restrictions on the use of natural resources; inspection; and even the planning and implementation of plans and programs) is only for legal purposes, but in this field the revision is extensive in face of the constitutional provisions (Art. 5 subparagraph XXXV of the Federal Constitution), which state that the law shall not exclude from the analysis of the Judicial Power, any lesion or threat to the law, including herein the possibility of discussing the illegality of plans, programs, and projects which do not internalize the costs of environmental preservation or the costs required for efficient prevention, by means of measures to mitigate and compensate the environment damage.

Bear in mind also that according to Article 5, Subparagraph LXIX, of the Federal Constitution:

"any citizen is a legitimate party to propose a popular action capable of nullifying an offensive act on a public asset or entity in which the state participates, the administrative morality, environment, historical or cultural heritage, leaving the author absolved unless bad faith is proven, exempted from legal charges and the burden of a lawsuit loss."

Therefore, it is noticeable that the correct application of the PNMA instruments, as well as the entire set of CONAMA standards, among them, the evaluation of environmental impacts, are control measures for preventing and/or correcting environmental damage, which are incorporated not only in the planning, execution, and correction of activities directly related to the environment, but also, and mainly, in all the different levels of planning of public or private policies, in any sector of human activities.

Once this is understood, the PNMA administrative instruments and procedures, among them, environmental planning, strategic evaluation of policies, plans, and programs, zoning; project licensing based on EIA/RIMA, are procedures for the prevention and monitoring of environmental data, codirected by the various organized segments of civil society which contribute to the guidance of territorial occupation, and to ensure the rational exploration of natural resources.

It should be noted, nonetheless, that environment studies while acting as public policy tools, can only be considered efficient if they simultaneously play four supplementary roles: a) an instrument to aid decision making; b) an instrument for the conception of projects and planning; c) an instrument for social negotiation; and d) an instrument for environmental management. (Sanchez, 1992).

Although the largest portion of the legal system in force, relative to the theme, refers to environment studies only as an essential part of the licensing of works or activities that use natural resources, considered effective or potentially polluting, or capable, in any way, of causing environment degradation (CF art. 225, paragraph 1, subparagraph IV - Law nº. 6938/81 art. 10, and Decree 99274/90 art. 17 - CONAMA Resolutions nº/No. 001/86 and 237/97), tying it to the idea of licensing per se of works or activities, its role should always be that of an evaluation tool subsidizing, as in the case of studies, the preparation of a Strategic Waterway Plan, its programs and projects, of national coverage.

Competency for Environmental Issues

The issues relative to the environment policy are fitted in the group of standards upon which falls the supplementary competence for the states and municipalities (the municipalities under the protection of the local interest, according to article 30, subparagraph I), and the Union can only dictate “general rules” with regard to these standards.

These parameters can be found in art. 24, subparagraphs VI and VII of the Federal Constitution, which expressly authorize the federated states to legislate concurrently with the Union on forests, hunting, fishing, fauna, preservation of nature, defense of the soil and other natural resources, protection of the environment, and pollution control; protection of historical, cultural, and artistic heritage, tourism, landscaping; and with regard to article 30, subparagraphs I and II, which authorize the municipalities to legislate supplementarily to federal / state legislation on matters of local interest. To exemplify this operation of the state government in the formulation of standards, policies, laws and decrees related to environmental policies, the main legislation connected with the environmental theme were leveraged for each Brazilian state, resulting in approximately 260. The respective table can be found in Attachment III.

Its paragraph 1 shows the competence of the Union for establishing only general rules, not excluding the supplementary competence for the states in paragraph 2, and, paragraph 3 assigns a full legislative competence for the states to meet their peculiarities in case of non-existence of a Federal Law; in case of supervenience, the general federal standards should prevail, suspending the efficacy the rules which oppose them.

In other words, this means that the states and municipalities have full competence for legislating environmental issues, provided there is no opposition to provisions established by federal laws, that is, provided the innovations do not result in disguised non-compliance with the general rules. This way, the state governments and municipal town halls can make the federal standards more restrictive, but never less restrictive than those valid for the entire national territory.

On the other side, it should be noted that, although the legislative competence is concurrent, the executive competence to “*protect the environment and fight pollution in any of its form,*” as well as to “*preserve the forests, fauna, and flora*” is common, as determined by article 23 of the Federal Constitution, between the Union, states, Federal District, and municipalities, being up to any of these entities the assignment to promote actions capable of supporting these purposes, observing Supplementary Law 140/11.

Therefore, the preservation, conservation, defense, recovery, and improvement of the natural and artificial environment, and the work, are duties of the state and municipalities with the participation of the collectivity, with local and regional peculiarities met in harmony with socio-economic development.

This means that the agencies of SISNAMA, within their spheres of competence, are legally obligated to put the imperatives of the PNMA into effect, including its mechanisms and instruments, even when their own environmental standards do not yet exist at the state or municipal level.

e) Environmental Licensing of Waterways, Ports, Dams, Dredging, and Hydraulic Works

Relevance to the Theme

Since these undertakings are potentially polluting, the ports, as well as the waterways, dams, and hydraulic works, are subject to environmental licensing, established by CONAMA Resolutions 001/86 and 237/97, as mentioned above.

It should be noticed that the largest portion of Brazilian ports has been operating for centuries in a system that does not contemplate the impact on adjacent ecosystems.

Therefore, a considerable portion of Brazilian ports are currently in the process of regularization with the environment agencies, whether state or federal (IBAMA), through the preparation of Estudos de Impacto Ambiental e Relatório correspondente (EIA/RIMA) (Studies of Environment Impact and Corresponding Reports) and Planos de Controle Ambiental (Environmental Control Plans) and Termo de Ajuste de Conduta (Conduct Adjustment Term) and/or other mechanisms available in the legislation.

It is worth mentioning the enactment of CONAMA Resolution 344/04, which established the general guidelines and minimum procedures for the evaluation of the material to be dredged in Brazilian jurisdictional waters.

Another aspect is CONAMA Resolution 293/01, which established the minimum content for the preparation of Planos de Emergência Individual (PEI) (Individual Emergency Plans) for occurrences of oil pollution originated from organized ports, port facilities or terminals, ducts, platforms, as well as their respective supporting installations, since Brazil is a signatory of MARPOL (Law 9.966 of April 28, 2000 – Oil Law).

Besides this legislation, it is worth mentioning that CONAMA Resolution 306/02 establishes, specifically, criteria for environmental audits of ports, and Decree 4871 of November 06, 2003 set forth provisions on the institution of area plans for fighting oil pollution in national jurisdictional waters.

With all these legislations, the federal government established, in 1998, a protocol of intentions in the called Agenda Ambiental Portuária (Port Environment Agenda) whose intent, among other aspects, was the compliance of the ports with the environmental legislation.

It should also be noticed that the process for the progressive implementation of standards and procedures referring to safety and health in port work (NR-29), which could become a powerful instrument capable of inducing the modernization of equipment and methods and processes of cargo movement in ports and port terminals.

Licensing Per Se

Environment licensing is an administrative legal procedure characterized as one of the instruments of the National Environmental Policy. It was introduced in the country legal system, initially, by Law nº 6.803, of 07/02/80, and later consolidated by Law nº 6.938/81.

The works relative to the implementation of waterways; dams and dikes; drainage channels; ratification of water courses; opening of navigation channels; port entries, river mouths and channels; ports; ore and chemical product terminals; transposition of river basins; dredging and rock excavation in water bodies; are activities considered potentially harmful to the environment and subject to environmental licensing, as explained in CONAMA Resolution Nº/No. 001/86, and reinterated by CONAMA Resolution nº 237/97, Attachment I.

It is worth noting that environmental licensing is irreplaceable and indispensable for the installation and operation of any actual or potential polluting activity, without prejudice to other legally required licenses issued by other federal, state, or municipal agencies.

This characteristic is often not realized, but it is intrinsic to the spirit of environmental licensing, assuming a biunique state/administrator (undertaker).

The issue of a license represents the formalization of a commitment agreed to between the undertaker and the Public Power.

On one hand, the person in charge of the undertaking commits him/herself to implement and operate his/her ativity according to the conditions included in the license; on the other hand, the issuing agency ensures that during the license validity term, provided the conditions expressed therein are followed, no other environmental control requirement will be imposed on the licensee.

Therefore, note that no one is entitled to pollute, and if adjustments are necessary, the public power can and will apply them to protect the public health and the environment, even though such measures imply the possibility that the undertaker may discuss possible indemnification.

This procedure, according to the provisions of article 19 of Decree Nº 99.274 of June 06, 1990, that regulated Federal Law nº 6.938/81, will address, on the part of the undertaker, the submission of the environmental impact studies and, on the public administration side, the granting of administrative acts which received the name of environmental licenses, namely:

> *"I – Previous License (LP), in the preliminary phase of activity planning, containing basic requirements to be met in the location, installation, and operation phases, observing the municipal, state, and federal plans for use of the soil; (the term not being longer than five (5) years).*
>
> *II – Installation License (LI), authorizing the beginning of the implementation, according to the specifications included in the approved construction design; (the term not being longer than six (6) years), and*

III – Operation License (LO), authorizing, after the verifications required, the beginning of the licensed activities and the operation of the pollution control equipment according to the provisions of the previous and installation licenses (the term must be, at least, four (4) years, and, at most, ten (10) years."

It is opportune to remember that CONAMA Resolution n.º 237/97, in its Article 10, Paragraph 1, determines that the opening of the licensing procedure should take place with the characterization of the undertaking (engineering description), including obligatorily the following:

- Town Hall certificate stating that the type of undertaking/;project or activity is in compliance with the municipal legislations for the use and occupation of the soil;
- Authorization for clearing the vegetation - ASV by the competent environmental agency, and
- The granting of the right for the use of water.

We reiterate herein, according to the comments made subsequently, that simplified or specific procedures could be established for activities and undertakings of small potential impact on the environment, which should be approved by the respective Conselhos de Meio Ambiente (Environmental Councils), including those that integrate the development plans previously approved by the competent government agency, and also for undertakings that implement volunteer environmental management plans and programs, with aims at better continuous improvement of environmental performance according to CONAMA No. 237/97.

It is worth mentioning that with the development of this licensing institute over so many years and the experience accumulated, other evaluation tools were developed by the planning professionals, such as the AAE – Avaliação Ambiental Estratégica (Strategec Environmental Evaluation) for complex undertakings of high region-transforming potential, for long periods of time; the AAI – Avaliação Ambiental Integrada (Integrated Environmental Evaluation) for multiple uses of renewable resources where the synergy and cumulativeness? are essential indicators; the EVTEA – Estudos de Viabilidade Técnica Econômica e Ambiental (Studies for Technical, Economic and Environmental Feasibility) to enable selection of the most feasible alternative that precedes the environmental studies focused on licensing.

Therefore, according to the environmental licensing agency, in face of the specificities of each river basin where the waterways will be implemented, the licensing could be very speeded up if the studies mentioned above are processed previously. The next items referring to environmental licensing hould be interpreted in this context, bearing in mind that CONAMA Resolution 237/97 anticipated the possibility of adjusting the licensing according to the following:

Art. 12 – The competent environmental agency will define, if necessary, the specific procedures for environmental licenses, observing the nature, characteristics, and peculiarities of the activity or undertaking and, also, the compatibilization of the licensing process with the planning, implementation and operation steps.

Paragraph 1 – Simplified procedures could be established for the activities and undertakings of small potential impact on the environment, which should be approved by the respective environmental councils.

*Paragraph 2 – **A single environmental licensing process could be allowed for small undertakings and similar and adjacent activities or for those that integrate development plans previously approved by the competent government agency** provided the legal responsibility for the set of undertakings or activities is defined.*

Paragraph 3 – Criteria should be established to speed up and simplify environmental licensing procedures for activities and undertakings that implement volunteer environmental management plans and programs, with aims at continuously improving and upgrading environmental performance.

Manifestation of Intervening Agencies

The licensing process could also demand an interface with other federal level institutions which should be consulted during the licensing phases, especially during the Previous License application and obtainment phase.

These players, according to the provisions of article 14 of Law 11.516/2007 and Inter-ministerial Ordinance MMA MJ MINC MS No. 419/11, should provide a conclusive manifestation of assent on the environmental study required for the licensing within no later than ninety (90) days in the case of the EIA/RIMA, and no later than 30 days for the Terms of Reference, as from the date the request is received.

FUNAI is responsible for performing the evaluation of the impacts caused by the activity or undertakings to indigenous lands, as well as the appreciation of the adequacy of the control and mitigation measures proposal related to these impacts.

Fundação Cultural Palmares (Palmares Cultural Foundation) is responsible for evaluating the impacts caused by the activity or undertakings to maroon lands, as well as the evaluation of the adequacy of the proposals of control and mitigating measures resulting from these impacts.

IPHAN is responsible for evaluating the existence of protected assets identified in the area of direct influence of the activity or undertaking, as well as the evaluation of the adequacy of the proposals submitted for the recovery.

The Ministry of Health is responsible for handling the evaluation and recommendation related to the impacts with regard to the risk factors for the occurrence of malaria if the activity or undertaking is located within a malaria-endemic area.

The agencies and entities involved could require a single time, based on a duly justified decision, clarifications, detailing or complementation of information, based on the specific term of reference, to be delivered by the undertaker no later than 60 days in the case of a EIA/RIMA and 20 for other cases.

The ICMBio – Instituto Chico Mendes de Biodiversidade (Chico Mendes Biodiversity Institute) created by Law 11516/07 should provide a conclusive manifestation of assent for the environmental licensing processes that may interfere with conservation units, according to the provisions of CONAMA Resolution No. 13/90, and impose this manifestation.

According to the provisions of its article 1, the licensing of an undertaking of significant environmental impact, which may affect a specific conservation unit (UC) or its specific damping zone, considered this way by the licensing environmental agency, based on the environmental impact study and the respective environmental impact report (EIA/RIMA), can only be granted after authorization of the agency responsible for the UC administration.

As determined by article 7, subparagraphs XIII and XIV of the previously mentioned LC 140/11, the Union, through IBAMA, has the assignment of licensing and, consequently, inspecting the undertakings: (i) located and developed together within the country and bordering countries; (ii) located and developed in the territorial sea and continental platform; (iii) located and developed on indigenous lands; (iv) located and developed in two or more states; (v) located and developed in conservation units instituted by the Union (except in APA); (vi) of a military nature; and (vii) which may involve radioactive or and/or nuclear energy materials.

In effect, according to letter “e” of subparagraph XIV, of article 7, of LC 140/11, IBAMA is responsible for the environmental licensing of undertakings located in two or more states, being certain that this competence will affect the licensing of the waterways considered in this PHE.IBAMA should, nonetheless, subject the entire licensing process to an oral testimony hearning and manifestation of each state and municipality covered (as per the guidelines of paragraph 1, article 4, of CONAMA Resolution 237/97, for a technical examination carried out by federated entities which could raise objections to additional, supplementary or specific requirements to ensure the fulfillment of environmental excellence rates in their territories, as well as to adjust the inclusion of the undertaking in the planning of occupation and use of the soil with regard to environmental control programs that may have already been planned or are under way. The environmental agencies, that is, the licensing agencies of each state were studied and listed, and are shown in a table of Attachment IV.

Procedures for the Obtainment of Previous, Installation, and Operation Licenses (LP, LI, and LO) – Legal Requirements of the Environmental Impact Study and Environmental Impact Report (EIA/RIMA)

- The environmental licensing process starts by the determination of the environmental study corresponding to the required license, which should be carried out by the undertaker, and which could be of high, medium or low complexity, depending on the knowledge accumulated of the typology of the intended project and site, or even on grounds of legal determination.

- Respectively, these studies could be complex, such as EIAs /RIMA, or of medium or low complexity, such as the respective RAP – Relatórios Ambientais Preliminares (Preliminary Environmental Reports) or EAS - Estudos Ambientais Simplificados (Simplified Environmental Studies), but should always be technically sufficient to guarantee the findings of the licensing environmental agency and motivate the authority decision.

- The undertaker should then announce, publish by means of the local and regional press, its intention and licensing request.
- After that, the undertaker should submit a work plan, considering the technical studies deemed necessary.
- By analyzing this work plan the environmental licensing agency issues a term of reference with the scope of the work, delimitating the universe of study that should be carried out, considering all themes, methodologies and depth for the studies that will be conducted.
- This term of reference should be named by the agencies and institutions that should obligatorily manifest themselves in the process.
- Upon completion of the studies, or during their preparation, technical meetings could be requested by the competent licensing agency.
- If necessary, complementation could be requested, one time only.
- Based on these studies, the environmental agency should request, in the case of an EIA/RIMA, public hearings.
- Subsequently, a conclusive technical report should be prepared on the environmental feasibility of the undertaking.
- And, based on this technical report, the authority will decide on the granting of the previous license and its validity conditions.

Please find below the flowchart of how this process occurs:

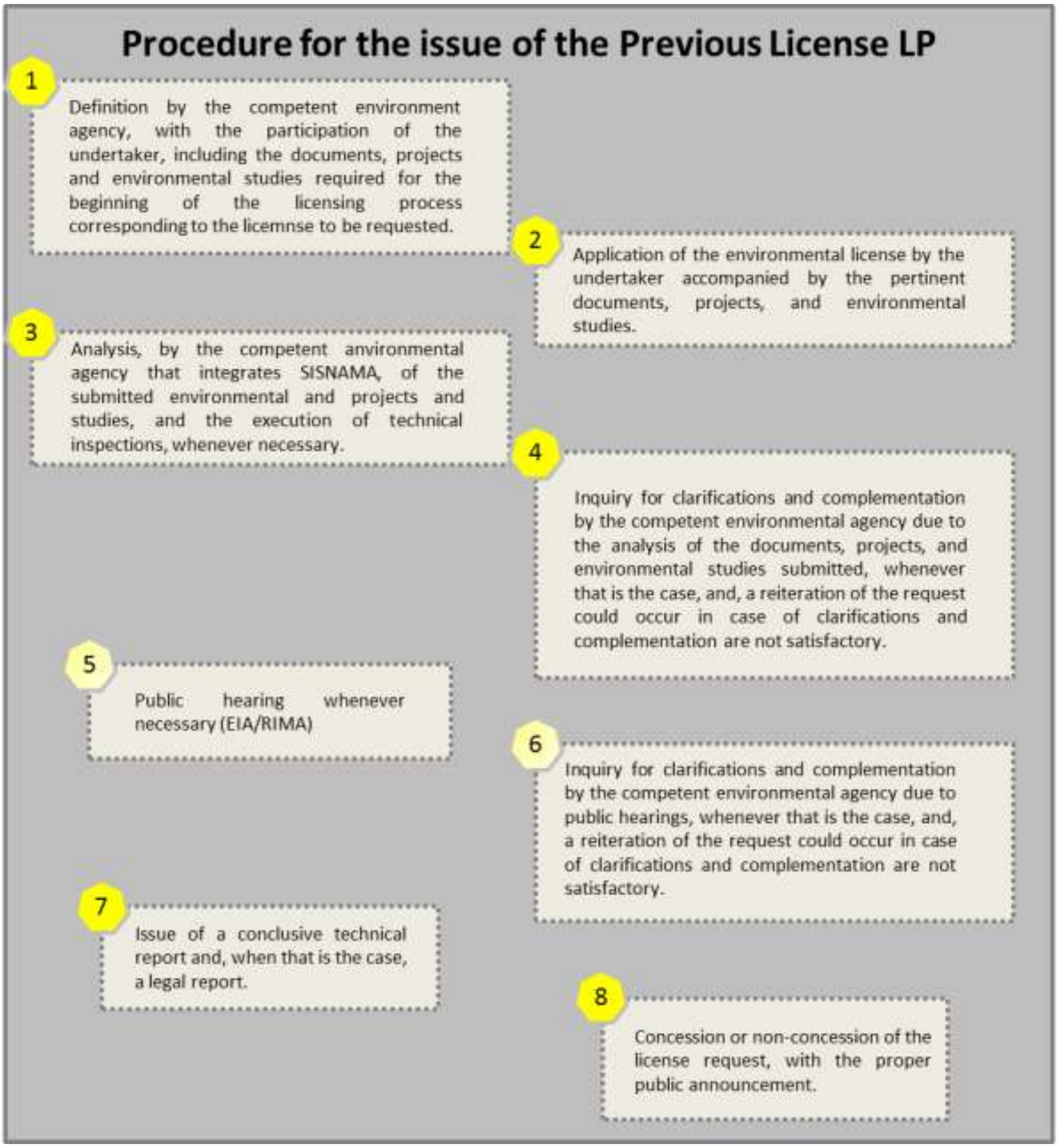

Figure 3.1.6: Procedure for the issue of a Previous License - LP

Source: Consórcio Arcadis Logos, 2012.

In a general manner, the environmental studies, regardless of their degree of complexity, follow some steps for their preparation. These steps were shown by the Ministry of the Environment in the figure below.

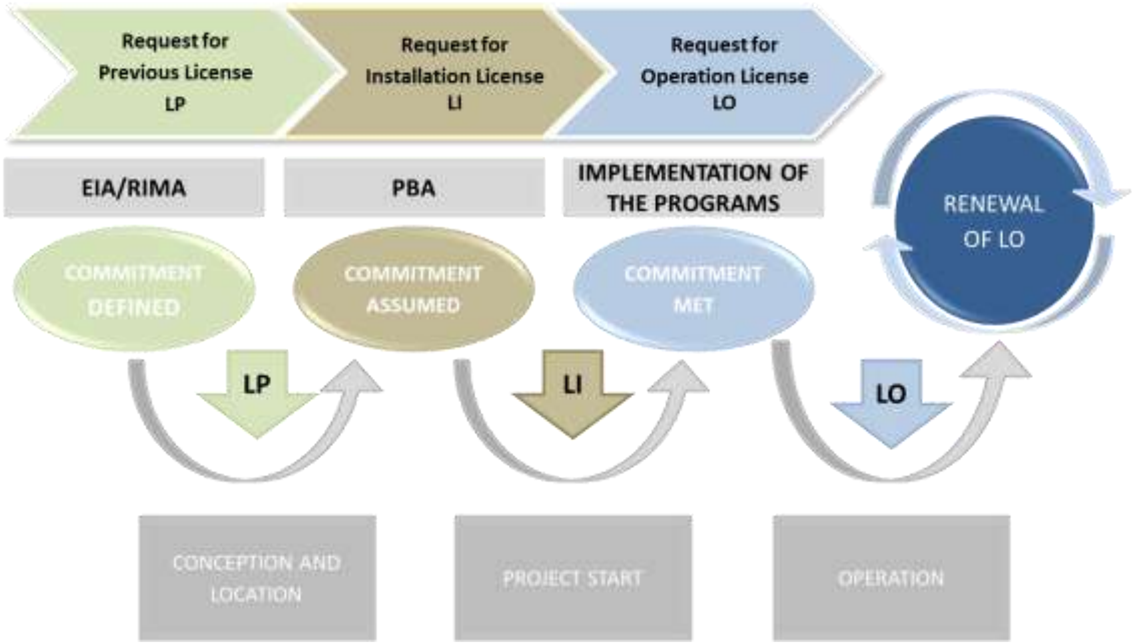

Figure 3.1.7: Phases of Environmental Licensing

Source: Consórcio Arcadis Logos, 2012.

The EIA in addition to complying with the environmental legislation in force, will observe the following general guidelines, according to article 5 of CONAMA Resolution No. 01/86:

- Contemplate all project technological and location alternatives, confronting them with the assumption of non-execution of the project;
- Systematically identify and evaluate the environmental impacts generated in the implementation and operation phases;
- Define the limits of the geographic area directly or indirectly affected by the impacts, referred to as the project influence area, considering, in all cases, the river basin in which it is located;
- Consider the government plans and programs proposed and underway in the project influence area, and their compatibility.

It can be noticed that the guidelines which the EIA should be in line with outline the comparative panorama between the scenario before and after implementation of the undertaking. For this reason, the EIA should cover at least the following aspects:

- Environmental diagnosis of the project influence area, containing a description of the environmental resources and their interactions, characterizing the environmental conditions before implementation of the project. This diagnosis should contemplate the physical, biotic, and socio-economic conditions;
- Analysis of the project environmental impacts and their alternatives by means of forecast of the magnitude and interpretation of the importance of probable relevant impacts (direct and indirect; immediate and medium and long term; temporary and

permanent; their degree of reversibility; the distribution of burdens and social benefits;

- Mitigating measures – are those provided for correcting negative impacts or reducing their magnitude. After the impacts are identified, research should be carried out to find out which mechanisms are capable of reducing or eliminating them;
- Follow up and monitoring programs, established during the EIA phase, to enable a comparison, during the implementation and operation of the activity, of the anticipated impacts with those that effectively occurred (MMA, 2009, p.40).

The Relatório de Impacto Ambiental (RIMA) (Environmental Impact Report) should reflect in a clear[21] and objective manner the conclusions of the EIA, because its purpose is to inform society on the impacts, mitigating measures, and monitoring programs for the undertaking or activity.

Upon issuance of the LP, the detailing of the construction design and the preparation of the Plano Básico Ambiental (PBA) (Basic Environmental Plan) can start, the latter is a study that should instruct the request for the Installation License (LI) as well as compliance with the conditions of the referenced LP.

The following environmental licensing steps comprise the LI application:

1) Compliance with the LP conditions and request publication.

2) Preparation of the Basic Environmental Design (PBA).

Please find below the flowchart of the procedures necessary for the issuance of the LI:

[21] For this purpose to be met RIMA should be submitted in an objective manner, of easy understanding. The information should be provided in accessible language, accompanied by maps, charts, graphs, etc. so that the project advantages and disadvantages, as well as all environmental consequences from its implementation can be shown clearly (MMA, 2009, p.40).

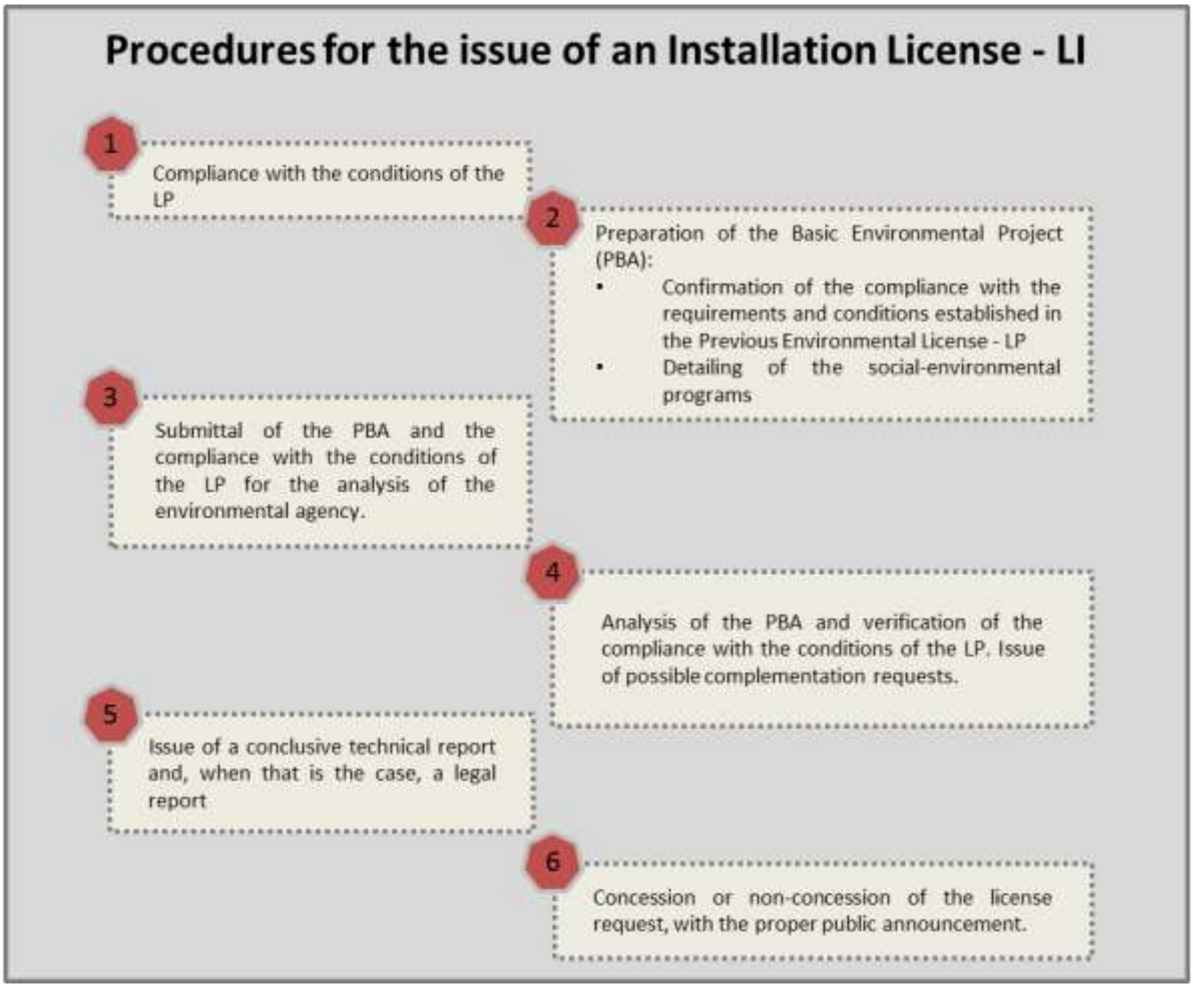

Figure 3.1.8: Procedure for the issue of an Installation License - LI

Source: Consórcio Arcadis Logos, 2012.

It is important to observe that the PBA should demonstrate synchronicity of mitigation and compensation actions with the possibility of the occurrence of impacts, since these are measures taken for their neutralization, reduction, control or compensation or indemnification, when the loss of the previous conditions affect public or private resources in a thorough or irreversible manner.

Once compliance with the LI conditions is confirmed, especially with regard to the adoption of pollution control programs and mitigation or compensation of social impacts, after inspection, the environmental agency will issue the LO – Operation License. In order to obtain this Operation License, the environmental agency should observe the following procedures:

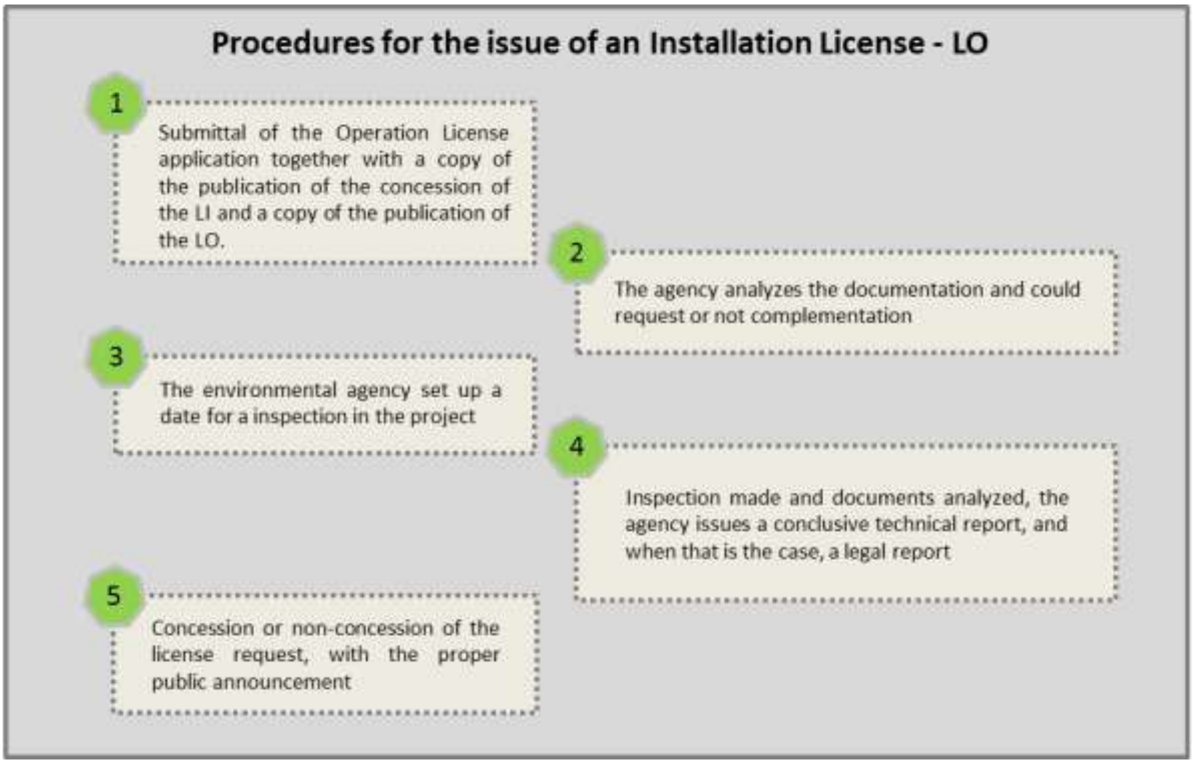

Figure 3.1.9: Procedure for the issuance of an Operation License - LO

Source: Consórcio Arcadis Logos, 2012.

Some Points of Divergence between the Players Involved – Ministry of the Environment, Ministry of transports and Ministério Público (Public Prosecutor's Office)

The environmental licensing of waterways has been considered by the transportation sector a burden to its implementation. This is so due to the slow pace of the approval required for the previous studies, which usually causes delays in the approval of environmental licenses.

The main reasons raised for the delay in the approval of these studies were the lack of definition of the environmental licensing purpose and the difficulty of conciliating the economic and administrative interests with the environmental interests (TCU, 2007, p.24).

While IBAMA suggests that the licensing should be for the waterway as a whole, encompassing the civil works and hydraulic works; the Ministry of transports says that the licensing should be specific, that is, each civil or hydraulic work should have a specific license, covering each engineering work or service, however, within a general view of the waterway[22].

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[22] The Ministry of the Tranportation states that: one of the main burdens for the development of the waterways is the difficulty of approval of environment licenses, mainly due to the lack of clear definition of the purpose to be licensed and lack of common understanding about the technical conceptions connected with the theme (Diretrizes da Política Nacional de Transportes Hidroviários (revised edition), item 3.4 Regulamentar o Licenciamento Ambiental de Intervenções em Hidrovias 2010, p.11) (Regulate the Environment Licensing for Interventions in Waterways 2010, p 11).

These competing interests were considered by the Tribunal de Contas da União (Court of Auditors of Brazil) points to be solved, and the recommendation was for IBAMA, together with the Ministry of transports, to technically define the purpose of the environmental licensing for waterways, in the granting of the previous license, installation license, and operation license, so as to solve the outstanding matters recognized by IBAMA itself and by the Coordenação-Geral de Meio Ambiente (General Coordination of the Environment) of the DNIT , directing the undertaker and providing more efficiency to the environmental licensing process for the implementation and operation of waterways (TCU, 2007, p. 85)[23].

This is so because, even though, since 1997, according to CONAMA Resolution 237, there is a clear determination for the lincensing of waterways, and before that, based on the examples listed in CONAMA Resolution 01/86, the environmental agencies already could demand this licensing, and the only procedure applicable was for the isolated activities or undertakings in specific interventions that were capable of changing the natural conditions of the river, such as rock excavation, dredging, and changes in the waterway navigation channel.

This understanding was reiterated by means of a publication by the Despacho do Diretor da Diretoria de Licenciamento Ambiental (DILIC) (Dispatch of the Environmental Licensing Directorate) of IBAMA, on September 25, 2006, (before the referenced CONAMA Resolution 237/97), which stated that there was no environmental licensing for waterways (Franco, 2009).

This statement was justified by the fact that the waterways are understood as rivers, lakes, canals, bays, coves where navigation exists due to use of the natural conditions offered by the waters (Franco, 2009), that is, the water course itself is a navigable waterway.

According to the referenced dispatch, the dredging, rock excavation, dams, locks, ports, workshops and shipyards should be licensed, that is, the civil and hydraulic work that exists in the waterway and not the waterway per se.

IBAMA then is responsible for analyzing these undertakings when impacts directly affect in part or as a whole the territory of two or more states. Otherwise, the licensing will take place at the state level (Franco, 2009).

[23] The origen of the requirements for the MT and IBAMA to discuss comes from Public Civil Actions. The original act was Court Decision 351/2006-P, of 03/22/06. The inspection was assigned by Ordinance n.º/No. 225, of 03/29/07. The period covered by the monitoring was from May 2006 to May 2007, for access to the full documents, please go to:
http://portal2.tcu.gov.br/portal/page/portal/TCU/comunidades/programas_governo/areas_atuacao/transporte

Artificial waterways[24], according to the dispatch, depend on a previous environmental licensing, as well as the installation and operation licenses, through presentation of an environmental impact study (Franco, 2009).

The Ministry of Transports provided the document "Diretrizes da Política Nacional de Transporte Hidroviário"[25] (Guidelines for the National Waterway Transport Policy), prepared according to the goals of the Plano Nacional de Logística e Transportes (National Logistics and Transport Plan) – PNLT[26], and in alignment with the Plano Nacional sobre Mudança do Clima (National Climate Change Plan)[27]. This document shows the general guidelines required for fostering Brazilian inland navigation, which should define the action of the public sector, and serve as a reference for the initiatives of the private sector. They were prepared in accordance with the provisions established for the assurance of multiple use of waters, and integrated water resources planning, as determined by the National Water Resources Policy (Federal Law No. 9.433/97).

The "Diretrizes da Política Nacional de Transporte Hidroviário" (Guidelines for the National Waterway Transport Policy) present a detailing of the multisector problem that involves the implementation of locks, mainly with respect to articulation with the electrical power sector.

> *"If, on one hand, the generation of hydroelectric power consolidates a highly efficient, safe, inexpensive, and less polluting source of electric power for the energy sector, waterway navigation, on the other hand, also enables a modal system that is very efficient, safe and inexpensive, with smaller environmental impact" (Ministry of transports, 2010, p.1)*[28].

After these considerations we may state that environmental licensing for waterways has been going through changes in the last few years. This is so because the Ministry of the Environment, through IBAMA and the Ministry of transports realized the need to concilidate actions and discuss a new focus for this type of licensing (CGTMO/DILIC/IBAMA, 2009).

The idea is to solve the burden shown herein to reach an understanding about a regulatory framework for environmental licensing of interventions in waterways.

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[24] It is important to clarify that the artificial inland waterways are those that were not navigable and which acquired this condition due to engineering works (Ministry of transports, 2012).

[25] To see the entire document go to: http://www.transportes.gov.br/conteudo/3347

[26] To see the entire document go to: http://www.transportes.gov.br/conteudo/36391

[27] To see the entire document go to: http://www.mma.gov.br/clima/politica-nacional-sobre-mudanca-do-clima/plano-nacional-sobre-mudanca-do-clima

[28] According to news anounced by the Ministry of Tranportation on 08/07/2012, the following was stated: All bids involve the participation of the waterway administrations subordinated to the DNIT in their respective areas of peration. Namely: AHIMOC- Administração das Hidrovias da Amazônia Ocidental; AHIMOR – Administração das Hidrovias da Amazônia Oriental; AHINOR – Administração das Hidrovias do Nordeste; AHSFRA – Administração das Hidrovias do São Francisco; AHIPAR – Administração da Hidrovia do Paraguai; AHRANA – Administração da Hidrovia do Paraná e AHSUL – Administração das Hidrovias do Sul.

The expectations were to reach a consensus about a normative instrument that could be forwarded to the President of the Republic in 2010, but up to the present time this document has not yet been released for public access (Ministry of transports, 2010).

IBAMA, through Ordinance MMA No. 341 of 08/31/2011 created a Coordenação Geral de Transportes, Mineração e Obras Civis – CGTMO (General Coordination of Transport, Mining, and Civil Work) which is a specific coordination to handle Licenciamento Ambiental Federal (Federal Environmental Licensing) for the segment of land transport infrastructure, in the sector of ports, airports, and waterways.

For the Coordenação Geral de Transportes, Mineração e Obras Civis of the Diretoria de Licenciamento Ambiental (Environmental Licensing Directorate) of IBAMA-CGTMO/DILIC/IBAMA (CGTMO/DILIC/IBAMA, 2009) the waterways should be submitted to the environmental licensing procedure, with the regulation of those already existing, and evaluation of the feasibility in the case of implementation of new ones.

The referenced coordination intends to put the already existing waterways through a corrective environmental licensing process. During this corrective process, studies capable of characterizing the waterway and its use should be submitted (types of vessels that will travel on it, types of cargo, critical points for navigation, and required engineering works, location of port terminals, traffic estimates, etc.), showing the environmental impacts by means of studies and proposing mitigating and compensatory measures, including impact monitoring programs.

Through this procedure for regulation of the waterway environmental licensing process, routine interventions such as maintenance dredging or signaling services do not need to be licensed separately, because they would all be included in the same context, however, they would need to be an integral part of the term of reference issued for the licensing of the waterway per se.

The implementation of new waterways should be conditioned on submittal of an EIA/RIMA considering the entire coverage area of the waterway and the interventions required for its implementation, that is, the suggestion is that waterway licensing should already be provided as a whole (CGTMO/DILIC/IBAMA, 2009).

According to the CGTMO/DILIC/IBAMA, the Ministério Público Federal (MPF) (Federal Public Prosecutor's Office) has an important role in this process of setting up a new focal point for environmental licensing of waterways. This is so because the MPF understands that waterways should be submitted to licensing that analyzes the set of impacts caused by waterway activity.

This MPF requirement occurs by means of the proposition of Ações Civis Públicas (Public Civil Actions), whose decisions could cause the temporary suspension of environmental licenses for individual undertakings in the waterways, or could prevent the environmental agency from issuing or renewing environmental licenses (CGTMO/DILIC/IBAMA, 2009).

The Coordenação Geral de Transportes, Mineração e Obras Civis (General Coordination of Transport, Mining, and Civil Work) integrates the Diretoria de Licenciamento Ambiental (Environmental Licensing Directorate) of IBAMA (CGTMO/DILIC/IBAMA). Both were created by Ordinance MMA No. 341 of 08/31/2011.Nonetheless, it is worth mentioning that for civil and hydraulic works, there are impacts that should be considered during the analysis of the environmental licensing process.

In 2005, the Tribunal de Contas da União (Court of Auditors of Brazil) prepared the Relatório de Auditoria de Natureza Operacional (ANOp) (Operational Nature Audit Report) established in the program for DAQ/DNIT Waterway Maintenance. This document pointed out the main difficulties found during the audit, as well as the good practices which could be noticed in that period.

In a general manner, the audit of the TCU (2005) identified the following themes as the main difficulties:

- Difficulty in setting up the signaling and beaconage;
- Lack of updated information on navigability conditions;
- Lack of clear rules included by IBAMA during the environmental licensing process.
- Impediments to the multiple use of waters due to the construction of hidrelectric power plants and locks;
- Erosion of the river banks and consequent reduction of draft;
- Delay in the dredging services or no service provided at all;
- Slowness in release, on the part of the DNIT, of authorizations for bids;
- Need for updating the nautical charts;
- Robbery of and damage to traffic and buoy signaling.

We have, therefore, the current scenario and a possible future scenario for waterway environmental licensing: Improvement of the relation between players (DNIT, Administrators, and IBAMA or environmental licensing state agencies) and the definition of clear rules before the beginning of the licensing process.

f) National Water Resources Policy

The Constitution reserves lakes, rivers, and any water courses on land under its control, or which flow over more than one state, serve as borders with other countries, or extend into or come from foreign territory, as property of the Union, as well as bordering land and river shores. The other water collections are considered state property, reserving, however, "those with hydroelectric energy potential" for the Union.

In effect, this is reflected in Article 20 of the Federal Constitution, by virtue of:

> *"Art. 20. Property of the Union includes:*
>
> *I - that which currently belongs to it and that which may be assigned to it;*
>
> *II – Vacant lands deemed indispensable for the defense of borders, military fortifications and constructions, federal means of communication and environmental conservation, defined in law*

III -........(referenced above)

IV - river and lake islands in areas bordering other countries; ocean beaches; ocean and coast islands, excluding those which contain municipal seats, except for those areas used for public service and federal environmental units, and those referred to in Art. 26, II;.

V - the natural resources of the continental shelf and the economic exclusion zone;

VI - the territorial ocean;

VII – marine land and its additions[29];

VIII - those with hydroelectric energy potential;

IX - mineral resources, including those of the subsoil;

X - natural underground caves and archeological and prehistoric sites;

XI - lands traditionally occupied by indigenous peoples.

The other water collections are considered state property, reserving, however, "those with hydroelectric energy potential" and the "marine land of navegable rivers" for the Union.

In effect, the Constitution in its Article 26, Paragraphs I, II and III considered the following to be property of the states:

I - surface or underground waters, flowing, emerging or deposited, with the exception, in this case, under the law, of those resulting from works of the Union;

II - areas, on ocean and coastal islands, that are under its control, excluding those under the control of the Union, municipalities or third parties;

III - river and lake islands not belonging to the Union.

In terms of water resources, the former Water Code of 1934 remains in effect, excessively centralizing in giving domain to the Union, a situation which did not change under the new Constitution. But currently, Federal Law No. 6.938 of 08/31/81 regulates the National

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[29] Art. 2. Marine land at a depth of 33 meters, measured horizontally to the earth, from the 1831 average high tide is: a) that located on the continent, on the marine coast and on the banks of rivers and lakes, up to the point where the influence of the tides is felt; b) those that surround islands located in the zone where the influence of the tides is felt. Sole paragraph. The influence of the tides is characterized by a regular oscillation of 5 centimeters lower than the water level occuring at any time of year. Art. 3. Additional marine land is that formed, naturally or artificially, on the oceanside or on the banks of rivers and lakes, in continuation of the marine land. Art. 4. Marginal lands are those bathed by navigable currents, outside the reach of the tides, which extend fifteen (15) meters, measured horizontally from the earth part, counting from an average line of common flooding.

Environmental Policy and creates the (SISNAMA) National Environmental System), already mentioned in the initial sections of this chapter.

On January 8, 1997, in compliance with the provisions of Article 21, Paragraph XIX, of the Federal Constitution, Law No. 9.433 was passed, establishing the (SNGRH) (National Water Resources Management System, changing this centralizing scenario and adopting the principles agreed to at ECO RIO-92:

> *"the development and management of water resources should be planned in an integrated manner, taking into consideration the needs of long-term planning, as well as the narrower horizons, i.e. should incorporate environmental, economic and social considerations based on the principle of sustainability; it should include the needs of all users, as well as those related to the prevention and mitigation of water-related hazards; and it should be an integral part of the planning process of socioeconomic development" (UNCED, 1992).*

In effect, Law No. 9.433/97, in its conception, adopted the principles of the "Convention on the right relative to uses of international water courses for purposes other than navegation," signed in New York, in 1997, which are:

- Recognition of river basins as planning units;
- The priority of use for human consumption;
- Water being a good of public domain30 (Article 1, Paragraph I);
- Water being a limited good, sometimes scarce, that, consequently, has economic value (Article 1, Paragraph II);
- Water being a resource with multiple uses whose management should combine and provide for them (Article 1, Paragraph IV);
- Water being a good whose management should be decentralized (Article 1, Paragraph VI).

In order to achieve these objectives, the referenced law promoted a radical decentralization of management: from the seat of public power to the local sphere of the river basin, by means of the River Basin Committees) andWater Agencies). This attempts to implement the principle of subsidiarity[31], already formally recognized at the international level, which completely modifies the spirit of the former Water Code of 1934.

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[30] Water that is considered *res nullius* – without an owner, consequently, subject to individual appropriation – is considered *res communis*, a common asset. Therefore, Art. 8 of Dec. 24.643, of July 10, 1934 (Water Code) that allowed the possibility of private appropriation is revoked.

[31] For which the larger entity only acts, if necessary, supplementarily.

The National Water Resources Policy has as guidelines: the systematic management of water resources, without ignoring the quantity and quality aspects; adjustment of water resource management to the physical, biotic, demographic, economic, social and cultural diversity of the various regions of the country; integration of water resource management with environmental management; the connection of water resource planning with user sectors and with regional, state and national planning; the connection of water resource managment with soil use and integration of managment of river basins with estuary systems and coastal zones.

Classification of Waters

It should also be remembered that, in compliance with CONAMA Resolution No. 357 of March 17, 2005, complemented by CONAMA Res. No. 430 of May 13, 2011, fresh, brackish and saline waters are classified, according to their main uses, into thirteen quality classes.

In light of this classification, the competent state bodies frame and establish permanent programs to monitor their condition, as well as programs to control pollution for the execution of the respective classifications.

In effect, the classification of the waters is proposed by the Basin Agency) to the River Basin Committee) for routing to the respective Federal or State Council, depending on the domain of the river, as provided for in Art. 44 of Law No. 9.433/97, in accordance with the CONAMA guidelines and environmental legislation. These procedures were regulated by CNRH Res. No. 12 of July 19, 2000.

Table 3.1.13: Classification of Waters

Classification	Class	Destination of the Waters
Fresh Waters	Special class	Waters used for supplying human consumption, with treatment; for preservation of the natural balance of aquatic communities; and the preservation of aquatic environments in integrated protection conservation units.
	Class 1	Waters that may be used for supplying human consumption after simple treatment; for protection of aquatic communities; for primary contact recreation, such as swimming, water skiing and diving, according to CONAMA Resolution No. 274, of 2000; for irrigation of vegetables that are consumed raw and fruits that grow in contact with the soil and are eaten raw without removing the skin; and for protection of aquatic communities on indigenous lands.
	Class 2	Waters that may be used for supplying human consumption after simple treatment; for protection of aquatic communities; for primary contact recreation, such as swimming, water skiing and diving, according to CONAMA Resolution No. 274, of 2000; for irrigation of vegetables, fruit plants and parks, gardens, sports and leisure fields, with which the public may have direct contact; and for aquiculture and fishing activities.
	Class 3	Waters that may be used to supply human consumption, after conventional or advanced treatment; for irrigation of tree, cereal and forage crops; for amateur fishing; for secondary contact recreation; and for watering animals.
	Class 4	Waters that may be used for navigation and for landscape harmony.
Brackish Waters	Special class	Waters used for preservation of aquatic environments in integrated protection conservation units; and for preservation of the natural balance of aquatic communities.
	Class 1	Waters that can be used for first contact recreation according to CONAMA Resolution No. 271, of 2000; for protection of aquatic communities; for aquiculture and fishin activities; for supplying human consumption after conventional or advanced treatment; for irrigation of vegetables that are consumed raw or fruits that grow in contact with the soil and which are eaten raw without removing the skin, and for irrigation of parks, gardens, sports and leisure fields, with which the public can come into direct contact.
	Class 2	Waters that may be used for amateur fishing and for secondary contact recreation.
	Class 3	Waters that may be used for navigation and for landscape harmony.
Saline Waters	Special class	Waters used for preservation of aquatic environments in integrated protection conservation units; and for preservation of the natural balance of aquatic communities.
	Class 1	Waters that may be used for first contact recreation according to CONAMA Resolution No. 274, of 2000; for protection of aquatic communities; and for aquiculture and fishing activities.
	Class 2	Waters that may be used for amateur fishing and for secondary contact recreation.
	Class 3	Waters that may be used for navigation and for landscape harmony.

Source: CONAMA Resolution 357/05

Prepared by Consórcio Arcadis Logos

For each of these classes, the referenced CONAMA Res. No. 357/05 provides parameters per substance whose limits can be present in the water body.

Likewise, CONAMA Resolution No. 430/11 complemented CONAMA Resolution No. 357/05, indicating standards for disposing of effluents from any polluting source, which may only be discharged directly into receiving bodies after proper treatment and in compliance with the conditions, standards and requirements indicated for each substance.

It is important to clarify that the disposal parameters of CONAMA Resolution No. 430/11, which cover effluent discharges, should be compared to the parameters of the water body, in each concrete case, by means of sampling and laboratory analyses, and the competent environmental agency will define acceptable values based on this evaluation.

National Water Resources System and its Instruments

Management of water resources is done by means of a system that has five levels:

a) Conselho Nacional de Recursos Hídricos (National Water Resources Council)

b) Conselho de Recursos Hídricos of the states and Federal District

c) Comitês de Bacia Hidrográfica

d) Agências de Bacia

e) Federal, state and municipal agencies involved in managing water resources

According to Article 32 of Law No. 9.433/97 this system has the following objectives:

I. *To coordinate integrated management of waters;*
II. *To administratively arbitrate conflicts related to water resources;*
III. *To implement the política nacional de recursos hídricos;*
IV. *To plan, regulate and control the use, conservation and recovery of water resourcs;*
V. *To promote means of charging for the use of water resources.*

It is important to note here the instruments of the, since it is through them that managment will achieve its planned objectives, as per Article 5:

I. *Water Resources Plans;*
II. *Classification of water bodies into classes, according to the main use of the water;*
III. *Granting of rights to use water resources;*
IV. *Charge for the use of water resources.*
V. *Compensation to municipalities;*
VI. *The Sistema de Informaçoes sobre Recursos Hídricos (The Water Resources Information System).*

Multiple Uses of Water

Management of water resources should always provide for multiple uses of water and should be decentralized and have the participation of the Public Power, users and communities. Environmental management can help in this adequate and participative management, by means of instruments such as the EIA/RIMA, environmental licensing, environmental zoning, and the establishment of management systems, among others.

Multiple uses of water are anticipated as fundamental aspects of the National Water Resources Policy. Multiple uses are understood to be human consumption, animal watering, public supply, disposal of sewage and other liquid wastes or gases for the purpose of dilution, transport or final disposal; the exploitation of hydroelectric energy potential; and waterway transport, among others.

According to Machado (2000), the multiple use of water should be sought by means of the Water Resources Plan that consists of master plans that are long-term, depending on their programs and projects, to be prepared by the and approved by the .

According to Article 7 of Law No. 9.433/97, these plans should have the following minimum content:

a. An evaluation of the current status of water resources;

b. An analysis of demographic growth alternatives, the evolution of productive activities and changes in land occupation patterns;

c. A balance between water resources availability and future demands, in quantity and quality, identifying potential conflicts;

d. Targets for rationalization of use, increase in quantity and quality improvement of available water resources;

e. Measures to be taken, programs to be developed and projects to be implemented to meet the targets set;

f. Priorities for granting the use of water resources;

g. Guidelines and criteria for charging for the use of water resources;

h. Proposals to create areas of restricted water use, intended to protect water resources.

Machado (2000) also argues that there should be legal steps taken to favor one or only a few uses. In this sense, it is imperative that the feasibility of granting several and concomitant usage rights be studied, considering the content of Article 1, Paragraph IV. Furthermore, there is Article 13, Sole paragraph that states that "*the grant of water resources use shall preserve the multiple use of them*." According to Machado (2000), "*the Public Power is explicitly prohibitted from granting usage rights that only allow a single use of the waters. Therefore, acts that grant usage rights and Water Resources Plans that do not comply with these rules should be annulled, administratively or judicially.*"

Since the transportation sector is responsible for managing waterways, it is this sector's responsibility to support the preparation of water resource plans by presenting and providing lists of all the navigable sections of rivers, waterways of national interest and interconnections provided for in federal government plans (ANA, 2005, p. 44).

It should also be emphasized that:

> *To effectively guarantee multiple uses of water courses, the waterway transport sector should survey planned dams, water demand for agriculture and irrigation, for human and natural supply, for tourism, leisure, fishing and aquiculture. With this, the minimum water level to be maintained can be determined for each waterway, in each section or at each critical point, so that waterway transport is possible, considering the dimensions of the vessels used or planned. With the anticipated water levels and the key-curves of the fluviometric stations available on the rivers, it is possible to determine the flows to be maintained in each section or at each critical point (ANA, 2005).*

It should be clarified that in situations of scarcity, according to Art. 1, III, of Law No. 9.433/97, the priority use of water resources is human and animal consumption. According to Machado (2008), "if there is a scarcity of water, it is the responsibility of the federal or state government body responsible for granting rights to use the water to partially or completely suspend the grants that could endanger 'human consumption[32] and animal watering[33]'."

Grants of Usage Rights

Machado (2008) emphasizes the consequences of considering water a good of people's common use: "the use of water cannot be appropriated by a single individual or legal entity with absolute exclusion of other potential users; the use of water cannot mean the polluting or damage of this good; the use of water cannot exhaust the very good used and the concession or authorization (or any type of grant) to use water should be motivated or justified by the public manager[34]."

He also emphasizes the strength of Article 13 of the legal document mentioned above that requires every grant to be conditioned on the water use priorities set by the Water Resources Plan) approved by the respective Comitê da Bacia Hidrográfica.

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[32] Paulo Affonso Leme Machado explains that "human consumptio will be understood only as the use for each person's minimum needs, this is, water to drink, for eating and for hygiene." MACHADO, P.A.L. Direito Ambiental Brasileiro. São Paulo: Ed. Malheiros, 16th edition, 2008. p.449.

[33] OP.cit.p.449.

[34] OP cit. p.443

At the federal level, the Agência Nacional de Água (ANA) (National Water Agency) determines the criteria, and it is responsible for issuing the grants for the rights to use water resources, among other duties.

The ANA is a body tied to the Ministério do Meio Ambiente (MMA) (Ministry of the Environment), created by Federal Law No. 9.984/00 for the purpose of implementing the established by Law No. 9.433/97, and it is responsible, among other duties, for regulating the uses of river and lake water under the control of the Union by means of grants and inspections. It is also responsible for implementing and coordinating shared and integrated management of water resources and regulating water access, promoting its sustainable use.

The ANA is composed of the entities on the following organization chart, of which the Superintendency of Regulation) and the Grant Management) stand out.

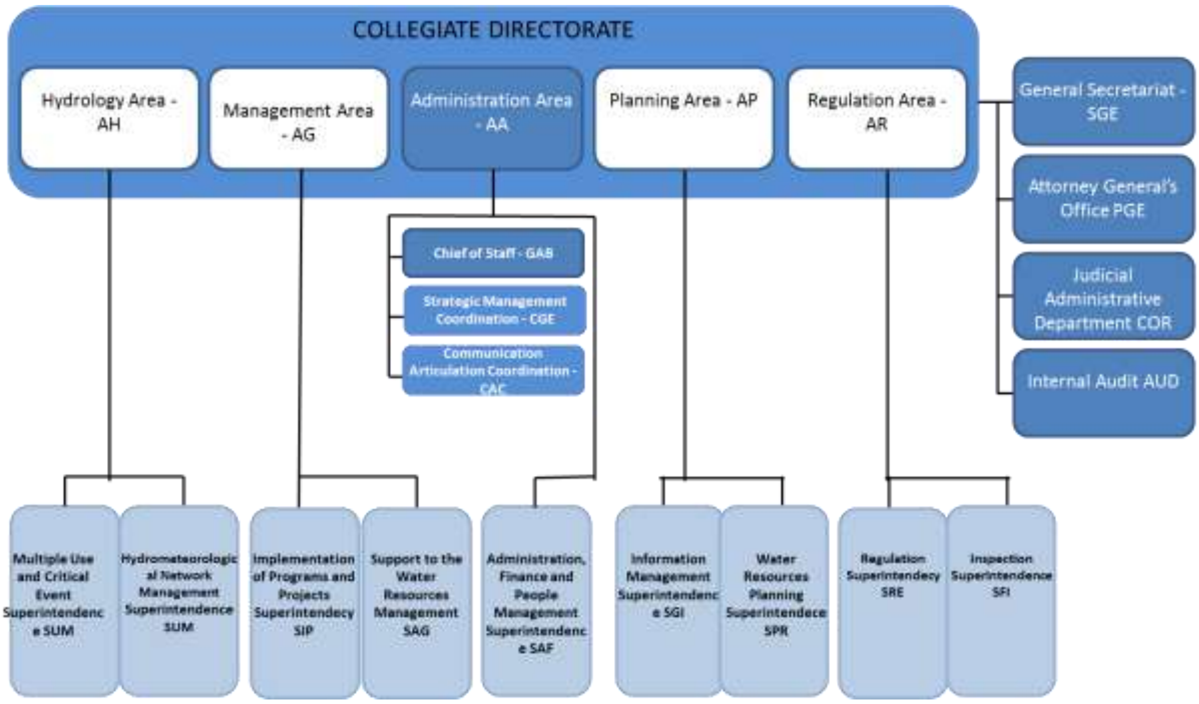

Figure 3.1.10: ANA Organization Chart

Source: http://www2.ana.gov.br/Paginas/institucional/SobreAna/organograma_inst.aspx

A grant is an act by which the Public Power authorizes a user, under preestablished conditions, to use or make hydraulic interferences in water resources necessary for its activity, ensuring the right of access to these resources. Users who do not have a grant are subject to warnings, fines and even seizures provided for in the Law.

The authority to issue a grant depends on the domain of the water course (or water body). Thus, the grant could be issued by the Union when dealing with federal or transborder rivers, or by states when dealing with state rivers, in the case of rivers, lakes, state dams and underground water.

Rivers and lakes that border more than one state or country, as well as water stored in reservoirs managed by federal entitites (DNOCS[35] and CODEVASF[36] dams, for example) are in the domain of the Union and, in these cases, the grant is issued by the ANA. Grants to use water resources for water bodies under the domain of the Union (those that are not restricted to a single state) and in reservoirs built with Union funding are issued by the ANA.

Within the Superintendency of Regulation), the body responsible for issuing grants is the Gerência de Outorga (GEOUT) (Grant Management) authorized to[37]:

I. Examine requests for preventive and direct use grants for water resources in water bodies under the domain of the Union and issue technical reports on them, accompanied by the respective resolution draft;

II. Carry out technical analysis of the grant process, in terms of efficiency and rational use of water by the undertaking;

III. Propose the signing of agreements, contracts and terms of cooperation for the execution of activities related to the grant and monitor its execution;

IV. Format and systemitize complementary information to support the technical analysis of grant requests;

V. Specify the requirements and support the structuring and implementation of grant procedures; and

VI. Provide for the issuance of Water Use Regularization Certificates for cases in which the required use is considering insignificant.

It should be clarified that at the federal level, due to ANA Res. 833/11, all uses that alter flow regime or hydroelectric energy potential are subject to grants.

This means that navigation and waterways are subject to water use rights grants. However, dredging with suction pumps, rock excavations and locks necessary for a waterway may be subject to federal grants since their interference with flow can be significant.

It is also important to note that starting with the publication of Federal Law No. 12.334/10[38], the National Dam Safety Policy), the ANA became responsible for inspecting the safety of dams

[35] Departamento Nacional de Obras Contra Seca (http://www.dnocs.gov.br/)

[36] Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba (http://www.codevasf.gov.br/)

[37] http://www2.ana.gov.br/Paginas/institucional/SobreaAna/uorgs/sof/geout.aspx#cartilha

[38] Federal Law No. 12.334/10 establishes the Política Nacional de Segurança de Barragens, designed to accumulate water for any use, final or temporary disposal of wastes and the accumulation of industrial wastes, and created the Sistema Nacional de Informações sobre Segurança de Barragens and alters the text of Art. 35 of Law No. 9.433, of January 8, 1997, and of Art. 4 of Law No. 9.984, of July 17, 2000.

it authorizes, generally multiuse dams, and for the creation and implementation of the Sistema Nacional de Informações sobre Segurança de Barragens (National Dam Safety Information System).

g) Insitutional Record of the Port Sector – Main Questions – New Regulatory Framework

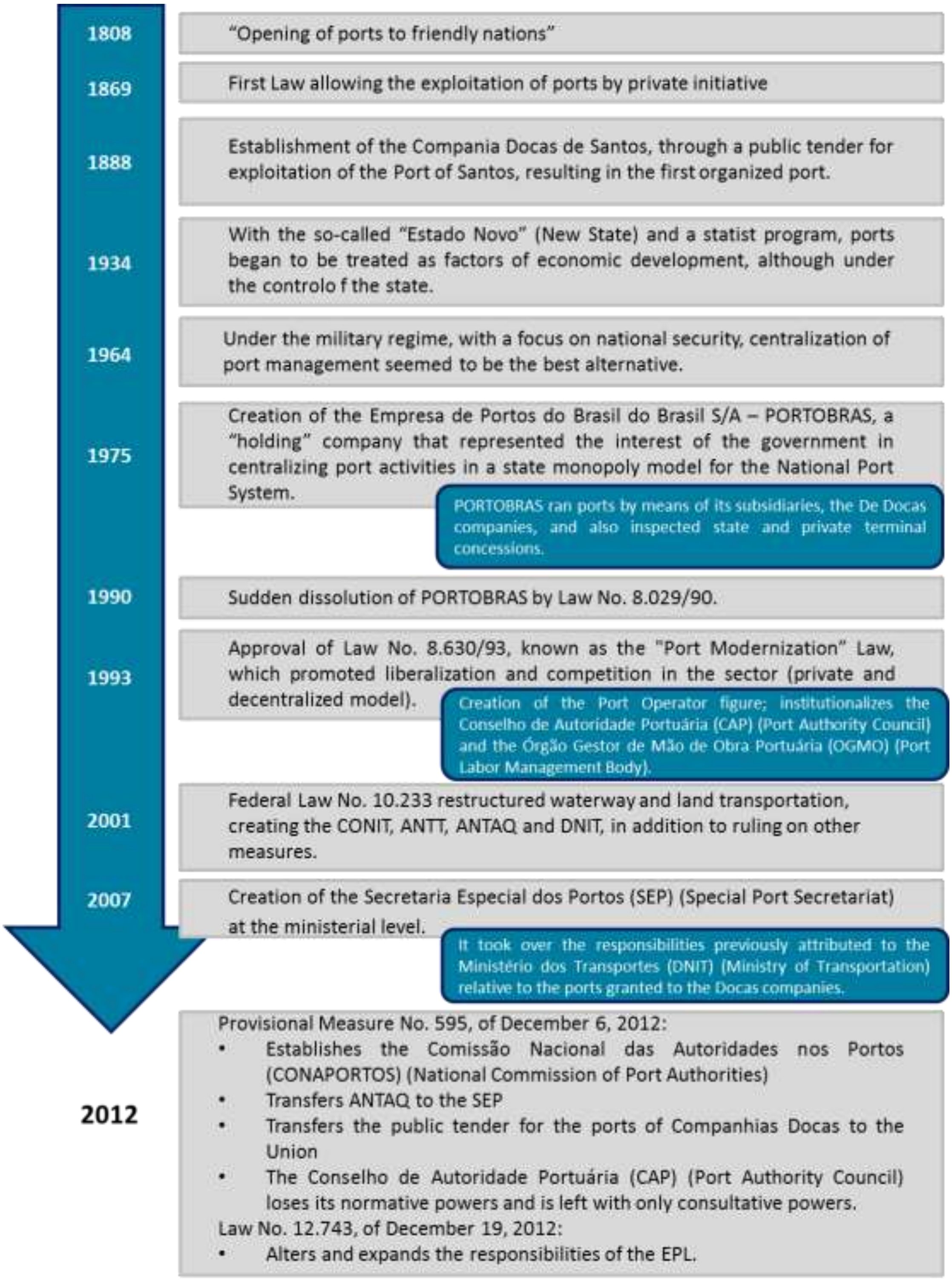

Figure 3.1.11: Port Regulatory Framework

Source: KAPPEL, undated. Prepared by Consórcio Arcadis Logos, 2012.

It is important to note that right after publication of the Port Modernization Law, published on February 25, 1993, in the middle of August of that year, two actions challenging its constitutionality were filed with the Supremo Tribunal Federal (STF) (Federal Supreme Court), ADPF 139 – Claim of Noncompliance with Basic Provision and ADI 929 – Direct Claim of Unconstitutionality.

The main unconstitutionality, evaluated at the time, consisted in the possibility of undermining competition between ports, particularly between the Mixed TUPs and the public terminals. While the "new" Mixed TUPs would be free to hire labor, negotiate and use the terminal, set prices, etc., the terminals installed within the organized ports were subject to all the formality of public and port law, which includes regulation by the Port Authority and the Conselho de Autoridade Portuária (Port Authority Council) and hiring of employees by means of the OGMO (labor managment body).

In addition, the public structures had to follow the rates set by the public power, to permit wide access to those interested in shipping cargo and only engage in this activity after public tender.

Besides the competition risk, the suits claimed that a port is an access to the country and, consequently, a matter of national security underlies public port operations (control of what enters and leaves Brazil). Simultaneously, there is also a legal discussion of the possibility of providing public services in an authorized regime such as the Private Use Terminals. This entire issue was under legal discussion in the Supremo Tribunal Federal (ADI 929 and ADPF 139), but it should now be closed without judgement of merit due to loss of object since the challenged law no longer exists.

Although the new regulatory framework provided by Provisional Measure 595/2012 seems to have overcome these issues, mainly with the creation of CONAPORTOS, several administrative, legal and political opposing arguments can be anticipated to integration of security actions within the scope of the port authority, first, within the National Congress that is still expected to make PM 595 law with amendments, replacements or modifications; and second, again before the FSC because the use of authorization and leasing instead of concessions continues to be controversial, as well as the unfair competition attributed to those who can operate without tariff control[39].

There is also the issue of the structure of the labor managing body, closely watched by the Federação Nacional de Estivadores (National Federation of Stevedores), the Federação Nacional de Conferentes e Consertadores de Carga e Descarga, Vigias Portuários, Trabalhadores de Bloco e Arrumadores (National Federation of Loading and Unloading Checkers and Repairmen, Block Worker Port Watchmen, Ship Stewards and Corders, in Port Activities), and the Federação dos Portuários (Federation of Port Workers), which authors of the ADI mentioned above also claimed harmed acquired labor rights.

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[39] "Lei dos Portos pode sofrer alteração (Port Law can undergo alteration)" available at http://www.sindaport.com.br/noticia-interna.php?id=1746

In effect, in spite of being celebrated, the new regulatory framework is still controversial.

The new norms for the sector are:

- Provisional Measure No. 595, of December 6, 2012, which rules on the direct and indirect exploitation, by the Union, of ports and port facilities and activities performed by port operators ("PM No. 595/2012");
- Decree No. 7.860, of December 6, 2012, which created the Comissão Nacional de Assuntos de Praticagem (National Commission for Pilotage Affairs); and
- Decree No. 7.861, of December 6, 2012, which established the Comissão Nacional das Autoridades nos Portos (CONAPORTOS) (National Commission of Port Authorities) and rules on integrated operation of the public bodies and entities in the organized ports and port facilities.

PM 595/2012 covers ports and port facilities and provides for their direct or indirect exploitation, the latter by means of concessions, leases and authorizations that will be granted to businesses that demonstrate the ability to perform them at their own expense and risk.

According to Art. 3 of PM No. 595/2012, the guidelines of the new regulatory framework are:

a. *Expansion, modernization and optimization of port infrastructure;*

b. *Guarantee of sliding scale and publicized rates and market prices, quality of the services provided and the honoring of user rights;*

c. *Modernization and improvement of the management of organized ports and port facilities, appreciation and training of port labor;*

d. *Promotion of navigation safety for vessels entering and leaving ports; and*

e. *Encouragement of competition, incentivizing the participation of the private sector and ensuring broad access to organized ports and port facilities and activities.*

The most important changes in the sector are:

Provisional Measure No. 595/12

- The Secretaria de Portos will be responsible for centralizing planning for the sector and will also be responsible for coordination of CONAPORTOS;

  (Art. 18. The Secretaria de Portos of the Presidency of the Republic will coordinate the integrated operation of the public bodies and entities in the organized ports and port facilities, for the purpose of ensuring the efficiency and quality of their activities, under the regulatory terms)

- The disconnection of the ANTAQ from the Ministério dos Transportes and its connection to the Secretaria de Portos; (river and lake ports will be directly subordinated to the SEP, although waterways remained with the ANTAQ).

  (Art. 21. The Agência Nacional de Transportes Terrestres (ANTT) (National Land Transport Agency) and the Agência Nacional de Transportes Aquaviários (ANTAQ) (National Waterway Transport Agency) are established, entities subject to indirect federal administration, submitted to the special autarchical regime and tied, respectively, to the Ministério dos Transportes and the Secretaria de Portos of the Presidency of the Republic, under the terms of the law.)

- Leases in organized ports will no longer be awarded by public tender by the port authorities of these ports (Companhias Docas), but rather by the Union itself, and authorization of the Terminais de Uso Privado (TUP) (Private Use Terminals) will not longer be issued by the ANTAQ (which will inspect the contracts and handle the public tender and call for proposals procedures.);

  (Art. 60. In the public tenders for concession and lease contracts, the greatest movement with the lowest rates will be considered as judging criteria, as well as others established in the tender rules, in the form of the regulation.

  § 2. It is the ANTAQ's responsibility, based on the guidelines of the conceding authority, to handle the procedures for the tender this article deals with.)

- The Conselho de Autoridade Portuária (CAP) loses its normative powers and is left with only consultative powers;

  (Art. 16. A port authority council, a consultative body for port administration, will be established in each organized port.)

- A new leased port terminal public tender with a remaining contract term less than 18 months or for which the term has expired (unless there are explicit provisions for extension);

  (Art. 49. Lease contracts in effect on the date of publication of this Provisional Measure remain active for the terms established, and should be awarded by tender at least twelve months in advance, counting from their termination date.

  § 1. If the remaining term of the contract is less than eighteen months or has expired, the ANTAQ shall hold a public tender within one hundred and eighty days of publication of this Provisional Measure.)

- The end of the grant value as a tender criteria and adoption of criteria of greater movement with a lower rate for new concessions and leases;

(Art. 60. In the public tenders for concession and lease contracts, the greatest movement with the lowest rates will be considered as judging criteria, as well as others established in the tender rules, according to the regulation.)

- The difference between its own cargo and that of third parties for exploitation of the TUPs dissapears from the new text. Their authorization grant will be preceded by a public call for proposals.

- The concession and lease contracts will have a term of up to 25 years, extendable for, at the longest, an equal period, a single time, at the discretion of the granting power.

(Art. 5. The related clauses are essential to the concession and lease contracts:

§ 1. The concession and lease contracts will have a term of up to twenty-five years, counting from their signature date, extendable for, at the longest, an equal period, a single time, at the discretion of the conceding power.)

- TUP authorizations, in turn, will have a term of 25 years, extendable for successive periods, as long as the port activity is continued and the authorized party makes the investments necessary to expand and modernize the port facilities;

(§ 2. The port facility authorization will have a term of up to twenty-five years, extendable for successive periods, as long as:

I - the port activity is continued; and

II - the authorized party makes the investments necessary for expansion and modernization of the port facilities, in the form of the regulation.)

- The TUPs cannot be located within the area of an organized port, except for those that have authorization or active adhesion contracts and which will be ensured continuity of their activities for the established terms;

- Breach of port rates will impede extension of concession, lease or adhesion (authorization) contracts, as well as impede controlling, subsidiary or associate companies of the concessionaire/authorized party from obtaining new authorizations;

- The DOCAS companies will no longer need to comply with Law No. 8.666, of June 21, 1993 ("Public Tender Law"), but rather a simplified regulation, for acquisition of goods and services; and

(Art. 55. The Docas companies will follow simplified regulations for contracting services and acquiring goods, observing the constitutional principles of publicizing, impartiality, morality, cost-effectiveness and efficiency.)

- The tender processes for concession of organized ports and leasing can be made under the Differentiated Procurement Regime ("RDC").

(Art. 47. Dredging by result consists of the contracting of engineering works for deepening, widening or expansion of port and waterway areas, including

shipping channels, turning and anchoring basins and mooring berths, as well as signalling, beaconage, environmental monitoring and other services for the purpose of maintaining the depth and safety conditions established in the implemented design.

§ 4. Contracting of the works and services within the scope of the Programa nacional de Dragagem Portuária e Hidroviária II (2nd National Port and Waterway Dredging Program) can be done by means of international tenders and under the (Differentiated Public Procurement Regime) that Law No. 12.462, of August 4, 2011, deals with.)

As informed by the press, the possibility of a new tender displeased leased port terminal operators before Law No. 8.630/1993, who are already taking action in the courts to ensure maintenance of their lease contracts.

The end of the requirement of a minimum movement of a terminal's own cargo for authorization of the grant to run a TUP should increase competition between public and private terminal' and mitigate the problems currently faced by terminals with a substantial movement of third party cargo, including in the administrative area (Tribunal de Contas da União (Federal Audit Court) and the ANTAQ) and in the courts.

The tender shall follow the greater movement of cargo and lowest rate criteria and not that of higher grant value.

To incentivize investments in ports, the government also announced the creation of a line of credit that will be offered by the Banco Nacional de Desenvolvimento Econômico e Social (BNDES) (National Bank for Economic and Social Development).

This line of financing for port investments will be adjusted by the Long-term Interest Rate (“TJLP”) plus 2.5% per year, with a three-year grace period, amortized over 20 years and with up to 65% leveraging.

It should be emphasized that lease contracts in effect will remain active for the terms established, and should be awarded by tender at least twelve months in advance, counting from their termination date. If they allow for extension of their terms, it will be conditioned on review of the contract values and establishment of new minimum movement and investment obligations.

The authorization terms and adhesion contracts, in turn, should be adapted, within 1 year, to the provisions of PM No. 595/2012.

Decree 7860/12:

- (Art. 1) The regulation of prices and improvement of pilotage services by means of creation of the Comissão Nacional para Assuntos de Praticagem; this commission should be composed of the Ministério da Defesa (Ministry of Defense) represented by the Autoridade Marítima (Maritime Authority), the Secretaria de Portos of the

Presidency of the Republic, the Ministério da Fazenda (Ministry of Finance), the Ministério dos Transportes, and the ANTAQ.

- (Art. 5) The proposals of this commission shall be sent to the Autoridade Marítima; and can be opened to public consultation.

Decree 7861/12:

- (Art. 1) Establishes the Comissão Nacional das Autoridades nos Portos (CONAPORTOS) under the coordination of the Secretaria de Portos for the purpose of integrating the activities performed by the public bodies and entitites in the ports and port facilities.

- (Art. 2) CONAPORTOS will have a representative and a respective alternate, from the following bodies: I – Secretaria de Portos of the Presidency of the Republic; II – Casa Civil da Presidência da República (Head of Cabinet of the Presidency of the Republic); III – Ministério da Justiça (Ministry of Justice); IV – Ministério da Defesa, represented by the Comando da Marinha (Navy Command); V – Ministério da Fazenda; VI – Ministério da Agricultura, Pecuária e Abastecimento (Ministry of Agriculture, Livestock Raising and Supply); VII – Ministério da Saúde (Ministry of Health); VIII – Ministério do Desenvolvimento, Indústria e Comércio Exterior (Minsitry of Development, Industry and Foreign Trade); IX – Ministério do Planejamento, Orçamento e Gestão (Ministry of Planning, Budget and Administration); and X – Agência Nacional de Transportes Aquaviários (ANTAQ).

- (Art. 3) It is the responsiblity of CONAPORTOS, among other duties:

  I. *To promote integration of the activities of the public bodies and entities in the organized ports and port facilities;*

  II. *To promote, improve or revise the normative acts that optimize the movement of vessels, goods, products and people, and occupation of the physical space in the organized ports, to improve the quality, safety and speed of operating processes;*

  III. *To establish and monitor performance parameters;*

  IV. *To establish mechanisms that ensure efficiency in the clearance of goods and products;*

  V. *To propose adequate measures to implement international standards and practices relative to port operation and marine transport, observing the international agreements, treaties and conventions to which the country is a signatory;*

  VI. *To propose and promote, within the scope of the organized ports and port facilities, measures designed to improve operational flows and processes, share information systems, train public agents, standardize actions, provide resources, improve criteria based on risk analysis, and standardize procedures with regard to safety, quality and speed requirements;*

VII. *To issue norms for the constitution, structuring and operation of local port authority commissions, and accompany, monitor and guide their activities; and*

VIII. *To evaluate and decide on proposals sent by the local commissions.*

- (Art. 5) The local commissions will consist of the following bodies:I - Companhias Docas; II – Departamento de Polícia Federal (Department of the Federal Police) of the Ministério da Justiça; III – Autoridade Marítima, by its local representative; IV – Secretaria da Receita Federal do Brasil (Federal Revenue Service of Brazil) of the Ministério da Fazenda; V – Secretaria de Defesa Agropecuária (Secretariat of Agricultural and Livestock Raising Defense) of the Ministério da Agricultura, Pecuária e Abastecimento; VI – Agência Nacional de Vigilância Sanitária (ANVISA) (National Health Surveillance Agency); and VII – Agência Nacional de Transportes Aquaviários (ANTAQ).

  § 1. Coordination of the local commissions will be exercised by a representative of Companhias Docas, in the ports and those authorized.

  § 2. For the organized ports not granted to Companhias Docas it will be the responsibility of the Secretaria de Portos of the Presidency of the Republic to name the body or entity responsible for coordinating the local commission.

  § 4. For the river and lake ports, except for those granted to Companhias Docas, the local commissions will also have representatives and their respective alternates from the Departamento Nacional de Infraestrutura de Transportes (DNIT) (National Department of Transportation Infrastructure).

- (Art. 7) The duties of the local commissions, among others, include: implementation and integration of actions and the sharing of information and systems; proposal to the port administration of adaptation of infrastructure, facilities and buildings to safety, quality and speed requirements; proposal to CONAPORTOS of measures to be implemented in periods of high demand; harmonization of the actions of agents of the public bodies and entities in application of International Maritime Organization (IMO) norms relative to facilitation of international marine traffic; proposal to CONAPORTOS of normative acts, revisions of regulatory procedures and work routines; support for ongoing iniciatives to comply with International Sanitary Regulations in designated organized ports, in order to execute public health controls against the international propagation of diseases and avoid unnecessary interference with the transport of people and international trade.

h) Institutional History of the Waterway Sector

The Waterway Administrations arose with that name starting with Law No. 6.222, of 7/10/75, which extinguished the Departamento Nacional de Portos e Vias Navegáveis (DNPVN) (National Department of Ports and Navigable Waterways) and created Empresa de Portos do Brasil S.A.(PORTOBRAS), a private company under private law, with administrative and financial autonomy, for indirect administration, to better deal with the challenge of managing the Brazilian port and waterway systems through a controlling company.

With extinction of the DNPVN, the former regional boards were named Waterway Administrations, executive offices responsible for the policy dictated by the Ministério dos Transportes, through PORTOBRAS, for the development of river transportation.

In the 1990s, with the beginning of privatizations in Brazil, PORTOBRAS was extinguished by Law No. 8.029, of 4/12/90, and by force of Decree No. 99.244, of 5/10/90, making the transport sector subordinate to the Ministério da Infraestrutura (MINFRA) (Ministry of Infrastructure) at the federal level. As a consequence of this change, the Secretaria Nacional de Transportes (SNT) (National Secretariat of Transportation) and the Departamento Nacional de Transportes Aquaviários (DNTA) (National Department of Waterway Transport) were created, which began to manage ports, waterways and shipping, reuniting these activities through direct federal administration.

The administrative changes after extinction of PORTOBRAS resulted in various agreements for decentralization of port and waterway services, signed with the federal government, by means of the DNTA and the SNT. These agreements tied the Waterway Administrations to Companhias Docas and were renewed annually from 1990 to 2007; the AHIMOC and AHINOR are tied to Companhia Docas do Maranhão (CODOMAR); AHIMOR and AHITAR are tied to Companhia Docas do Pará (CDP); Companhia Docas do Estado da Bahia (CODEBA) is responsible for AHSFRA. AHIPAR, AHRANA and AHSUL are tied to Companhia Docas do Estado de São Paulo (CODESP).

Starting with Law no. 8.422, of 5/13/92, the MINFRA was transformed into the Ministério dos Transportes e Comunicações (MTC) (Ministry of Transportation and Communications), and the Secretaria Nacional de Transportes (SNT) and the Departamento Nacional de Transportes Aquaviários (DNTA) continued, both responsible for managing ports, waterways and shipping, considering the actions of Companhias Docas.

The following year, Decree No. 731, of 1/25/93, reestablishes the Ministério de Transportes (MT), with the port sector managed by the Departamento de Portos e Hidrovias (DPH) (Department of Ports and Waterways), subordinate to the Secretaria de Produção (SEPRO) (Secretariat of Production), of the Ministério dos Transportes (MT).

In 2001, Law 10.233, of June 5, modifed by Provisional Measure 2.212-3, of September 4 of the same year, that rules on the restructuring of waterway and land transportation, creates the Conselho Nacional de Integração de Políticas de Transporte (CONIT) (National Council for Integration of Transport Policies), Agência Nacional de Transportes Terrestres (ANTT), Agência Nacional de Transportes Aquaviários (ANTAQ) and Departamento Nacional de Infraestrutura de Transportes (DNIT), and defines the duties, in relation to the Waterway Administrations, that will be exercised by the Departamento Nacional de Infraestrutura de Transportes (DNIT).

On January 30, 2008, the DNIT and CODOMAR signed the Technical and Financial Support for Management of Waterways and Inland Ports Agreement) No. 007/2008/DAQ/DNIT and its Addenda No. 001, No. 002, No. 003, No. 004 and No. 005 (published in the Federal Register of 10/31/2011). The purpose of this agreement is to decentralize port and waterway services, delegating the Waterway Administrations (AHIMOC, AHINOR, AHIMOR, AHITAR, AHIPAR, AHRANA, AHSFRA and AHSUL) under the responsibility of the DNIT to CODOMAR.

This agreement continues in effect today, tying the eight Waterway Administrations (each connected to a waterway system[40]) to CODOMAR, in terms of budgets, and to DNIT technically.

A flowchart illustrating the interactions described above follows below:

[40] AHIMOC administers the Western Amazon Waterway (main operating area of the Madeira Waterway); AHINOR administers the Northeast Basin waterways, mainly the Paranaíba Waterway; AHIMOR administers the Eastern Amazon Waterway, with the Teles Pires - Juruena – Tapajós Waterway as the main operating area; AHITAR acts in the region of the Araguaia and Tocantins River basins; AHIPAR administers the Paraguay Waterway; AHRANA administers the Tietê-Paraná Waterway; AHSFRA administers the São Francisco Waterway and AHSUL administers the Uruguay and South Waterways.

1975 Extinction of the Departamento Nacional de Portos e Vias Navegáveis (DNPVN) and creation of Empresa de Portos do Brasil S.A. - PORTOBRAS

With extinction of the DNPVN, the former regional boards were named Waterway Administrations, executive offices responsible for the policy dictated by the Ministry of Transportation, through PORTOBRAS, for the development of river transportation.

1990 As a consequence of this change, the Secretaria Nacional de Transportes (SNT) and the Departamento Nacional de Transportes Aquaviários (DNTA) were created, which began to manage ports, waterways and shipping, reuniting these activities through direct federal administration.

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1992 Starting with Law No. 8.422, of 5/13/92, the MINFRA was transformed into the Ministério dos Transportes e Comunicações (MTC), and the SNT and the DNTA continued to manage waterways.

1993 Decree No. 731, of 1/25/93, reestablishes the Ministério dos Transportes (MT), with the port and waterway sector managed by the Departmento de Portos e Hidrovias (DPH), subordinate to the Secretaria de Produçaõ (SEPRO).

2001 Federal Law No. 10.233 restructured waterway and land transportation, creating the CONIT, ANTT, ANTAQ and DNIT. It further makes the DNIT responsible for duties related to the Waterway Administrations.

2007 From 1990 to 2007, the Waterway Administrations were tied to Companhias Docas through agreements. AHINOR and AHIMOC tied to CODOMAR, AHIPAR tied to CODESP, as well as AHSUL and AHRANA; AHITAR and AHIMOR tied to the CDP and, finally, AHSFRA tied to CODERBA.

2008- 2012

On January 30, 2008, the DNIT and CODOMAR signed Technical and Financial Support for Management of Waterways and Inland Ports Agreement No. 007/2008/DAQ/DNIT and its Addenda No. 001, No. 002, No. 003, No. 004 and No. 005 (published in the Federal Register of 10/31/2011). The purpose of this agreement is to decentralize port and waterway services, delegating the Waterway Administrations (AHIMOC, AHINOR, AHIMOR, AHITAR, AHIPAR, AHRANA, AHSFRA and AHSUL) under the responsibility of the DNIT to CODOMAR. This agreement continues in effect today.

Figure 3.1.12: Institutional History of the Waterway Sector

Source: Prepared by Consórcio Arcadis Logos, 2012.

i) Transborder Basins – The Case of Mercosul

In dealing with the management of river basins at the transnational level, Brazil, due to its large territorial dimensions, has recently gotten involved in international discussions with the other South American countries for the purpose of making the logistical integration of the countries by means of rivers feasible. The Iniciativa para a Integração da Infraestrutura Regional Sulamericana (IIRSA) (Initiative for Integration of the South American Regional Infrastructure), created in 2000, has worked in the sense of promoting the development of the 12 South American countries, from a perspective of regional integration in a fair and sustainable manner.

The problem (that is repeated at the global, continental, national and regional levels) is that the development conditions and interests of the players are different with regard to environmental protection, which generates points of tension that have repercussions in the legal system.

Consequently, starting with Agenda 21, several agendas at the regional, state and even municipal level have been formed for the purpose of signing sustainability pacts between all the players responsible for economic development, territorial zoning and the use of natural resources.

As an example of this, we will analyze the case of MERCOSUL. According to Machado (2000), it is clear that the macroregional disparities between the countries that form the SOUTHERN CONE make each of them, for example, interpret the commands of the international conventions, such as the Convention for Protection of Biodiversity, according to their specific conditions.

In spite of the advanced positions of Brazilian diplomacy, little or no progress has been made in terms of concrete commitments to improve biodiversity protection, nor with regard to changing the consumption patterns of other countries, mainly those of the so-called first world, with the exception of the notice of adhesion of new countries to the Kyoto Protocol.

Although these circumstances do not blemish the Brazilian institutional position in terms of environmental protection and the search for new sustainable development standards, they strengthen the belief that the differences in socioeconomic conditions of the countries is a possible factor in the low degree of compliance with international agreements, a fact that confirms the crisis of efficacy or effectiveness, because of the diversity of interest of the players involved, a central axis of the analyses that have foreign trade as a basis, and which repeat at the national and regional levels.

Nevertheless, institutional advances were important at the Brazilian level, such as the opening of the G-7 programs previously destined exclusively for the Amazon for the Atlantic Forest biome.

In this international scenario the principle of good governance can clearly be seen, through which an attempt is made to eliminate the crisis of effectiveness of the institutional legal system, by better action of those responsible for the bodies and beneficiaries of the legal system, at its various levels.

The Treaty of Asuncion of 3/16/91, published in the Federal Register on 11/20/91, presents "*the expansion of the actual dimensions of the national markets through integration*" as one of the objectives of MERCOSUL.

The guidelines of the Common Market of the South (MERCOSUL) are set by Article 1 of the aforementioned treaty: 1) free circulation of goods; 2) establishment of a common external tarrif; 3) adoption of a common trade policy in relation to third states; 4) coordination of positions in economic-trade and international forums; 5) coordination of macroeconomic and sectorial policies aiming to ensure adequate conditions for competition between the states – parties; 6) na obligation to harmonize legislation in the pertinent areas.

The Declaration of Canela/92[41], signed by the four of signatories of the Treaty of Assuncion plus Chile, emphasizes that commercial transactions should include the environmental costs caused by the productive stages without transferring them to future generations.

According to MACHADO (2000), in 1992, the member countries of MERCOSUL met in Las Lenas (Argentina) and set the targets to be achieved and the deadlines for achieving them. Many of these targets dealt with environmental issues justifying a special meeting of the environmental ministers and secretaries of the states-parties, held in 1995 in Uruguay, where Resolution No. 38/95 was approved, to include a "(Additional Environmental Protocol) that has not yet been voted on, although there is a firm commitment of the Brazilian government to adopt a basic environmental norm in the face of the discrete resistance of the other countries.

Harmonization of legislation is essential for the regularity and success of MERCOSUL commercial transactions and to prevent conflicts, such as the recent registration case in Brazil, of agrochemicals produced in Argentina, under the provisions of Mercosul Resolutions No. 48/96, 87/96, 149/96, 156/96 and 71/98, in conflict with Law No. 7.802/89 that regulates the production and sale of agricultural pesticides in Brazil, reported by the *Invest News* website of *Gazeta Mercantil* on 10/22/02.

It reported that MERCOSUL, due to the lack or weakness of environmental and health surveillance institutions and systems in Paraguay, Uruguay and Argentina, would serve as a port of entry for products from other nations notably produced under criteria less restrictive than that required by Brazilian legislation.

This case, after many disputes and a group arbitration judgment of MERCOSUL itself, was not able to blemish Brazilian legislation that, in the meantime and to solve the conflict passed Decree No. 4.074/0 IN Interministerial No. 49, of 8/20/02, to internalize the registration of agrochemical products by equivalence, without undermining all the other forms of verification and control.

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[41] Declaração de Canela dos Presidentes dos Países do Cone Sul com vistas à Conferência RIO/92 (Canela Declaration of the Presidents of the Southern Cone Countries Anticipating the RIO/92 Conference – *O Estado de São Paulo*, Cities Section, edition 2/21/1992, p.4 – cited in Machado, P. A. Leme. "Direito Ambiental Brasileiro". 9th Edition. Pages 979-981.

In summary, one can state that although Brazil has bilateral agreements with Uruguay and Argentina to cooperate in environmental matters through methods of monitoring and evaluating environmental impacts and coordinated solutions of activities developed in the border region, as well as with respect to the set of decisions deriving from international conventions in environmental matters in which it takes part, harmonization of environmental legislation throughout the block and with the approval and commitment of all the SOUTHERN ZONE countries is essential and strategic to the success of the common market.

In this context, the projects that intend to leverage economic activities within the scope of the river basins selected in this PHE, should consider the lack of a common environmental agenda between the MERCOSUL countries, which can seriously undermine or at least obstruct the expected trade and the resulting estimated economic development, until the issue is effectively resolved.

3.1.4.3 Aspects of Current Waterway Management in Brazil

With the legal framework established, we turn to the practical characteristics of the waterway in order to understand their function and allow them to reveal their positive aspects, as well as the criteria that may be inhibitting advances in using waterways throughout the country. This, as previously described, was done starting from a first survey of all the institutional players objectively involved in the waterway issue in the country, starting with an analysis of their formal attributes[42], it was decided to conduct interviews with a semi-structured script (Attachment II) to allow an understanding of the informal structure that surrounds these institutions.

In addition to the analysis of the institutional players involved at the national level, analyzed below, it was decided to present a regional analysis, based on those waterway systems that were defined as the object of this plan, in order to identify good practices and aspects to be improved, that can be extrapolated for waterway management as a whole in Brazil. Thus, for each of the waterway systems analyzed by this study, the institutions involved in the waterway issue were considered and important aspects of their articulation at the regional level were discussed. This analysis, however, was highlighted and is presented later on, with a regional focus.

The topic at the national level follows, which, together with the regional analysis, allow an evaluation of waterway management in Brazil.

j) National Analysis

The analysis of the institutions involved in waterway management in Brazil involves the waterway structure itself (directly tied to the Ministério dos Transportes) and the port structure (tied primarily to the SEP), but it also has an impact on the structure of water resources management and on other governmental institutions involved in the environmental licensing processes of potential interventions that may be necessary to make expansion of the

[42] All the institutional actors mapped, as well as their respective duties are described in Attachment I.

modal under study feasible. Consequently, 249 institutions were analyzed, not intending to cover all of them, selecting only those that help prepare a reference view at the national and regional level.

The intervening institutions at the national level mapped in this study were: ten ministries – transportation, defense, foreign relations, environment, national integration, federal public, culture, planning, budgeting and management, tourism and mines and energy – (Attachment I) and one Presidential secretariat – the Secretaria Especial dos Portos – (Attachment I), each with its structures and associated entitites that provide, more or less directly, support for waterway management in Brazil.

In order to present the main institutional players involved in waterway and port[43] management at the national level and their connections and scope of operations, the schematic figure presented below was prepared. It does not intend to cover all the attributes of each institution, but only highlight those that in some way interact with the waterway and port issue:

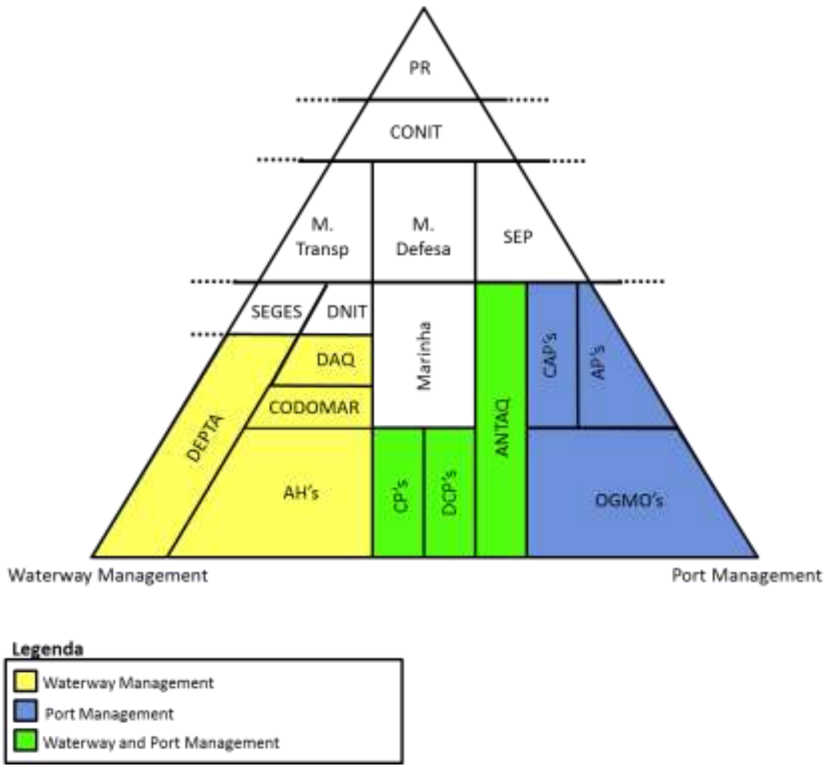


Figure 3.1.13: Institutional Players Involved in Waterway and Port Management

Source: Consórcio Arcadis Logos, 2012.

[43] Of the 33 marine ports that compose the SEP sphere of operations, 18 are managed by mixed public-private companies that have the federal government as their majority shareholder (Companhias Docas), 9 are managed by mixed public-private companies that have the state government as their majority shareholder, 2 are managed by state public companies, 3 are connected to municipal town halls and 1 is managed by private initiative.

The more detailed responsibilities of these agents is presented in the chart below, designed to provide an overview of the sector and explain the individual roles of each agent. To simplify this presentation the SEP was combined with the port agents (APs, CAPs and OMGOs) and the Navy was also grouped with its associated bodies (DCP and Port/River Captaincies). In addition to these agents listed in the figure above, control agents (TCU and Public Ministry), institutions involved in environmental licensing processes (IBAMA, FUNAI, INCRA, IMCbio, Fundação Palmares and IPHAN, among others) and the ANA were also included, in addition to other state level bodies.

Table 3.1.14: National Agents Responsibilties Matrix – Waterway and Port Management

Institution	Port Mgt	Inspection	Waterway Maintenance	Licensing Process	Management of Multiple Water Use Conflicts	Policy Formulation	Regulation
CONIT						■	
Ministry of Transportation						■	
DNIT/DAQ			■				■
CODOMAR	■						
ANTAQ		■					■
SEP and Port Agentes [2]	■	■				■	■
Navy and associated bodies[3]		■				■	■
Waterway Administrations– WA's	■		■				
IBAMA				■		■	■
ANA					■		■
State Governments	■	■	■	■	■	■	
Control agents[4]		■					■
Other agents[5]				■			

[1] Conducts drainage, dredging and signalling.

[2] Aps, CAPs and OGMOs

[3] DPC and Port/River Captancies

[4] Federal Audit Court and Public Prosecutor's Office

[5] This block includes all agents consulted by IBAMA in the licensing process (Fundação Palmares, FUNAI, INCRA, IMCbio, IPHAN and the Public Prosecutor's Office).

Source: Consórcio Arcadis Logos, 2012.

The responsibilities of each of the institutions mapped in the chart above, as well as those that act at the regional level, are found in Attachment I. The way the institutions involved at the national level Interact is detailed below.

The Minisitério dos Transportes is the body responsible for advising the President of the Republic in the execution and formulation of the country's transportation policy. With regard to waterways, it currently relies on the DNIT (Attachment I) – an autarchy that has management of the waterway infrastructure at the national level as one of its formal responsibilities - and its Diretoria de Infraestrutura Aquaviária (DAQ), in addition to the

Secretaria de Gestão de Programas de Transportes (SEGES) (Secretariat of Transportation Program Management), with its Departamento de Programas de Transportes Aquaviários (DEPTA) (Department of Waterway Transport Programs).

Decree No. 7.717, Federal Register of 8/15/2012 (*)
Provisional Measure No. 595, Federal Register of 12/7/2012 (**)

(COORDINATION OF MODERNIZATION AND ORGANIZATION)
(CGMO)
12/07/2012 (*) (**)

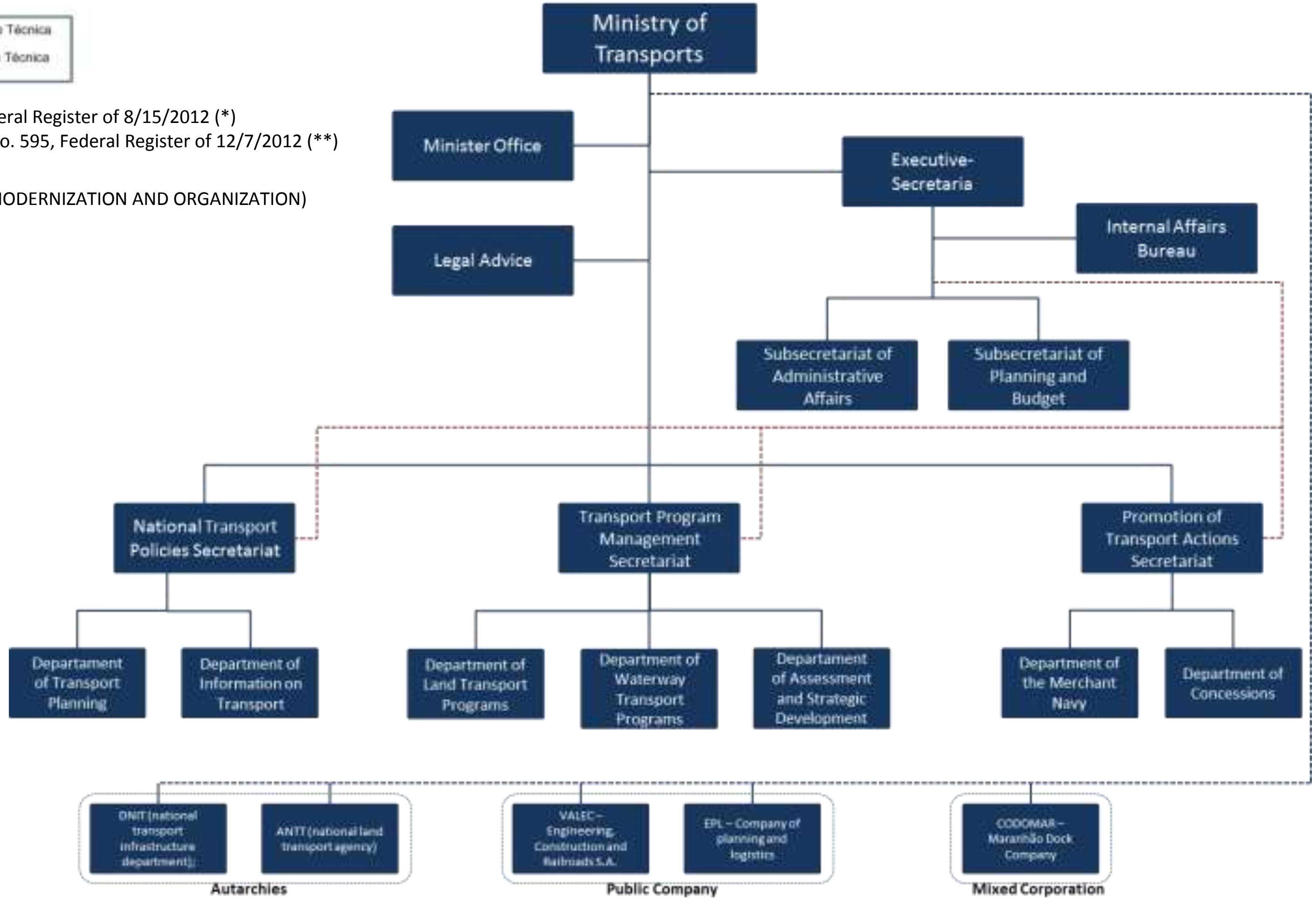


Figure 3.1.14 - Ministério dos Transportes Organization Chart

Source: Ministério dos Transportes, 2013.

SEGES is responsible for coordinating and guiding implementation of plans, programs and actions designed to develop the Sistema Nacional de Viação (National Transport System), as well as follow up, monitor and provide information on the implementation of investments provided for in the Pluriannual Plan (PPA) for the transportation sector.

In its founding law (Law No. 10.233/2001), the DNIT was given the responsibility to implement the policy developed for management of the Sistema Federal de Viação (SFV) (Federal Transportation System), ensuring its operation, maintenance, replacement, capacity adaptation and expansion, under the terms of Art. 80 of the referenced law, which affirms that the navigable waterways are within its area of operation (Art. 81).

For execution of the responsibilities of the DNIT with regard to waterway transport, the DAQ is formally subdivided into two coordinating bodies: the Coordenação Geral de Construção (General Coordination for Construction) and the Coordenação Geral de Manutenção e Operação (General Coordination for Maintenance and Operations). The first develops activities to execute waterway infrastructure design and works, as well as establish technical standards and norms for their control. The second executes activities for waterway infrastructure maintenance, recovery, safety programs and operation, as well as establishes technical standards and norms for the safety and operation of waterways.

Also based on the law that created it, the DNIT is responsible for managing – directly or by means of delegation or cooperation agreements – programs that involve operation, maintenance, preservation, restauration and replacement of waterways. Thus, in 2008, in order to obtain support to better organize itself internally to support waterway management, the DNIT established with CODOMAR (Attachment I), Technical and Financial Support for Management of Waterways and Inland Ports Agreement No. 007/2008/DAQ/DNIT. This agreement initially had a temporary character, while the DNIT better trimmed and structured the DAQ, but it was extended each year by its Addenda No. 001, No. 002, No. 003, No. 004 and No. 005, published in the Federal Official Gazette of 10/31/2011 and it continues active today.

By means of this agreement, the port and waterway infrastructure services provided by the DNIT were decentralized to CODOMAR, assigning the use of assets of the Ministry of Transportation and the DNIT with regard to the Waterway Managements of Tocantins Araguaia (AHITAR), Eastern Amazonia (AHIMOR), Western Amazon (AHIMOC), São Francisco (AHSFRA), Paraná (AHRANA), Paraguay (AHIPAR), Parnaíba (AHINOR) and the South (AHSUL).

CODOMAR is an authorized public-private corporation tied, by force of the referenced agreement, to the Ministério dos Transportes, which gave up its former function as Companhia de Docas to have the managment of Waterway Management (AH) activities as its primary objective. Today, it is composed of two directorates: an administrative-financial one for the purpose of analyzing the work plans sent by the Waterway Managements and providing the funds necessary for these activities to be conducted, and another engineering and operational one that conducts studies and issues opinions.

It is this very intermediation by CODOMAR with regard to the funding coming from the DNIT that is one of the main limiting factors to waterway management activities. If on one hand, the resources destined for waterway management are not significant, on the other, the role of

CODOMAR seems to result in greater difficulty in accessing funding, since, under the terms of the agreement, non-submission of a rendering of accounts by any AH blocks the sending of funds[44] for all of them, since the agreement covers the managements as a whole and not each one individually.

In addition to the lack of funding provided for waterways in Brazil, another great impediment found is the large number of hydroelectric power plants, often build without locks, existing in potential waterways, making commercial navigation unfeasible in certain stretches.

The Agência Nacional de Águas (ANA) (Attachment I) has the mission to implement and coordinate shared and integrated management of water resources and regulate water access, always striving to maintain multiple use of water. Given this, it should intermediate conflicts between those interested in making waterways viable (Ministério dos Transportes) and those interested in building hydroelectric power plants (Ministério de Minas e Energia), so that both can realize their projects.

As previously seen, it is necessary to obtain a grant to exploit hydroelectric power potential on a river and construction of a dam specifically to ensure continual river navigation must consider, in its design, the technical characteristics that would make multiple use of the water feasible. This is because during the construction phase, many of the projects block or restrict navigation, even the few for which locks are planned in their design. Thus, many companies decide not to invest in river transport, knowing about the new hydroelectric power projects underway on the rivers and their effects on navigation.

In recent years, Brazil has been prioritizing the use of hydroelectric power potential in rivers to the detriment of river navigation. But these are not mutually exclusiver choices. There is room in integrated planning of water to resolve this conflict.

The Comitês de Bacias Hidrográficas (CBHs) (Attachment I) have a more local focus in managing water use. They are collegiated bodies composed of water users and interested parties; civil society or the government; and federal and state entities active in the region with regard to water resources.

One of their responsibilities is to prevent conflicts between those interested in using water resources. For this, the committee holds discussions and coordinates the actions of the entities involved, aiming at agreement. When this is not possible, it acts as an arbitrator in the first administrative instance; establishing mechanisms and suggesting the values for charging for water use; among others. These decisions, however, can be reviewed by the committee itself, or it is possible to request review by the water resources councils, in the last administrative instance, depending on the dominion of the waters in dispute.

Since the CBHs have no executive function, the figure of the Water Agencies or Basin Agency was created to provide technical support to the committee exercising, among others, the

[44] Except funds for paying staff payroll.

function of executive secretary. The creation of the Water Agency occurs only when financial feasibility is ensured by charging for water use in the area of operation and the agency implementation process has been slower than expected.

Thus, the vast majority of Comitês de Bacias Hidrográficas do not have Water or Basin Agencies and, therefore, do not have technical support, making their decisions “weak," and as a consequence, they are not able to effectively manage water use.

Also with regard to the conflict between energy operators and those interested in making waterways viable, Congress is considering Bill No. 3.009, of 1997, which establishes the obligation to include locks, or equivalent transposition devices, and equipment and procedures for protecting water fauna, when building dams on water courses. However, a vote on this bill has not yet occurred, and construction of locks for hydroelectric power plants is not mandatory on potentially navigable rivers.

Another conflict resulting from this lack of “agreements” between the ANEEL (Ministério de Minas e Energia) and ANTAQ (Secretaria Especial de Portos) regulatory agencies, also mediated by the ANA, occurs as a result of the change in water level caused by hydroelectric power plants when they close their gates during dry seasons or due to poor functioning, thus changing the downstream water flow, making navigation impossible.

In addition to maintaining multiple use of water, another benefit resulting from this bill would be that the environmental licensing of the hydroelectric power plant would be the same as that of the lock, since both would be connected to a single Project, thus reducing the bureaucracy and, consequently, the related costs. Another important factor is that when the locks are built together with the hydroelectric power plants, their cost is 7% of the total value of the plant. However, if they are build separately, the locks can cost 30% of the value of the hydroelectric power plant (Source: *Valor Econômico* 5/3/2012 - Produtores do Mato Grosso querem eclusas nos rios Tapajós e Teles Pires (Mato Grosso producers want locks on the Tapajós and Teles Pires Rivers). There are also uncertainties resulting from the current concession model for energy exploitation of the rivers, since the construction costs of locks cannot be considered in calculation of the rates to be charged by concessionaires. Even though the federal government has already shown a willingness to cover these costs through its Minstério dos Transportes, there has been no clear decision on the subject (Source: Diretrizes da Política Nacional de Transporte Hidroviário, Ministério dos Transportes, 2010).

Environmental licensing is conducted by the state environmental secretariats when the coverage of a project or work falls within a single state’s borders. When it covers the area of more than one state, IBAMA (Attachment I) is responsible for licensing civil works (dikes, dredging channels, wharves, locks) and hydraulic works for exploiting water resources (dredging, rock excavation).

IBAMA must ask the state bodies responsible for licensing to provide technical opinions on the compliance of projects to their plans and norms, as well as other institutions responsible for specific subjects, such as:

- Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) (Chico Mendes Institute of Biodiversity Conservation) if the intervention crosses or occurs near a Conservation Unit (UC);
- Fundação Nacional do Índio (FUNAI) (National Indian Foundation) if there are indian lands on the banks of the river or in its proximity;
- Instituto Nacional de Colonização e Reforma Agrária (INCRA) (National Institute of Colonization and Land Reform) if there are traditional communities;
- IPHAN if there is some type of cultural heritage;
- And the Fundação Palmares (Palmares Foundation) if there are maroon communities.

However, there is no clear definition of the content to be licensed. An example is the difference in the requests made by IBAMA to each waterway, in the case of the Parnaíba Waterway, IBAMA did not require licensing for works to clear the bed for movement (to remove trunks and branches), services to maintain the depth in the preferred navigation route, beaconage, nautical signalling on the banks, or cleaning and anchoring of banks along the waterway, since it characterized these as preventive maintenance activities that had no environmental impacts. On other waterways, maintenance of depth is considered a utility service (according to Attachment I of CONAMA 237/97) that requires licensing.

International waterways that cross more than one country also must be licensed by IBAMA. In addition to IBAMA, the Ministério de Relações Exteriores (Ministry of Foreign Affairs) must also be included in the negotiations. In the case of Brazil, we have three international waterways: the Amazon, Uruguay and Paraguay Waterways. The Madeira Waterway also has the potential to become an international waterway with the expansion projects in the Porto Velho - Guajará Mirim stretch. This transport ring will connect important Bolivian and Peruvian cities by waterway (Madre de Dio, Beni and Mamoré Rivers) to the Madeira and Guaporé Rivers, opening an access route to the Atlantic Ocean.

Created by a meeting of South American presidents in August 2000, the Iniciativa para a Integração da Infraestrutura Regional Sul-americana (IIRSA) (Attachment I) defined the agenda of joint actions to drive the process of South American political, social and economic integration. In a subsequent meeting that occurred in December of the same year, the Ministers of Transportation, Energy and Telecommunications of the countries involved appeared to deal with integration primarily related to infrastructure. The territory was consequently divided into 10 axes:

- Andes Axis that includes the Andes mountain range in its northern portion extending into Venezuela, Ecuador, Colombia, Bolivia and Peru.
- South Andes Axis that includes the southern portion of the Andes mountain range, but for which not activities have begun.
- Capricorn Axis, in which Brazil (the states of Rio Grande do Sul, Santa Catarina, Paraná and Mato Grosso do Sul), Argentina, Paraguay, Bolivia and Chile participate.

- Paraguay-Parana Waterway Axis, that includes Argentina, Bolivia, Brazil, Paraguay and Uruguay.
- Amazon Axis that includes Ecuador, Colombia, Peru and Brazil.
- Guiana Shield Axis, in which Brazil, Guiana, Suriname and Venezuela are included.
- South Axis, including Argentina and Chile.
- Central Interocean Axis that includes Peru, Chile, Bolivia, Paraguay and Brazil.
- Mercosul-Chile Axis that includes Chile, Argentina, Paraguay, Uruguay and Brazil.
- Peru-Brazil-Bolivia Axis in which the three countries participate.

This division into axes often coincides with the division by waterways, thus containing infrastructure and improvement projects of these stretches.

Once a waterway is licensing and operating, the Navy (Attachment I), through its Port Captaincies (Attachment I), is responsible for the safety of navigation, inspecting vessels and signalling along the waterway, informing the Waterway Managements if any norm is not being followed. The Port Captancies also guide the signalling of maintenance or construction work along the waterway.

The Navy is also responsible for making and updating the Brazilian nautical charts, for both the ocean and rivers. In some Brazilian regions, these river nautical charts are very old and not compatible with the current reality, making navigation only possible with pilots, limiting the number of vessels used due to a lack of qualified manpower.

The Secretaria de Portos (SEP) is the autarchy responsible for Brazilian maritime ports. Created in 2007 and tied directly to the Presidency of the Republic, it has the authority to coordinate and supervise national policies and guidelines to develop and support the port and marine port terminal sector. With passage of Provisional Measure No. 595, of December 6, 2012, the Agencia Nacional de Transportes Aquaviários (ANTAQ) formerly tied to the Ministério dos Transportes, was incorporated into the SEP.

The Companhias Docas (Attachment I), mixed private-public companies, are tied to the SEP, and although their main focus is marine ports, they still manage some river ports “inherited” from the time when the Water Managements were connected with the Cias. Docas.

Another important issue that arose is the separation of strategic decisions between the SEP and the Ministério dos Transportes, as manager of the waterway issue. Waterway management cannot be separated from the port issue and these two forums have to be as close as possible. This integration is expected to be provided by CONIT (Attachment I), but in practice, just as the waterway issue has received little priority with regard to federal government decisions, the same has occurred in CONIT meetings.

It should be mentioned, further, that the Ministério Público Federal (Attachment I), unlike the other ministries, can intervene in all phases of waterway implementation, whether it be during licensing, installation of its support works or its operation. One of its duties is to defend the rights and interests of citizens potentially interested or affected, the environment, and property and rights of artistic, esthetic, historic or landscape value that make up the national assets. This intervention may occur by its own initiative or upon request and it can stop works and studies. An example of this is what is taking place in the Paraguay Waterway. Because of the existence of indigenous communities near the river in the Ínsua Island stretch, the conducting of any study or intervention along the waterway was prohibitted.

3.1.4.4 Important Considerations

It is interesting to emphasize some considerations that result from the analysis presented on waterway management in Brazil. This because, at this stage of the analysis, these should be highlighted so that alternatives can be prepared and proposed for the purpose of overcoming any obstacles and leveraging the use of waterways in the country.

a) Waterway Management Structure

Separation of waterways and ports in managmeent is a complicating factor

Waterway transport depends on the existence and operation of ports and wharves. Seperate management of these two requires forums that integrate and allow shared management. If the former structure of the Ministério dos Transportes included port management, but did not have the ability to give it adequate attention or priority, creation of the Secretaria dos Portos (SEP) resulted in some duplication of command and gaps. The DAQ, ANTAQ (recently modified) and the Waterway Administrations remained with the Ministério dos Transportes. It was given management of waterways and river and lake ports. SEP had the responsibility for managing marine ports and formulating policy for the sector.

It should be emphasized, however, that the distinction between river/lake and marine ports is not well resolved. It is still not clear if the definition is made based on the location of the port or the type of navigation that it services (there are river ports with ocean going navigation and marine ports are of extreme importance for river navigation, primarily that of cargo transportation for export).

Currently, integration of these forums is expected to occur in the Conselho Nacional de Integração de Políticas de Transporte (CONIT), but this forum has not proven to be effective.

Until quite recently, ANTAQ, the waterway transport regulatory agency and part of the indirect federal administration, was subject to a special autarchy regime and tied to the Ministério dos Transportes. With a sphere of operation that includes: (a) river, lake, crossing, marine support, port support, cabotage and oceangoing navigation; (b) organized ports and small-scale public port facilities; (c) private port terminals and cargo transshipment stations; (d) waterway transport of special and hazardous cargo; (e) use of the federal waterway infrastructure; ANTAQ, tied to the Ministério dos Transportes, has been directly intervening in SEP operation, since a large part of its efforts have been spent on regulation and inspection of marine ports. Recently, ANTAQ, by means of Provisional Measure 595/2012, was tied to the SEP. If on one hand, this could turn out to support integrated port management, on the other, it could even further weaken waterway management, since there is no river navigation without ports. It thus becomes even more important for CONIT or another forum to achieve integrated port and waterway management.

Within the Ministério dos Transportes, waterway management resides primarily in the sphere of the DNIT, a department notably focused on the highway issue

Since its creation in 2001, the DNIT has assumed a large part of the responsibilities of the former Departamento Nacional de Estradas de Rodagem (National Department of Highways), establishing itself as the executive highway body of the Union. Although its sphere of operations covers implementation of policies related to administration of the federal transportation network (with the exception of the marine ports) – which theoretically includes navigable waterways, railways and federal highways, transshipment facilities and routes, as well as river and lake ports –, the DNIT has federal highway management as its main focus.

Thus, although in its structure there is a Diretoria de Infraestrutura Aquaviária (Waterway Infrastructure Directorate), as well as a Diretoria de Infraestrutura Ferroviária (Railway Infrastructure Directorate), it is the Diretoria de Infraestrutura Rodoviária (Highway Infrastructure Directorate) that has the most influence in the department. The current structure is not capable of handling the operating power of the three referenced boards and, both the Diretoria de Infraestrutura Aquaviária and the Diretoria de Infraestrutura Ferroviária have been put on the backburner compared to highway management, reflecting the priority historically given by the federal government.

Agreement established between DNIT/DAQ and CODOMAR has a weak management structure

They are structures remaining from a prior institutional arrangement, in which the former regional directorates of the – extinct – Departamento Nacional de Portos e Vias Navegáveis (DPVN) (National Department for Ports and Navigable Waterways) were incorporated into the - also now extinct - PORTOBRÁS, gaining the name by which they are now known (AHs). When PORTOBRÁS was extinguished (1990), the AHs were tied to the then Ministério de Infraestrutura (MINFRA), by means of agreements established between its Departamento Nacional de Transportes Aquaviários/MINFRA and the Companhias Docas, remaining administratively tied to the Companhias Docas, but technically tied to MINFRA. Amid the ministerial restructuring that transformed MINFRA into the Ministério dos Transports e Comunicações (Law No. 8.422/92), the tie between the Waterway Managements and Companhias Docas continued. With the institutional reorganization that occurred at the start of the 2000s (Law No. 10.233/01), the tie to the Companhias Docas of the Ministério dos Transportes was shifted to the DNIT. These agreements that were regularly amended during this period were terminated in 2007. In 2008, it was decided to prepare a new agreement, this time a single one, tying all the Water Managements to CODOMAR and this, in turn, to the DNIT/DAQ.

Agreement No. 007/2008, established between them, was intended to temporarily support waterway management while the also recently created Directoria de Infraestrutura Aquaviária was being structured. Its objective was also that of decentralizing port and waterway services, with CODOMAR remaining responsible for administering waterways and their already existing respective administrative structures (AHs).

The agreement that ties all the AHs to CODOMAR establishes that each of them must submit its activities plan annually to the DNIT for approval. It has regularly been seen that *the plans presented had activities cut by DNIT technicians, reducing the operating ability of the AHs*.

In addition to this issue, there is very dynamic of the agreement that establishes the obligation to render accounts monthly and respective approval prior to any subsequent remission of funding. There would be no problem with this dynamic if it were not for the fact that all the managements are tied by a single agreement to CODOMAR and, in turn, to the DNIT. *Whenever one management does not fulfill its obligations with regard to rendering accounts, the remittance of funding is blocked for all the managements.* These are prevented from implementing their schedules of activities and financial commitments, losing credibility with suppliers and partners. The funds sent to pay agents and for investments are independent. The AHs receive funds to pay their staff monthly, but funds for investments are withheld until the rendering of accounts by all the AHs have been approved.

In addition, under this agreement *obtaining alternative sources of funding to carry out necessary works is complex since the managements have weak legal and administrative structures*. This also compromises their ability to collaborate regionally.

Finally, another weak aspect associated to the current institutional arrangement concerns the human resources allocated for waterway management. Currently, the AHs are generally made up of four commissioned positions (one superintendent and three heads of operating units) and the remaining employees are outsourced. The staffs are quite lean and *the end activities generally are exercised by outsources employees*. This aspect places the structure of the AHs at risk, since the Ministério Público has prevented the involvement of outsources employees in end activities.

The agreement that, as previously mentioned, should serve to temporarily support the structure of the DAQ in the DNIT, was amended five times, extending its term until 2012. In the interim, the DAQ was structured, even without having sufficient power within the DNIT to intensify the waterway modal within the Brazilian transportation matrix. The DAQ currently has a structure to assume the duties anticipated for it, but with the regular extension of the referenced agreement, duplication of command/operation has begun to appear, or, even worse, cases in which one institution waits for the actions of another and actions end up not being carried out.

There is a lack of clarity on the role of the ANTAQ

With the recent change proposed by Provisional Measure No. 595/12, the ANTAQ is not longer tied to the Ministério dos Transportes and is now tied to the Secretaria de Portos (SEP). As set forth in its Art. 57, the previous authority of the Ministério dos Transported and the DNIT relative to river and lake ports passes to the SEP.

Under this new scenario, port managment, which previously was split between the Ministério dos Transportes (river and lake ports) and the SEP (marine ports), is now completely concentrated in the SEP, relying on the support structure of the ANTAQ tied to it. If on one hand this integrates port managment, on the other it further splits waterway management, which, as already emphasized, does not exist without ports.

Further, in order to combine efforts for port management, there needs to be unification of procedures that have not been uniform, as emphasized in a recent Booz & Company study (2012). It presents discrepancies between the guidelines provided by Decree No. 6.620/08 and ANTAQ Resolution No. 1.695/10 with regard to definition of “own cargo,” “third party cargo” and “hiring of manpower by the OGMO.”

There are also potential conflicts of interest (although there already were when the agency was under the Ministério dos Transportes structure), since the agency, in order to fulfill its role, must be independent (which is not the case due to the ANTAQ's lack of its own income sources).

b) Management of multiple water resource uses has not been effective for waterway navigation

River navigation is not characterized as a consumptive use of water resources and does not require a usage right grant. Nevertheless, it is known that current legislation values a guarantee of multiple water resource uses – either through the Federal Constitution, the Water Code (Decree No. 24.643/34) or the National Water Resources Policy (Law No. 9.433/97) – in order to avoid competition between different water uses, such as human supply, energy generation, industry, irrigation, tourism and, among others, navigation.

An important conflict that has occurred in relation to water use involves energy generation and navigation. The construction of hydroelectric power dams and plants has represented an obstacle to the use and expansion of waterway potential in the country. This is because their construction has not taking locks for vessel passage into account and, consequently, if on one hand it ensures energy supply, on the other it prevents potential optimization of the transportation matrix that could reduce logistics costs. With the recent priority given the energy sector, without adequate integration in terms of planning with the transportation sector, many companies operating/interested in river navigation are postponing their navigation projects along these rivers, once they become aware of the federal governments intention to build new plants/dams, since they understand that both in the works phase, as well as during operation, navigation will be impeded until locks are built.

The construction of locks after the completion of the hydroelectric power plant works tends to have considerably higher costs than if included as part of the project. There remains some indefinition with regard to the responsibility for lock construction costs. If they are attributed to the power companies, they cannot be reimbursed through the rate charged for energy use. The Ministério dos Transportes has already shown its intention to cover these costs, but still considers it necessary to be involved in the planning stage of energy sector works. This is also important to ensure that dam and plant projects are made in a way not to impede navigation during construction.

Circumstances today show the inability of the current management model to ensure multiple simultaneous uses of water resources. Planning in the electricity sector should be sufficiently aligned with that for transportation to avoid cases like this of competing uses.

In this sense, it can further be observed that there are initiatives in terms of integrating the transportation sector with management of water resources (Câmara Técnica de Gestão de Recursos Hídricos Transfronteiriços (CTGRHT) (Technical Chamber for Managing Transborder Water Resources) and the Câmara Técnica de Análise de Projeto (CTAP) (Project Analysis Technical Chamber)). Federal government decisions in relation to annual investment guidelines end up prioritizing the energy sector and leaving that of transportation as a mere spectator in decisions that directly impact it. The previously mentioned lack of prioritization with the Brazilian transportation sector for the waterway issue (historically prioritizing highways) is another issue that adds to the difficulty of expanding the participation of the waterway modal in the national transportation matrix.

c) There is a lack of federal government investment prioritization for the waterway issue in Brazil

If the PAC is the most recent public effort in the sense of driving Brazilian infrastructure and it is known that the Brazilian waterway sector has been relegated to third or fourth place for years with regard to transportation infrastructure, one might expect that the PAC would set aside considerable resources to make progress in the sector. The PAC 2 announced in 2010 anticipated investments of R$ 2.7 billion in waterways and another R$ 5.1 billion in ports, out of a total transportation investment of R$ 109 billion (representing close to 7% of the total value being set aside for ports and waterways)[45]. The previous PAC had destined only 6% of the total resources planned for transportation in the period between 2007 and 2010 for waterways and marine ports (IPEA, 2010).

The investments in transportation in Brazil have historically been focused on the highway modal and balancing the matrix will require not only a restructuring of management, but the dedication of resources to overcome the current obstacles to river navigation, since this could contribute to removing current logistical bottlenecks.

d) There is a lack of clarity with regard to licensing processes for waterways

A TCU report (2006) already noted the lack of clarity with regard to the object to be licensed in relation to waterways. In interviews with the Waterway Mangements, it observed that this lack of clarity persists, as in the case reported of AHINOR, which when requesting permission from the regional IBAMA office to undertake routine maintenance services (clearance of the bed for movement, removal of trunks and branches, depth maintenance service in the preferred navigation route, beaconage, nautical signalling, cleaning and anchoring of Banks) in the Parnaíba Waterway, received proper authorization that classified these services as exempt

[45] Report 4 of PAC 2, available at http://www.brasil.gov.br/pac/pac-2/pac-2-relatorio-4, accessed on 1/16/2012.

from environmental impacts. It required studies on the potential impacts cuased by these same services from other AHs.

An IBAMA survey (2009) shows that the agency has acted in licensing specific works in each of the waterways:

- Paraguay Waterway: licensing of dredging and port terminals
- Tietê-Paraná Waterway: licencing of port terminals and demolition
- Madeira and São Francisco Waterways: licencing of dredging
- Tocantins-Araguaia Waterway: licencing of demolition and dredging.

There is a suggestion by the DILIC/IBAMA staff that licensing should no longer be dealt with by specific work and be done for a waterway as a whole in order to allow a view of the combined impacts that particular projects or certain vessels might have on the region. This understanding is corroborated by actions of the Ministério Público Federal. Consequently, it is necessary to regularize the existing waterways and, more than this, create guidelines for licensing, clearly difining their purpose and who is responsible for licensing, in order to make the process objective and clear.

e) Insertion of the EPL in the structure of the sector should seek to provide coheision and integration to transportation planning

Empresa de Planejamento e Logística S.A. (EPL) (Company for Planning and Logistics S.A.) was created by Provisional Measure No. 576/12, that was later converted into Law No. 12.743/12, which established that the former Empresa de Transporte Ferroviário de Alta Velocidade (ETAV) (High-Speed Railway Transportation Company) be converted into the EPL.

Under the terms of the law, the purposes of the EPL are to plan and promote the development of high-speed railway transportation services in a manner integrated with the other transportation modals, promoting studies and research, building infrastructure, operating and exploiting the service, among others. It further determined that the EPL would be responsible for "providing services in the area of design, studies and research designed to support logistical and transportation planning in the country, considering the infrastructure, platforms and services relevant to the highway, railway, pipeline, waterway and airway modes." (Art. 3, II)

Decree No. 7.789/12, in turn, makes the EPL responsible for exercising the function of executive secretariat within CONIT with another set of duties. It establishes its responsibilities in a vague and broad manner that might generate a conflict of authority with what is provided for in the law.

Regardless, it is important to overcome any potential challenges that may appear during the process of structuring the company and ensure that EPL bring greater cohesion and integration to planning in the Brazilian transportation sector.

f) CONIT can be more effective in promoting actions to integrate the sector

It is the responsibility of CONIT, as set forth in its founding Law (10.233/01), to propose national policies to the Presidency of the Republic, which make integration of the different transportation modals (for people and goods) feasible, ensuring that there is coordination between the actions of the Ministérios dos Transportes, da Defesa, da Justiça, das Cidades (of Cities) and the Secretaria de Portos with regard to actions important to the Sistema Federal de Viação.

It can be seen, however, that there is a lack of integration and linkage between the more macro planning of transportation and between these and what should be their unfoldment, in relation to public policies. Starting with the Plano Nacional de Viação, created in 1973 (Law No. 5.917/73), that established and configured the Sistema Hidroviário Nacional, some policies and plans that impact the waterway issue in the country were established. Among them it is worth mentioning the Plano Nacional de Logística e Transportes (PNLT) (National Logistics and Transportation Plan), which was an instrument created by the Ministério dos Transportes to help outline the government investments of programs such as the Programa de Aceleração do Crescimento (PAC) (Growth Acceleration Program).

On the other hand, the Secretaria de Portos also felt the need to develop a plan to outline its actions and the destination of investments for ports and developed the Plano Nacional de Logística Portuária (PNLP) (National Port Logistics Plan). The Plano Geral de Outorgas (PGO) (General Grant Plan), prepared by the ANTAQ, has already been made in response to the requirements of Law No. 10.233/2001. This was considered by the PNLP and revised and expanded by it.

With these large scale plans underway, it became apparent that something was needed to unify them. The Plano Nacional de Logística Integrada (PNLI) (Nacional Integrated Logistics Plan) (still in development) was created. This, however, according to a logical order, should have been the first to be discussed and presented and the guidelines for the PNLT and PNLP should have come from it, ensuring the integration of both, which we know did not occur.

There are also the Plano Nacional de Integração Hidroviária (PNIH) (National Waterway Integration Plan), being developed by the ANTAQ, this Plano Hidroviário Estratégico (PHE) (Strategic Waterway Plan) (under development by the Ministério dos Transportes) and the Estudos de Viabilidade Técnica Econômica e Ambiental (EVTEA) (Economic and Environmental Technical Feasibility Studies). If, in the same way, we follow a logical order, the PHE should be a development of the PNLT, which, in turn, would provide guidelines for preparation of the PNIH, which, finally, would lead to preparation of the EVTEAs. Since these studies are occuring simultaneously (even simultaneously with preparation of the PNLT 2012), it can be seen that the EVTEAs, that should be the final point of planning, are being issued requesting that future contracted parties not only conduct preliminary studies of the navigable waterways, but also prepare basic designs for any works necessary.

In this sense, there is a lack of coordination of planning actions in the transportation sphere, Which would avoid repetition or even duplication of work that is occurring simultaneously, since in the absence of information that should be coming from a particular study, these end up being incorporated into the scope of more than one study, resulting in inefficiency in allocating resources and possibly even resulting in disparate/inconsistent information as a result of the different studies.

3.1.5 National Waterway System SWOT

Strong points	Weak points
• The Brazilian economy is growing very rapidly. This growth is reflected in an increase in exportation of products that could potentially be transported by inland navigation, such as soybeans, corn, sugar, iron ore and pulp. • Inland waterway transport is already in current use for shipping cargo and, according to forecasts, the volume of cargo will increase substantially (close to four times) in the next decades. The most important products are (and will be) soybeans and soy meal, corn, sugar, ethanol, pulp, iron ore, bauxite, manganese and steel products. • Some rivers, such as the Amazon, Solimões, Paraná and Paraguay, in addition to the Lagoa dos Patos, have adequate conditions for navigation of commercial convoys during the entire year. Other river, however, have considerable oscillations of water level throughout the year, being fully navigable only during the rainy season, with shallow depths and natural barriers that restrict navigation during the dry season. • In general, the costs of inland navigation are lower than the costs of other transport modes. • In the South, there is a denser network and different alternative transport modes, thus offering opportunities to encourage multimodal solutions. • Waterway transport has been experiencing a low rate of crime and occurrences in relation to competing modes of transportation. • The waterways in the South and Southeast region (Uruguay, South, Tietê-Paraná) have fewer areas vulnerable to future interventions from the socioenvironmental point of view. • The regional structure of the AHs brings them closer to their potential customers and allows them to better understand the specific needs of their end users.	• Logistics are precarious: there is a lack of transshipment stations (there are not sufficient connections with other modes). The main reason is that the different transport systems (highway, railway, waterway) developed in independent ways, without taking advantage of the strong points of each. • Low accessibility to the market due to the lack of infrastructure (terminals, fuel supply stations, shipyards). • Domain of highway transport. • Dams without locks were constructed on many rivers: Alto Madeira, Tocantins, Parnaíba, Lower São Francisco, affluents of the Paraná (except the Tietê), Upper Uruguay (Salto Dam between Uruguay and Argentina, cutting Brazilian access to the Atlantic Ocean), affluents in the South Atlantic basin. These dams are clear obstacles to navigation. • From the navigation point of view, the river basins are isolated systems that are not always connected to marine ports. • High rates of sedimentation in many waterways, such as the Madeira, upstream of Porto Velho, in the Araguaia, Parnaíba, São Francisco and in other rivers. • Strategies to minimize/solve some obstacles to expansion of inland navigation can turn out to be much more expensive than budgets allow. • High interest rates for investments in vessels in comparison to investments in trucks. • Legislation relative to indigenouos communities and conservation units are of fundamental importance for the development of inland waterway transport and need to be well analyzed in the process of making decisions on the locations of ports and terminals. The presence of indigenous communities is concentrated primarily in the North and Mid-West waterways. • A lack of guidelines for the environmental licensing process for all waterways (the process has become slow and has been analyzed on a case-by-case basis). • The regulations established for AHs inhibits their ability to overcome their own limitations (they cannot establish partnerships to overcome the lack of financial capacity; they run the risk of being punished administratively for their actions, such as having outsourced personnel working on

	priority functions; they have little influence to address the matter with the Ministério dos Transportes). • In the case of international management of a waterway, the Ministério das Relações Exteriores of the countries involved are those that should discuss the matter, but they are not always aware of the regional issues and cannot always contribute with concrete actions for waterway management. • Tax payment on transshipment operations: multimodal transport can reduce the demand for highway transport and is encouraged in Europe. In Brazil, multimodal transport is, however, burdened with extra taxes in some states (like São Paulo). • Strict Navy regulations for crew qualification, resulting in greater operating costs than for other transport modes. • AHs are very limited in their support to end users (because of their regulatory framework) and, consequently, the regional secretariats are developing specific partnerships directly with the DNIT to finance waterway maintenance. The DNIT, in turn, is not able to directly help the AHs and, consequently, strengthens other institutions, which makes the position of the AHs even more delicate.

Opportunities

- New industrial facilities have direct access to waterways (for example, Eldorado (pulp) in Três Lagoas, or ALPA (steel) in Marabá).
- The containers market is growing, but the participation of inland waterway transport has been very low, mainly due to the limited logistics.
- The important river navigation markets in Brazil are dominated by large companies, such as Vale, Petrobras, Cargill, ADM, Cosan and others. If these companies decide to use inland navigation, this would result in large transport flows (for example, that of ethanol (Paraná-Tietê), iron ore (Paraguay River) or soybeans (Madeira River). This could be very good for inland navigation. However, if these companies decide not to use inland navigation, a great potential will not be exploited.
- Good examples of improvements in maintenance of navigable waterways have recently been seen (such as in the South Atlantic basin).
- Highway transport has its problems. The costs are becoming high and there is congestion in the ports, such as at the Port of Santos (a waiting time of 30 days is not unusual). In some regions, the roads are in terrible condition, increasing maintenance costs. Regulations on driving and rest times for drivers increase costs. Security cannot be ensured (cargo is robbed, insurance is expensive).
- Railway transport also has its problems. Speed is very low and the network has different gauges. In addition, there is no national railway system, limiting this type of transport to the regional sphere.
- In the North region, where vegetation is well preserved and the roads are not well developed, inland navigation would be an ecologically-correct alternative for transport.
- Interest in the use of inland waterway transport by companies that are in a growth sector (increased exportation of agricultural products).
- The potential use of waterways could increase if navigability conditions were improved.
- The construction of locks on planned dams will allow and expand navigation on many rivers.
- The time is right for changes, navigable waterway potential has caught the attention of the authorities.
- The Ministério dos Transportes has considered creation of a Comitê de Gestão Hidroviária (Waterway Management Committee).
- If the regulatory framework for the AHs could be modified, public-private partnerships could be signed to execute the work of waterway

Threats

- Investments planned by large companies and the government in favor of other modes of transport. If a good waterway connection already existed or can be created (for example, between Porto Alegre and the Port of Rio Grande), on new railway alternative should be constructed parallel to this navigable waterway.
- Lack of maintenance can reduce the number of navigable waterways. In certain áreas, maintenance of navigable waterways has been neglected. Dredging works have not be undetaken; beaconage could be improved in some sections. However, maintenance is a large challenge, with high rates of sedimentation in certain áreas, which implies the need for regular dredging works. The presence of natural obstacles in the waterways (such as rocks) is not the exception.
- The increased amount of applicable legislation results in a complex set of jurisdictions and regulations that blocks investments and private initiative.
- The lack of understanding of the advantages and possibilities of inland navigation can influence shippers' decisions. Highway transport is easier to organize.
- The separation of the Secretaria de Portos from the Ministério dos Transportes makes waterway management more difficult.
- Since navigation is not characterized as a consumptive use of water resources, the Comitês de Bacias and the ANA have not given much importance to its compatibility with other uses (for purposes of power generation, irrigation, etc.). Government policies have supported the use of water for power generation without proposing/preparing alternatives to make navigation feasible.

maintenance. • The transfer of waterway maintenance activities to the private sector through contracts that would require execution of works and guarantee maintenance of waterways for a period of five years (as in some highway contracts) was mentioned as an alternative to the current system.	

3.2 THE AMAZONAS WATERWAY SYSTEM

3.2.1 Physical river system, environment and social aspects

The Amazon Waterway System covers 13 river basins, namely: Amazon Mouth, Iça, Japurá, Jari, Jatapu, Juruá, Jutai, Negro, Paru, Purus, Tapajós, Trombetas and Xingu, totaling an area of approximately 3,000,000 km², equivalent to approximately 35% of the Brazilian territory, according to information provided by ANA (2000), including the states of Acre, Amazonas, Amapá, Mato Grosso, Pará and Roraima, as can be seen on the map shown below.

The Amazon waterway system is composed of a series of waterways currently navigable by various types of vessels. The most important rivers - Amazonas and Solimões – can accommodate maritime vessels from their mouth in the Atlantic Ocean to Tabatinga, in the Brazil-Peru-Colombia tri-border, throughout the year.

The main tributaries of the Solimões River are the Purus River, Acre River, Juruá River, Tarauacá River, Envira River, Japurá River and Içá River, in addition to the Branco River. These rivers, in addition to showing very homogeneous behavior, offer good navigability conditions for commercial convoys in the period of floods, when the water levels rise considerably. In ebb currents these rivers show shallow depths and many deposits of sediments, making their course sinuous, narrow, and shallow.

Among the left bank rivers of the Amazon, the following stand out: The Negro, Uatumã, Trombetas and Jari rivers feature fewer processes capable of causing the build up of sandbanks, deeper depths, and less sinuosity, being fully navigable until the appearance of rock outcrops, rapids, and falls which delimitate the Amazon Depression in the north spread.

The waterways of the Madeira-Mamoré-Guaporé and Tapajós-Teles Pires-Juruena Rivers were analyzed separately, due to the importance they have and represent in the national context.

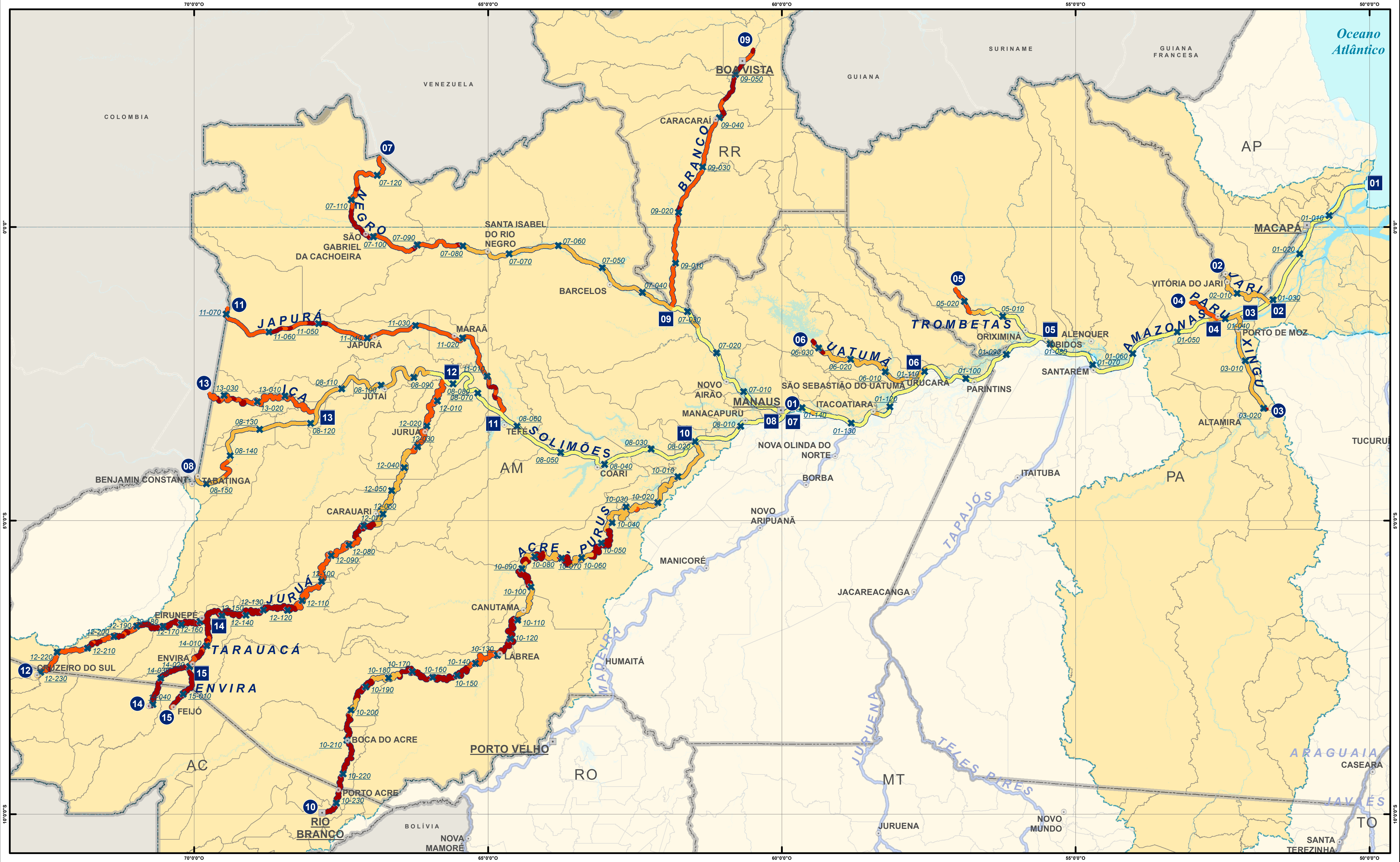
The analyses and studies performed for the characterization of the physical and social and environmental characteristics of the potential waterways of the Amazon Waterway System followed the methodologies shown in Chapter 1 – Item 1.3 – Methodology, of the present report.

Due to the large volume of information gathered and analyzed, the present chapter includes a summary of the main results and conclusions obtained for each river under study.

The CD that accompanies the present report (Step C: Assessment and Diagnosis) contains a table, in a .xls format, including more details of all the variables and information analyzed for each river and for each section being studied.

The linear diagrams contained in the present chapter synthesize the table mentioned, according to the methodology presented in Chapter 1, Item 1.3 of the present report.

As a product of the final step of the Waterway Strategic Plan (Step F: Preparation of the Final Strategic Plan) a geo-referenced data bank is shown containing all information existing in the table of the CD attached to the present report. The main characteristics as to the navigability conditions of the waterways that compose the Amazon WS can be checked together with the one-line diagram showed subsequently.



CONVENÇÕES CARTOGRÁFICAS

Referências Locacionais
- Capital Federal
- Capital Estadual
- Sede Municipal
- Limite político adm.
- Limite municipal
- Massa d'água

- Jusante
- Montante

- 01 Rio Amazonas
- 02 Rio Jari
- 03 Rio Xingu
- 04 Rio Paru
- 05 Rio Trombetas
- 06 Rio Uatumã
- 07 Rio Negro
- 08 Rio Solimões
- 09 Rio Branco
- 10 Rio Acre - Purus
- 11 Rio Japurá
- 12 Rio Juruá
- 13 Rio Içá
- 14 Rio Tarauacá
- 15 Rio Envira

Bacias do SH Amazonas

Trechos de 10 km (xx-yyy)
xx: n° do rio
yyy: n° do trecho
*km = yyy * 10*

Escala de ponderação dos temas
1 - 5 (baixa - alta)
- IN - Insignificante
- BA - Baixa
- ME - Média
- AL - Alta
- MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionésimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

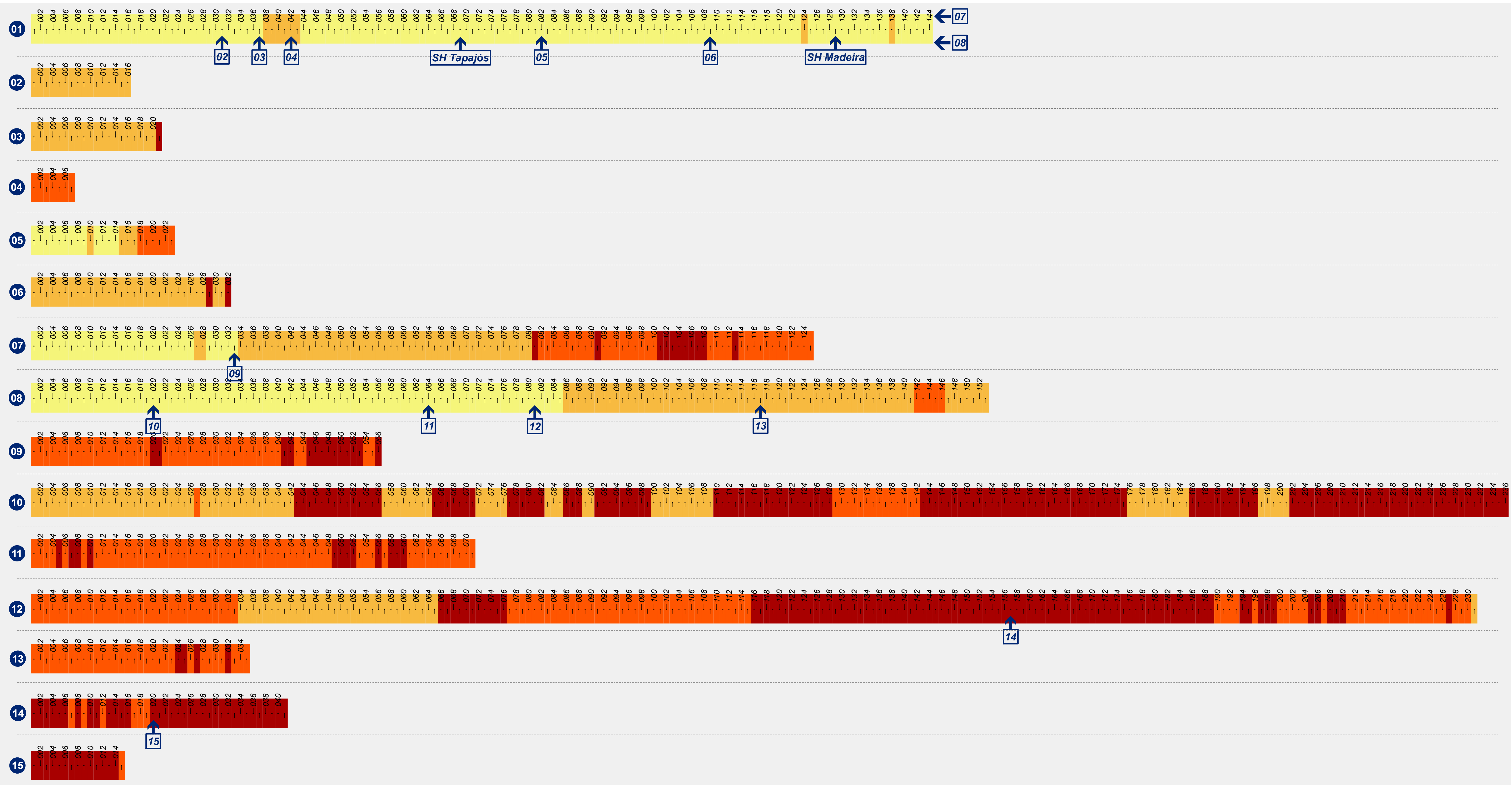
LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES
ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGNÓSTICO DE NAVEGABILIDADE

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:6.500.000	SH AMAZONAS	FEV/2013



CATEGORIAS - 5	CATEGORIAS - 4	CATEGORIAS - 3	CATEGORIAS - 2	CATEGORIA - 1
MUITO ALTO DE: Sinuosidade; ou Profundidade mínima; ou Empecilhos à navegação (construções); ou Energia do rio; ou Leito do rio; ou Assoreamento; ou Anteparos naturais; ou Largura mínima do rio.	ALTO DE: Sinuosidade; ou Profundidade mínima; ou Empecilhos à navegação (construções); ou Energia do rio; ou Leito do rio; ou Assoreamento; ou Anteparos naturais; ou Largura mínima do rio.	MÉDIA DE: Sinuosidade; ou Profundidade mínima; ou Empecilhos à navegação (construções); ou Energia do rio; ou Leito do rio; ou Assoreamento; ou Anteparos naturais; ou Largura mínima do rio.	BAIXA DE: Sinuosidade; ou Profundidade mínima; ou Empecilhos à navegação (construções); ou Energia do rio; ou Leito do rio; ou Assoreamento; ou Anteparos naturais; ou Largura mínima do rio.	Ausência das ocorrências

DIAGNÓSTICO DE NAVEGABILIDADE

CONVENÇÕES CARTOGRÁFICAS

01 Rio Amazonas
02 Rio Jari
03 Rio Xingu
04 Rio Paru
05 Rio Trombetas
06 Rio Uatumã
07 Rio Negro
08 Rio Solimões
09 Rio Branco
10 Rio Acre - Purus
11 Rio Japurá
12 Rio Juruá
13 Rio Içá
14 Rio Tarauacá
15 Rio Envira

Confluências

Numeração dos trechos

n° < Jusante

n° > Montante

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionésimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

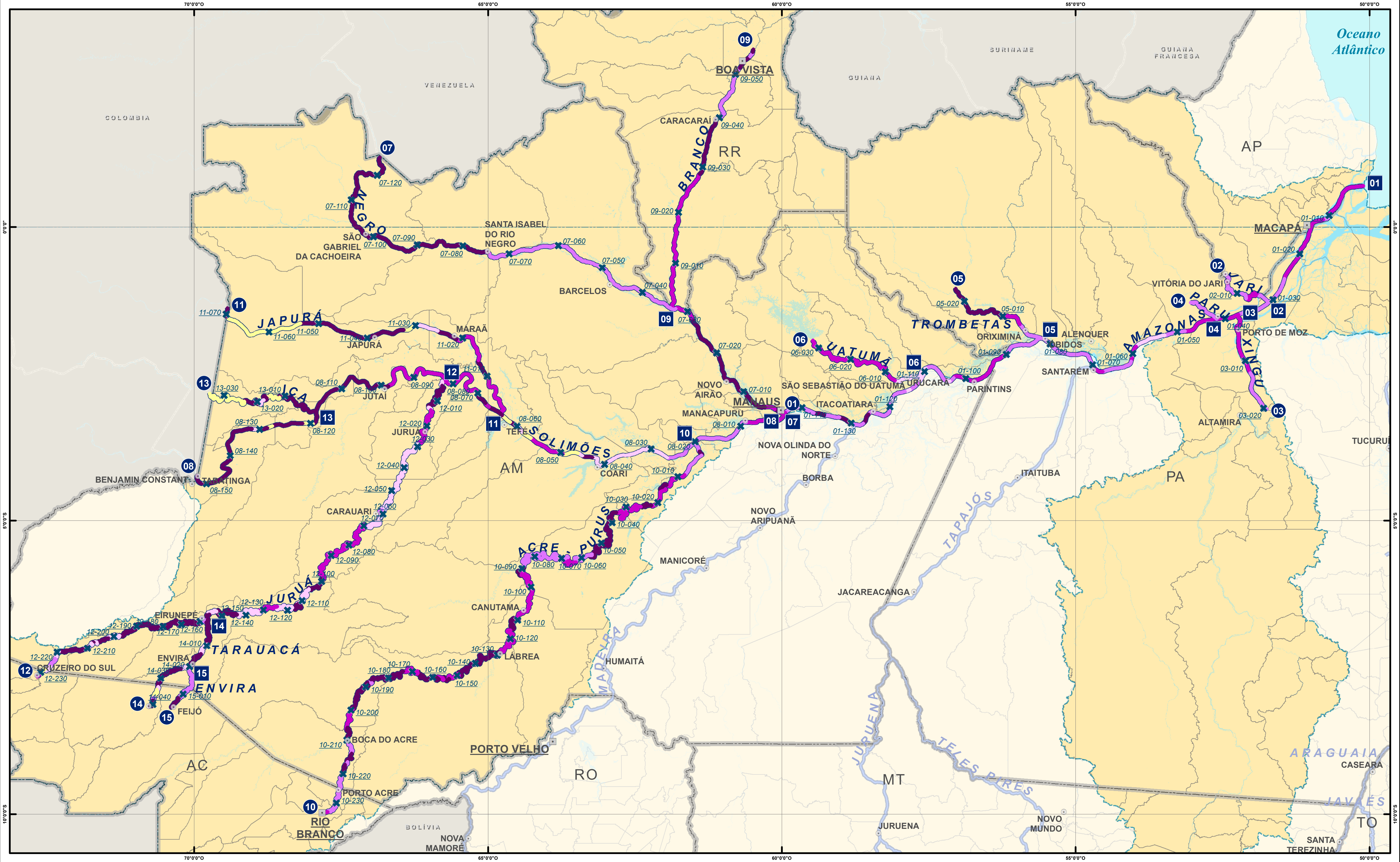
PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DO DIAGNÓSTICO DE NAVEGABILIDADE AGRUPADO PELO SISTEMA HIDROVIÁRIO (SH)

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	SH AMAZONAS	MAI/2013

The state capital cities Manaus, Rio Branco, Boa Vista, Macapá, as well as the municipalities of Santarém and Marabá (PA) and Sinop (MT), are the most prominent urban centers in terms of population and municipal development, according to the FIRJAN index (2010), among the municipalities in the area surrounding the Amazon Waterway System.

The main social and environmental characteristics that can be pointed out as a means of encouraging integrated planning for possible interventions required in the area where the Amazon WS is can be seen together in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

Referências Locacionais
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- Capital Estadual
- Sede Municipal
- Limite político adm.
- Limite municipal
- Massa d'água

- X Jusante
- X Montante

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- 12 Rio Juruá
- 13 Rio Içá
- 14 Rio Tarauacá
- 15 Rio Envira

Bacias do SH Amazonas

Trechos de 10 km (xx-yyy)
xx: n° do rio
yyy: n° do trecho
*km = yyy * 10*

Escala de ponderação dos temas
1 - 5 (baixa - alta)
- IN - Insignificante
- BA - Baixa
- ME - Média
- AL - Alta
- MA - Muito alta

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Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA 0 50 100 200 km

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

LOCALIZAÇÃO DA FOLHA

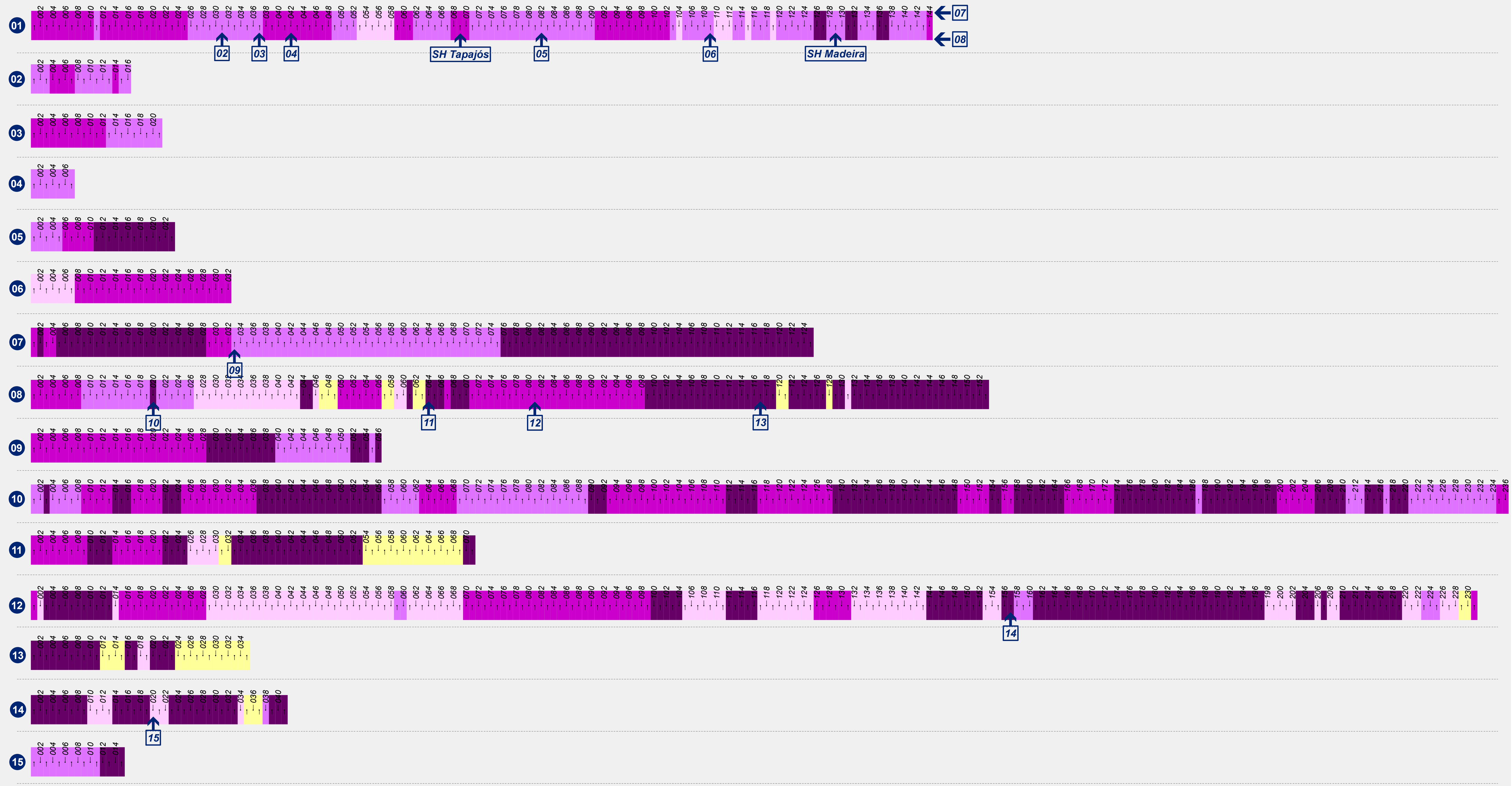
MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

VULNERABILIDADE SOCIOAMBIENTAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:6.500.000	SH AMAZONAS	MAI/2013



VULNERABILIDADE SOCIOAMBIENTAL

CATEGORIAS - 5	CATEGORIAS - 4	CATEGORIAS - 3	CATEGORIAS - 2	CATEGORIA - 1
UC - proteção integral; ou	*UC - uso sustentável; ou*	*Assentamento INCRA; ou*	*APCB; ou*	*Ausência das ocorrências*
Terra indígena	*Comunidade quilombola*	*Vulnerabilidade ao desmatamento; ou*	*Mineração - Lavra e garimpo*	
		Cavidades naturais		

CONVENÇÕES CARTOGRÁFICAS

01 Rio Amazonas
02 Rio Jari
03 Rio Xingu
04 Rio Paru
05 Rio Trombetas
06 Rio Uatumã
07 Rio Negro
08 Rio Solimões
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11 Rio Japurá
12 Rio Juruá
13 Rio Içá
14 Rio Tarauacá
15 Rio Envira

Confluências

Numeração dos trechos

n° < Jusante

n° > Montante

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA VULNERABILIDADE SOCIOAMBIENTAL PARA POSSÍVEIS INTERVENÇÕES AGRUPADO PELO SISTEMA HIDROVIÁRIO (SH)

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	SH AMAZONAS	MAI/2013

It is possible to observe, through the one-line diagram, that in general the waterways that make up the Amazon WS, except for those constituted by the navigable stretches of the Xingu, Jari, Paru, Uatumã Rivers, show a well conserved surrounding as to plant cover, in large part protected by Conservation Units, provided for indigenous lands, or considered of conservationist importance with the delimitation of APCBs (Biodiversity Conservation Priority Areas) forming sporadically continuous protection areas.

On the other hand, since the majority of the ports that make up this WS has been used as transport waterways, together with already installed port structures, there would be less need for interventions referring to works required for the installation of these navigation backup structures, which would result in smaller interventions in areas considered vulnerable as identified by the analyses of social and environmental vulnerabilities.

The individual characteristics of the waterways that make up the Amazon WS are shown below.

3.2.1.1 Amazon Waterway

a) Navigability Diagnosis

The Amazon River basin is the largest basin in the world, with a drainage area of approximately 7.0 million km². Of its total area, approximately 3.89 million km² is within Brazil, covering the states of Acre, Amazonas, Amapá, Mato Grosso, Pará, Roraima and Rondônia. The plant cover is dense forest. The climate in the region is hot humid equatorial with an annual average temperature of 27° C, with low thermal amplitude in the rainy period.

The Amazon River has a length of 6,850 km from its spring, 5.6 thousand meters high in Cordilheira dos Andes (Andes Mountains), in Peru, to its mouth, near the border of Pará with Amapá. It is a typical plains river and 3,165 km are in Brazilian territory.

Due to the continental dimensions, the rainfall rates, with an average of 2,100 mm/year, vary along the basin. The air relative humidity is very high due to the high evapotranspiration rate, reaching 80 to 90% in the most rainy months and a minimum of 75% during dry seasons. The relief has little influence on the climate, because the largest portion of the territory has an altitude lower than 200 meters.

The Amazon River is located in a region of marine, marine-fluvial, or fluvial plains with an average declivity of 1 cm/km. The geological structure of the region results from geological phenomena that occurred over millions of years, consolidating the formation of depressions and plains, predominantly in the largest portion of the Amazon area.

According to the? AHIMOC, the flood period in the Amazon River is between February and March, and the ebb period between July and October. The average Amazon River flow, at the Óbidos station, is close to 170,000 m³/s (see Appendix VII, Item 4.1.1).

The main tributaries are: The Napo, Içá, Japurá, Piorini, Negro, Manacapuru, Uatumã, Nhamundá, Trombetas, Curuá, Maicuru, Paru, Jari, Javari, Jandiatuba, Jutaí, Juruá, Tefé, Coari, Purus, Solimões, Madeira, Tapajós, Uruará and Xingu Rivers. The most important cities along the Amazon River are: Santana (AP) (stretch 13), Macapá (AP) (stretch 14), Almeirim (PA) (stretch 41), Monte Alegre (PA) (stretch 59), Santarém (PA) (stretch 69), Óbidos (PA) (stretch 81), Juriti (PA) (stretch 89), Parintins (AM) (stretch 98), Itacoatiara (AM) (stretch 124) and Manaus (AM) (stretch 144).

The average width of the Amazon River is around 5 km and the minimum depth is on the order of 30 m. At the point where the river has its narrowest section – called “Estreito de Óbidos" – the minimum width diminishes to 1.5 km and the depth can reach as much as 100 m. The average depth downstream of Manaus is roughly 45 m, with an average flow of approximately 109,000 m^3/s and 290,000 m^3/s, during the drought and humid seasons, respectively (see Appendix VII, Item 4.1.1).

According to the Brazilian Navy, the Amazon River is navigable during the entire year, with some navigation restrictions during the drought season only. At this time navigators could find sections with restricted visibility due to clearing fires, heavy rains or fog. Rock outcrops appear during the drought season in stretch 124, near the city of Itacoatiara (AM). In stretch 138, about 60 km downstream of Manaus (AM), the depth is reduced during the droughty season, which could affect the navigability conditions of deep draft vessels. Another point of concern is the considerable volume of vessel traffic in some ports, which could interfere with the speed of convoys passing through certain stretches.

Figure 3.2.1: Vessels in the ports of the Amazon River. (Source: acritica.uol.com.br)

The Amazon River, unlike the majority of its tributaries, is relatively long and straight and has very few meanders along its course, resulting in low sinuosity indexes, however, due to the presence of river archipelagos, the layout of the navigation course could result in more sinuous sections than expected.

Another obstruction that should be stressed are the landslides that occur in stretches of the Amazon River banks, causing bank instability problems and deposit of sediments.

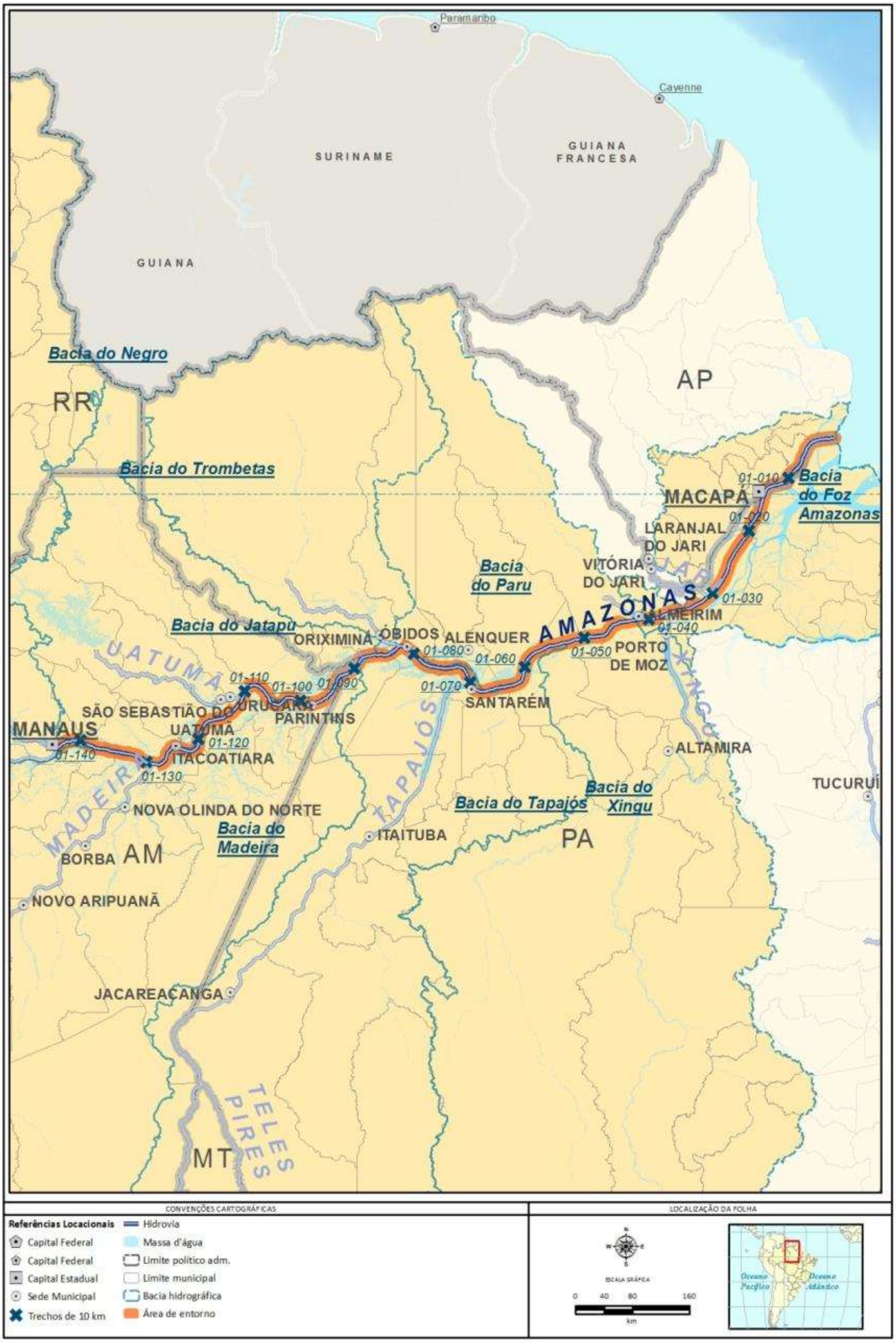
The Amazon River meets the Atlantic Ocean in a large delta composed of hundreds of marine islands, channels, and fluvial islands, and the city of Belém (PA) is located along one of the arms of the Amazon River. The waterway route that connects the Amazon River to Belém (PA) can be traveled by two types of navigation: Cabotage, in the North of Marajó Island, and, through the Breves narrows, and the Pará River, in the South and Southeast of the same island. The area of these narrows is cut by narrow passageways [“furos” (holes)] with accentuated curves in locations that allow the passing of one ship at a time. Depending on the ship draft and time of the tide, the route can vary, and the main routes are the Furo dos Limões with a depth of 7 meters and the Furo do Macaco, deeper, but more sinuous. The figure below shows a stretch of this channel.

Figure 3.2.2: Vessel traveling in the Breves narrows. Source: panoramio.com

There are no damming, bridges or hydraulic constructions in the Amazon River that could represent relevant difficulties for navigation.

b) Social and Environmental Vulnerabilities

The length of this waterway is 1,434 km, crossing the Foz do Amazonas, Jatapu, Madeira, Negro, Paru, Tapajós, Trombetas, and Xingu rivers basins. These basins all together have an area of 2,782,810 km². The basins of the Jatapu, Foz do Amazonas, Negro, Paru, and Trombetas Rivers are fully within the Amazon biome and the Madeira (99% and 1%), Tapajós (79% and 21%) and Xingu (93% and 7%) Rivers are partially within the Amazon biome and Cerrado biome, respectively, as shown in the figure below.



Map 1: Location of the Amazon Waterway

The set of river basins crossed by the Amazon Waterway runs through six states, that is, Amazonas (AM), Amapá (AP), Mato Grosso (MT), Pará (PA), Rondônia (RO) and Roraima (RR), with a total of 281 cities, including the state capital cities Manaus (AM), Macapá (AP), Boa Vista (RR) and Porto Velho (RO). The population is 9,225,492 inhabitants, (IBGE, 2010) and the state capital cities and Santarém (PA) are where most of this population is concentrated.

The Amazon Waterway crosses 29 cities in the states of Amazon, (AM), Amapá (AP) and Pará (PA). The population of these cities is 3,461,794 inhabitants, of which most are concentrated in Manaus (52%), Macapá (11,50%) and Santarém (8,5%).

The FIRJAN index (2010) varies considerably for the municipalities located in these river basins, varying from 0.36 in the municipality of Anajás (PA) to 0.90 in Lucas do Rio Verde (MT).The average for all the municipalities included in these river basins is 0.58, slightly above the average of the small size municipalities of the North region. For the waterway, the average of the municipalities for this index is slightly smaller than that obtained for the municipalities of the river basin, 0.54, and the extreme values occur for the municipalities of Porto de Moz/PA (0.37) and Macapá/AP (0.70).

With regard to the occurrence of Conservation Units (UC), in general, there are 67 Integral Protection UCs, and 133 Sustainable Use UCs in the array of the Amazon River basins. Of these occurrences, it is worth mentioning the concentration that exists in the Madeira River basin where there are 27 UCs/PIs and 60 UCs/USs. Furthermore, and also in this basin, there are a large number of APCBs (Biodiversity Conservation Priority Areas) of high and low priority (118). This type of occurrence is also very evident in the Tapajós River basin with 74 occurrences. Specifically, in the waterway surroundings the concentration of UCs is not significant, with only 7 Sustainable use UCs over the entire length.

In the study cutout area that adds up to a total of 144 stretches, a concentration of APCBs of high or very high priority can be noticed in stretches 047 to 090 from the junction with the Paru River to the vicinity of the city of Oriximiná (PA), 094 to 109, between Oriximiná (PA) and São Sebastião do Uatumã (AM), and 127 to 144, between Itacoatira (AM) and Manaus (AM), in the central and final portions of the waterway.

Also, from the point of view of potential use conflicts, these basins accommodate 798 INCRA settlements with a higher concentration in the Madeira River (302) and Tapajós River (238) basins. As for indigenous lands, there are 200 occurrences, with higher concentration in the Madeira (75), Negro (46) and Tapajós (35) River basins. In spite of this, the occurrences of settlements in the area of study for this waterway are not significant, amounting to a total of 28. On the other hand the indigenous lands occur in low density in the final stretches of the waterway (stretches 126 and 127, 131 and 132, 136 and 137) in the municipality of Itacoatiara (AM).

As for plant cover, stretches 019 to 034 of the waterway surroundings, in the municipality of Gurupá (PA), show a high percentage of plant cover conservation.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.

CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO AMAZONAS	MAI/2013

3.2.1.2 Jari waterway

a) Navigability Diagnosis

The Jari River is located in the mesoregion of the low Amazons, and it is one of the tributaries on the Amazon River left bank, approximately 170 km upstream of the city of Macapá (AP). Its spring is in the Serra do Tumucumaque, approximately 600 m high. The Jari River naturally divides the states of Amapá and Pará. The more important cities along the Jari River are: Laranjal do Jari (AP) (stretch 15) and Vitória do Jari (AP) (stretch 5).

The region has an equatorial climate, that is, hot and humid. The rain is constant except for the drought seasons. Considering the rain precipitation, two seasons stand out: Summer, from July to October, with maximum temperatures of 35°C; and winter, from November to June, with minimum temperatures close to 19°C. The annual rainfall rate varies between 2,000 mm and 3,000 mm. The relative humidity shows monthly averages around 80 to 90% with high levels during the entire year.

The hydrological regime of the Jari River basin is defined for a flood period, between the months of March and July, where the high flood occurs normally in the month of May. The drier periods are between October and December, and commonly October is the driest month. The average estimated flow is 1,200 m^3/s (see Appendix VII, Item 4.1.5).

The Jari River consists of the stretch from its mouth in the Amazon River to the city of Laranjal do Jari (AP) and the village of Monte Dourado (AP), totaling 160 km in length.

The Jari River is morphologically stable and does not undergo major changes in its bed over time, showing some stretches with fully developed meanders as normally present in the rivers of the Amazon River basin. The Jari River runs in the Amazon Depression and its geology typically consists of alluvial deposits and the river bed is predominantly sedimentary.

The Jari Waterway has low declivities, lower than 10 cm/km, with fluvial islands and a few sandbanks. The river is directly affected by the Amazon River backwater and the Atlantic Ocean tide.

According to the Brazilian Navy, the Jari River can be navigated at any time of year up to the port of Munguba (140 km upstream of its mouth) by various maritime ships with the support of navigation charts from the DHN (Ministry of the Navy). From this point on the river is still navigable in commercial terms up to the Santo Antônio Falls, located 20 km upstream of the urban area of the municipality of Laranjal do Jari (AP) (stretch 15).

The Jari River stretch under study has minimum widths on the order of 300 m. Along the river course there are no abrupt narrows that could restrict navigation, nonetheless, the sedimentation processes could cause bottlenecks, imperceptible by the present study.

The river shows minimum depths of 4.0 m in the period of high waters, and 2.4 m during the dry season. In the port of Munguba (AP) the average tide amplitude is 1.5 m during the drought season and 2.5 m during the rainy season.

The Santo Antônio Falls, located around 30 km upstream of Laranjal do Jari (AP), is the largest natural hindrance to navigation in the stretch of the lower Jari River, however, since it is located outside the waterway under study, it does not represent a natural obstruction to navigation.

The critical points for navigation are surveyed and mapped through navigation charts, available from the Brazilian Navy. The critical points should be basically the fluvial islands and sandbanks and, in this regard, the following locations should be stressed: Ilha Saudade, Ilha Xavier, the stretch between the locations of Paga Dívidas and Marapi, Ilha Jupatituba and Fazenda Caiçara.

There are no bridges or other structures which represent obstacles to waterway navigation.

The Jari River is the object of study for the implementation of hydroelectric power plants. According to the Jari River hydroelectric inventory, approved by ANEEL, the construction of the Santo Antônio do Jari UHE is foreseen for this waterway, located at the Santo Antônio Falls, at the most upstream portion of the waterway, and does not pose an obstacle to waterway navigation. If it is equipped with a lock system, the construction of this UHE could extend navigation from the mouth of the Jari River to stretches further upstream.

Figure 3.2.3: Santo Antonio Falls. (Overmundo, 2006)

b) Social and Environmental Vulnerabilities

The length of the Jari River is 151 kilometers and it is located within the Jari River basin. This basin has an area of 57,835 km² and crosses the territory of 6 municipalities, of which 5 are in the state of Amapá (AP) and one is in Pará (PA), and it located fully inside the Amazon biome.

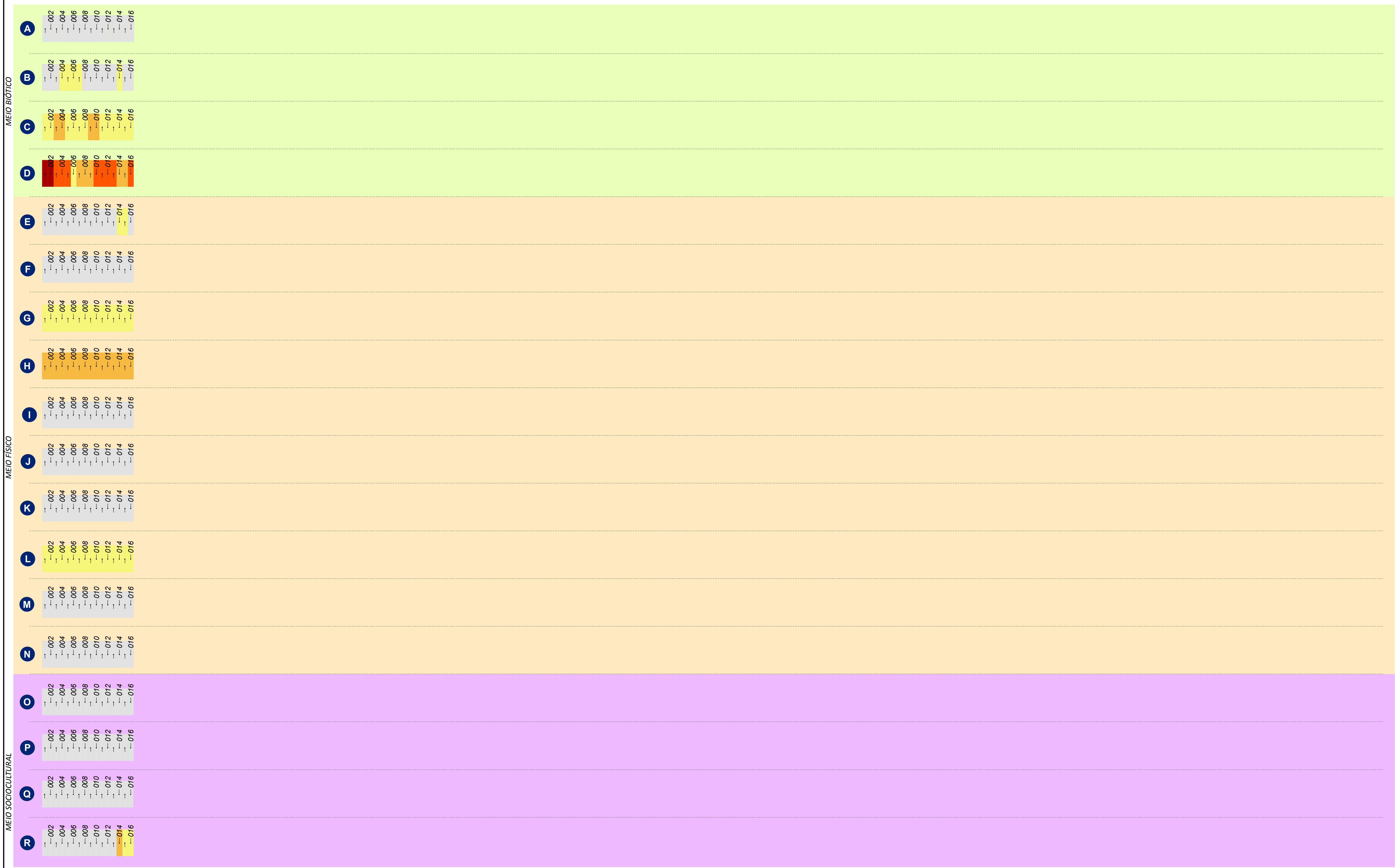
Map 2: Location of the Jari Waterway

The total population of the river basin municipalities is 134,297 inhabitants (IBGE, 2010). Specifically for the waterway study area there is a territory interface with 3 municipalities, two in Amapá and one in Pará state. The most populous municipality of the basin and area of study is Laranjal do Jari (AP) with 39.942 inhabitants (IBGE, 2010). The average of the FIRJAN index (2010) for the municipalities of this waterway is 0.52.

As for the conservationist aspects, the presence of 7 Conservation Units, of which 3 of Sustainable Use and 4 of Integral Protection, and 3 Indigenous Lands is observed in the basin.

The waterway surrounding area is subdivided into 16 stretches of 10 km each, and they do not show critical segments with regard to conservationist aspects. It is worth mentioning, however, that over its entire length, there are well conserved areas with regard to plant coverage and the occurrence of APCBs of extreme action priority on the right bank and high priority on the left bank, with regard to the course of the river. Sustainable Use CUs also occur between stretches 04 to 07 and 14, located in the municipality of Vitória do Jari (AP).

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO

- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO

- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL

- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

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REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
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- PNTL, 2010

N S W E

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO JARI	MAI/2013

3.2.1.3 Xingu Waterway

a) Navigability Diagnosis

The Xingu River is one of the main tributaries of the Amazon River right bank. Its spring is located in the West of Serra do Roncador, at an altitude of 600 m, and in the North of Serra Azul, east of Mato Grosso. It runs in a South-North direction, parallel to the Tapajos River, and after running a little more than 2 thousand kilometers it discharges its waters to the south of Ilha de Gurupá (PA), on the Amazon River right bank. The main municipalities along the Xingu River, within the stretch being studied, are: Porto de Moz (PA) (stretch 4); Senador José Porfírio (PA) (stretch 14), Vitória do Xingu (PA) (stretch 17) and Altamira (PA) (stretch 21).

The climate is hot and humid. The rain is constant except for the drought season. Considering the rain precipitation, the region's climate shows two distinct seasons: Summer, from July to October (maximum temperatures close to 35°C); and winter, from November to June (minimum temperatures close to 19°C), and this season is the time of heavy rains. The average annual temperature is 26°C with an annual rainfall rate varying between 2,000mm and 3,000mm. The average flow in the region of Belo Monte is 8,000 m^3/s (see Appendix VII, Item 4.1.7).

The Xingu Waterway consists of the stretch between its mouth, in the Amazon River, and the Belo Monte UHE Power House, next to the village of Belo Monte (PA), resulting in an extension of approximately 210 km.

The stretch under study is located in the Amazon Depression. From its mouth to approximately 100 km upstream of the Xingu River there is a region of alluvial deposits and sedimentary bed. From this stretch to the upstream portion of the river the appearance of sandstone rock formations can be noticed. The site for the construction of the Belo Monte power plant is located in the zone where the transition between the Amazon plains and the plateau regions occurs.

The Xingu River shows good navigability conditions, currently, along the entire length of the waterway under study. The river is currently navigable by local medium size vessels. The river shows low declivities, widths larger than 1 km, and little sinuosity. Following the Xingu River from its mouth, there is an estuary, narrowing in its mouth and upstream of the city of Vitória do Xingu (PA) (stretch 17), delimitating the stretch and showing better navigation conditions. The most sinuous stretches are located in the Xingu River mouth (stretches 1 to 3) and next to the municipality of Vitória do Xingu (PA), where a large number of fluvial islands makes the navigation route more sinuous than expected.

In general, the Xingu Waterway has depths higher than 6 m during high waters, between December and May. From its mouth to Senador José Porfírio (PA) (stretch 14), during low waters, the depth drops to 2.70 m, and in the remainder of the upstream stretch, to 2.30 m, during the same period. The stretch is affected by the tide which penetrates through the Amazon River.

The main natural obstacles to navigation consist of beaches and long sandbanks that outcrop during the drought season, in addition to a few rock outcroppings that appear in the vicinity of the city of Vitória do Xingu (PA), of which it is worth mentioning the Canazedo and Rendenção rock outcroppings. In these locations the maximum allowed draft is 2.3 m. Other critical points that offer restrictions to navigation are: the Xingu Açu sandbank (stretch 15); Mouro sandbank (stretch 16), Juncal sandbank (stretch 17) and the Barreira Vermelha passageway (stretch 19).

Figure 3.2.4: Xingu River with sandbanks. (Ferreira, 2012)

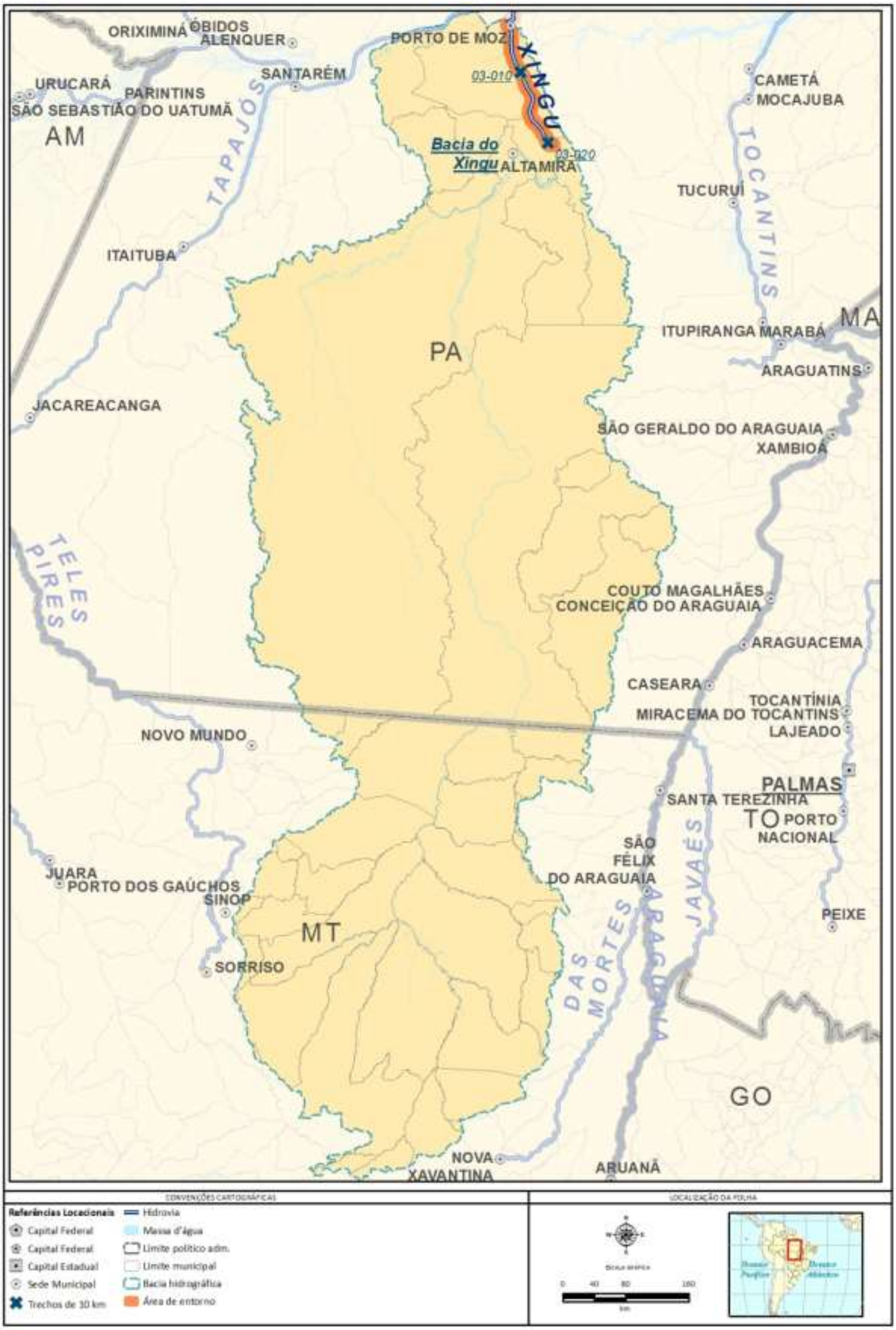
There are no bridges or other structures which represent obstacles to waterway navigation.

The Belo Monte UHE is at the upstream end of the waterway and does not represent a navigation impediment. This hydroelectric power plant is currently under construction and the date anticipated for the start of the first generating unit is 2015. Additionally, the Belo Monte UHE will be operated as run-of-the-river, and will not change the Xingu River hydrological regime upstream of this plant's power house.

If a lock system is built for this UHE, navigation can be possible and expanded up to the medium Xingu River.

b) Social and Environmental Vulnerabilities

The Xingu River's navigable stretch has a length of 202 kilometers, located inside the Xingu and Amazon Mouth River basins which, together, amount to an area of 621,816 km². The Xingu River basin crosses the Amazon biome (93%) and Cerrado biome (7%), and the Amazon Mouth River basin is fully inside the Amazon biome.



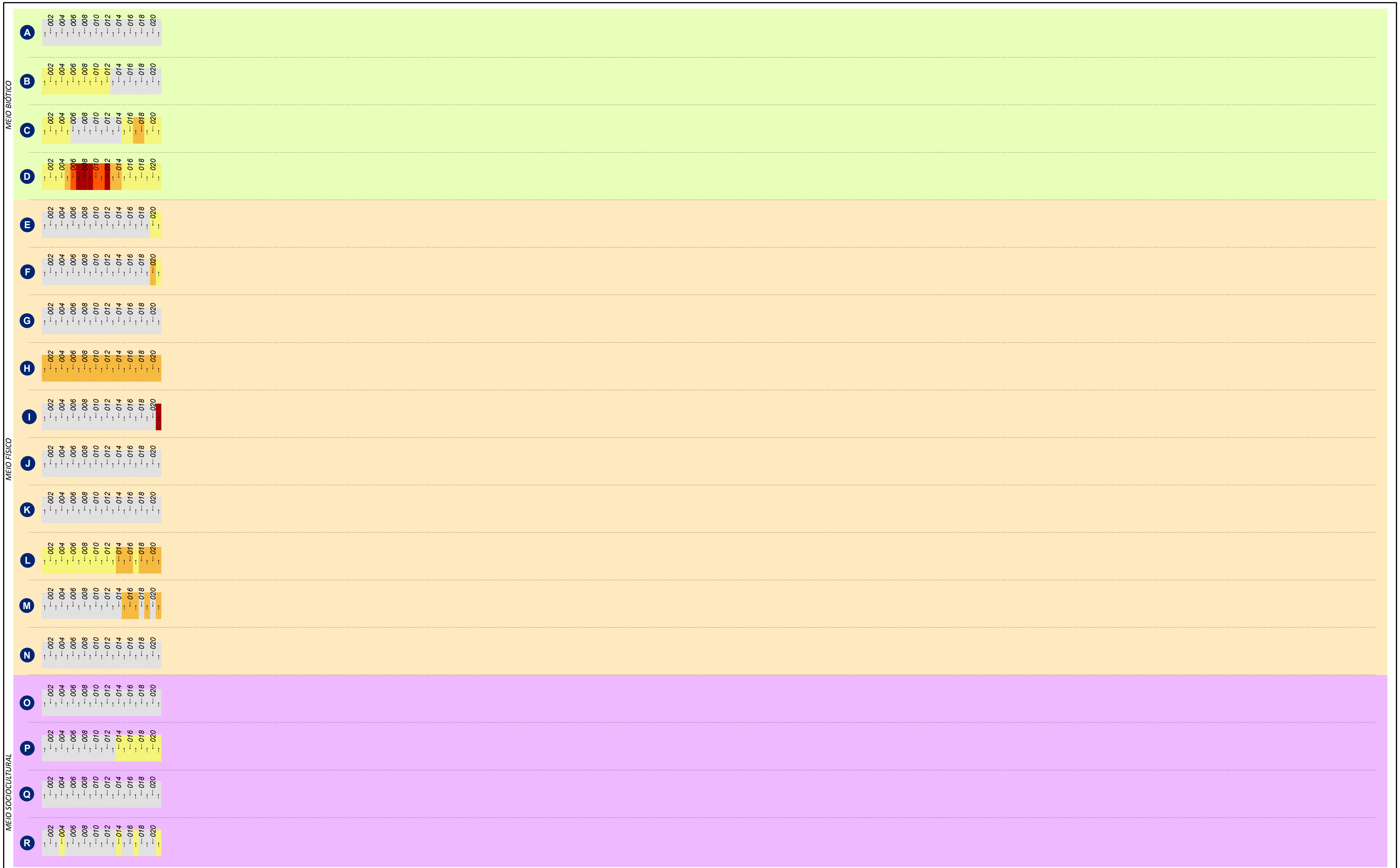
Map 3: Location of the Xingu Waterway

These river basins cross the territory of 99 municipalities, of which 69 are in the Xingu River basin and 30 are in the Amazon Mouth. The total population of these municipalities is 3,216,092 inhabitants (IBGE, 2010) and the state capital city Macapá (AP) is the most populous, accounting for a total of 12.24%. This area of study of the waterway crosses 5 municipalities, all located in the state of Pará. The population of these municipalities is 110,037 inhabitants (IBGE, 2010). The FIRJAN index (2010) for the municipalities of the basin varies between 0.36 in Anajás (PA) and 0.86 in Primavera do Leste (MT) with a general average of 0.56. For the municipalities in the waterway surrounding area the average is 0.46, slightly below the average of the river basin municipalities.

With regard to the conservationist aspects, the following characteristics may be stressed: 33 Conservation Units, of which 8 are of Integral Protection and 25 are of Sustainable Use, and 30 indigenous lands, the latter concentrated in the Xingu River basin. In the Amazon Mouth basin, there are 95 APCBs of which 57 are of extreme priority and 38 are of high priority.

The waterway area of study was divided into 21 stretches of 10 km^2 each, with the presence of APCBs of extreme priority in stretches 01 to 05 in the municipality of Moz (PA) and 016 and 021 in Vitória do Xingu (PA). In a general manner the waterway surroundings show low deforestation rates, and only in stretches 007 to 012, in the municipality of Porto de Moz (PA), are the deforestation rates above 50%, reaching as much as 87% in stretches 08, 09 and 12.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- Ⓐ Unidade de Conservação - Proteção Integral
- Ⓑ Unidade de Conservação - Uso Sustentável
- Ⓒ Áreas Prioritárias para Conservação da Biodiversidade
- Ⓓ Desmatamento do trecho

FÍSICO
- Ⓔ Mineração - Lavra e garimpo
- Ⓕ Espeleologia
- Ⓖ Sinuosidade
- Ⓗ Profundidade
- Ⓘ Empecilhos à navegação (construções)
- Ⓙ Energia do rio
- Ⓚ Leito do rio
- Ⓛ Assoreamento
- Ⓜ Anteparos naturais
- Ⓝ Largura do rio

SOCIOCULTURAL
- Ⓞ Comunidades quilombolas
- Ⓟ Assentamentos INCRA
- Ⓠ Terra indígena
- Ⓡ Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

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ESCALA GRÁFICA

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LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

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DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO XINGU	MAI/2013

3.2.1.4 Paru Waterway

a) Navigability Diagnosis

The Paru River is one of the tributaries on the Amazon River left bank and runs in the North of Pará state.The spring of the Paru River is located in the Serra de Tumucumaque (PA), 460 m high, on the border with Suriname. It runs approximately 710 km crossing in its entire length the municipality of Almeirim (PA), until discharging its water into the Amazon River left bank. The Paru River runs in an inhospitable area without any infrastructure. There is no development taking place in the region and the most important city along the waterway is Almeirim (PA) (stretch 1), whose seat is located on the Amazon River, next to the mouth of the Pari River. The Paru River influence area is fully deprived of federal and state highways, and it is intercrossed by PA-254, still in the planning phase.

The climate of the Paru River basin is typical equatorial Amazon, hot and humid with two seasons: drought and rainy. The drought season extends from June to November. The rainy season, “winter,” is characterized by constant rain, from December to May. The relative humidity shows monthly averages around 80 to 90% with high levels during the entire year. The total annual rainfall rates vary between 1,600 mm and 2,750 mm, and tend to increase towards the Southeast and Northwest. Precipitation, in most of the state, is abundant and without a clear dry season. Rainfall is not so intense in the months of June, July and August. The average annual temperature in the region is around 24.5° C, with the maximum temperature around 32° C.

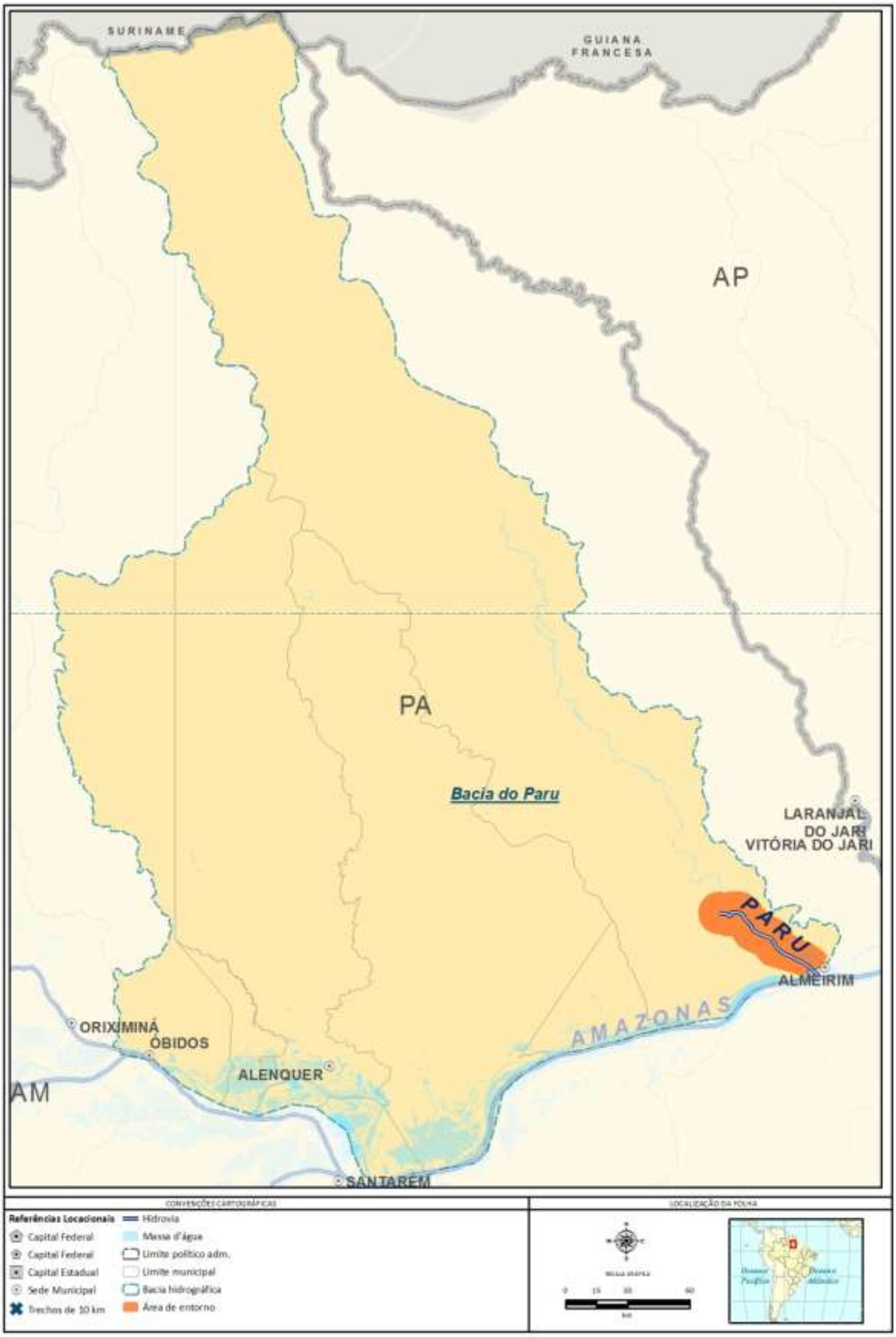
The Paru Waterway consists of the stretch from its mouth in the Amazon River to approximately 60 km upstream.

The river does not have sufficient information available to characterize the navigability conditions.

However, the Paru River is provided with a navigation floodgate for commercial vessels, used mostly during flood time. The Paru River is located in an alluvial deposit region with typical sedimentary formation in locations of low declivities, influenced by the Amazon River backwaters and the Atlantic Ocean tides. The minimum widths vary between 90 and 700 m, and it has low sinuosity indexes. The presence of a large number of fluvial islands can be noticed, which can make the navigation routes more sinuous and narrower than expected.

b) Social and Environmental Vulnerabilities

The navigable stretch of the Paru River, a tributary of the Amazon River, has a length of 65 kilometers, the shortest analyzed by this study, partially intercepting the Paru River and Amazon Mouth basins. These river basins together include 37 municipalities located between Amapá (AP) and Pará (PA) states, accounting for a population of 1,775,806 (IBGE, 2010), of which the state capital city Macapá (AP) is the most populous with 398,204 (22.42%) inhabitants.

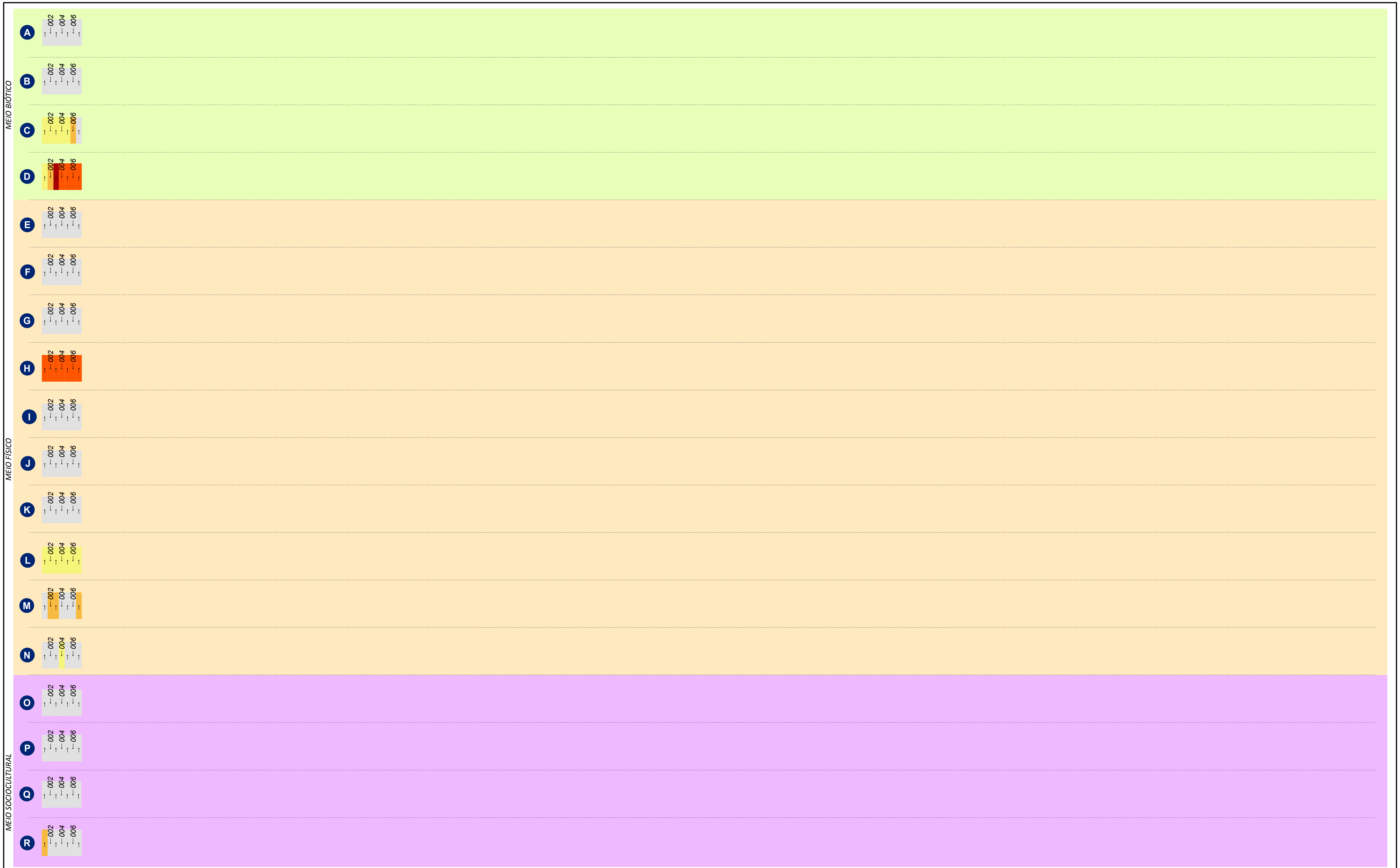


Map 4: Location of the Paru Waterway

The area of study of the Paru Waterway was divided into 7 analysis stretches. This cutout extends over the territory of only 1 municipality, Almeirim (PA), with a population of 33,614 inhabitants and it has a FIRJAN index (2010) of 0.55.

The Paru River and the Amazon Mouth basins show, as the most relevant aspects with regard to the vulnerability of the social and environmental aspects, 5 Integral Protection Conservation Units, far, however, from the Paru Waterway. Specifically for the waterway, even though there are no legally more restrictive protected areas such as UC/PI and/or TI delimitated, its surroundings are very well preserved in relation to plant cover. Additionally, its area of study is fully integrated into APCBs of extreme importance, indicating the conservationist importance of this area.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

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- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos

nº < Jusante

nº > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

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3.2.1.5 Trombetas Waterway

a) Navigability Diagnosis

The Trombetas River is located in the mesoregion of the lower Amazon, and it is one of the tributaries on the Amazon River left bank. The Trombetas River mouth is located in the Amazon River, approximately 11 km upstream of the city of Óbidos (PA). The main municipalities along the Trombetas River are: Oriximiná (PA) (stretch 4), Porto Trombetas (PA) (stretch 12) and a location called Cachoeira Porteira (stretch 23). Porto Trombetas (Trombetas Port) (PA), stands out because that is where the mining and transport of bauxite is carried out, and then loaded through the automated facilities of the private port mining complex existing therein.

The flood season in the Trombeta River goes from March to August, and the low waters take place from September to February. In the region of Porto Trombetas the annual average variation of the river is approximately 6 m. The average flow at the Caramujo station is approximately 1,900 m^3/s (see Appendix VII, Item 4.1.8).

The Trombeta Waterway considered in this analysis consists of the stretch between its mouth and the location of Cachoeira Porteira, with a total length of roughly 230 km.

The river stretch is located in a Amazon Plains region for the first 50 km downstream, and in the Amazon Depression for the remaining course. The river bed is predominantly sedimentary.

The Trombetas River, within the stretch under study, is, in general, deep and does not show any relevant sandbanks; its main channel is normally located in the middle of the river bed. The Trombetas River features low sinuosity indexes and minimum widths on the order of 300 m. The most critical stretch is known as Lake Bacabal.

The average declivities are low, varying from 4 to 7 cm/km. Upstream of Cachoeira Porteira there are rapids stretches, not feasible from the point of view of commercial navigation Supplementary information can be found in Appendix VII, Item 4.1.8.

Figure 3.2.5: Cachoeira da Porteira (PA) (stretch 23) (Environmental Education, 2010)

Frequent fog can represent difficulty, mostly when accompanied by gusty winds and heavy rain. According to the Brazilian Navy, the sinuosity of the region around Lake Bacabal to Porto Trombetas (PA) and the river narrowness in the area could make navigation dangerous during the occurrence of the meteorological conditions mentioned above.

The best navigating conditions can be found in the stretch extending from the Trombetas River mouth to Porto Trombetas (PA), 120 km from the mouth, where navigation is carried out by maritime vessels. The average depths in this stretch are above 10 m and the minimum is on the order of 4 m. The maximum draft allowed is calculated and publicized daily by MRN (Mineração Rio do Norte), based on the river levels in Porto Trombetas (PA) and Oriximiná (PA);

From Porto Trombetas (PA) to km 170, navigability still takes place under good conditions, and navigation can be made up to approximately 230 km, around Cachoeira da Porteira (PA) (stretch 23). In the last 90 km, the depths are 4 m during the flood season, and at least 1.50 m during dry periods.

b) Social and Environmental Vulnerabilities

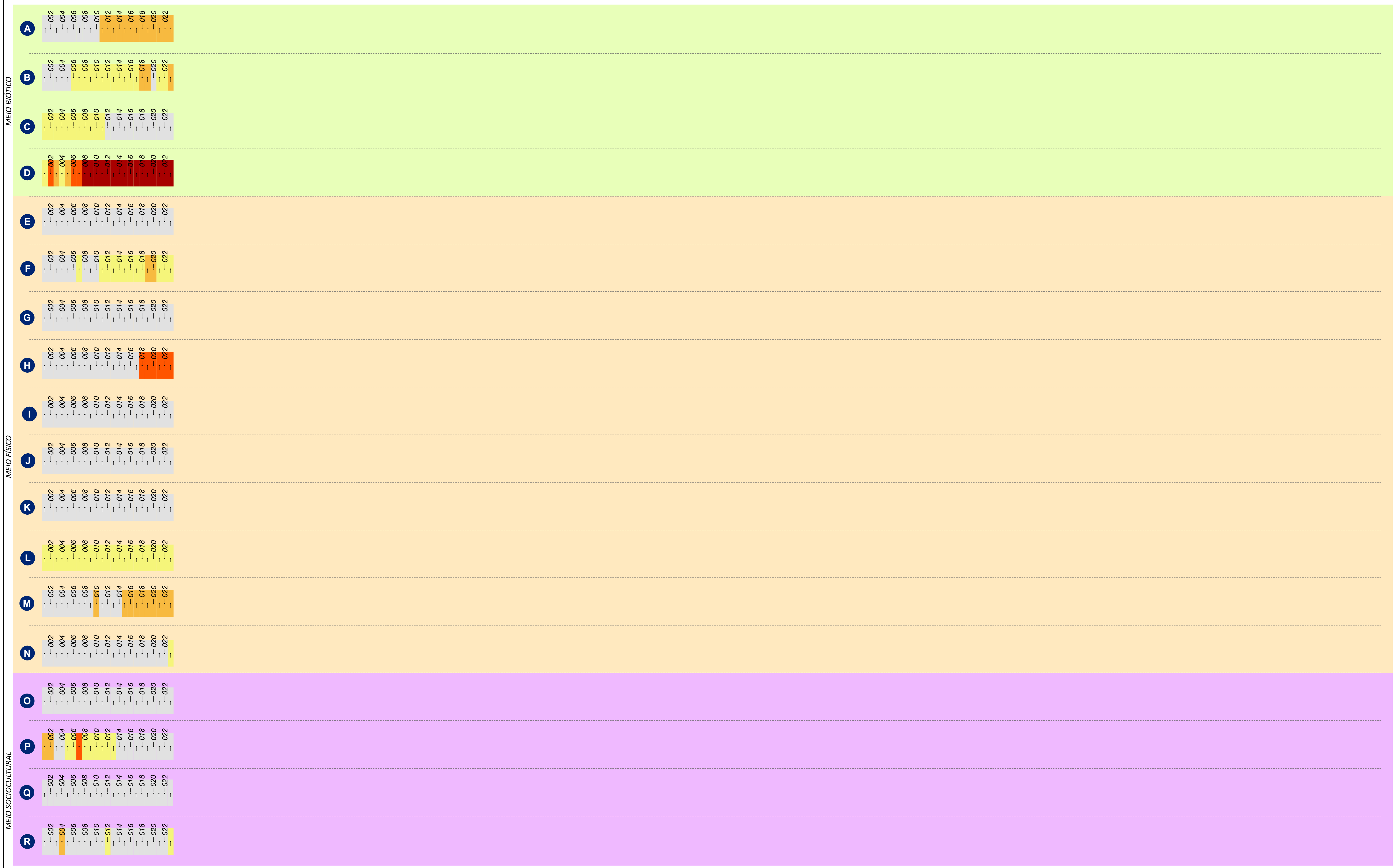
The Trombetas River, located between the the Purus and Trombetas River basins, has a length of 226 kilometers. Its limits are within the Amazon biome, inside Pará state.

Map 5: Location of the Trombetas Waterway

The Purus and Trombeta River basins together amount to an area of 528,327 km². They are located in the states of Acre, Amazonas, Pará, Rondônia and Roraima and these river basins cross the territory of 45 municipalities, with a total population of 1,890,298 inhabitants (IBGE, 2010). The state capital cities of Porto Velho/RO (22,67%) and Rio Branco/AC (17,78%) are the main cities that contribute to this total. In the waterway area under study, 2 municipalities are crossed in Pará state: Óbidos - with a population of 49,333 inhabitants and FIRJAN index (2010) of 0.49 - and Oriximiná with 62,794 inhabitants and a FIRJAN index (2010) of 0.62.

Within the limits of the Purus and Trombetas River basins it is important to mention the presence of 48 Indigenous Lands and 9 Integral Protection Conservation Units. Inside the cutout that represents the Trombetas Waterway area of study (divided into 23 stretches of 10 km^2 each), the end portion of the waterway is the most vulnerable since, in the municipality of Oriximiná, the occurrences of cavities between stretches 019 and 021 and Integral Protection Conservation Units between stretches 10 and 23 were identified.

The distribution of the occurrences in relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

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- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
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- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos
n° < Jusante
n° > Montante

Escala de ponderação dos temas
1 - 5 (baixa - alta)

IN BA ME AL MA

- IN - Insignificante
- BA - Baixa
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- MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA 0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

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3.2.1.6 Uatumã Waterway

a) Navigability Diagnosis

The Uatumã River is located in the mesoregion of the lower Amazon, and it is one of the tributaries on the Amazon River left bank. Its spring is located on the border of the states of Amazonas and Roraima in the Maciço das Guianas (Guiana Massif).Its mouth is around 100 km upstream of the city of Parintins (AM), on the Amazon River. The main cities along the Uatumã River are Urucará (AM) (stretch 3) and São Sebastião do Uatumã (AM) (stretch 5), located 30 km and 45 km from its mouth, respectively, on the left bank. Next to the Balbina UHE (stretch 32), there is the municipality of Balbina (AM).

The region has an equatorial climate, that is, hot and humid. The rain is constant except during the drought season. Considering the rain precipitation, the regional climate shows two distinct seasons: Summer, from July to October, with maximum temperatures of 35°C; and winter, from November to June, with minimum temperatures close to 19°C. The annual rainfall rate varies between 2,000 mm and 3,000 mm. The flood season of the Uatumã River goes from March to August, with the highest level in May; the low water goes from September to February, with the minimum level in December. The average Uatumã River flow, at Cachoeira Morena station, is around 600 m^3/s (see Appendix VII, Item 4.1.9).

The Uatumã Waterway considered herein consists of the stretch from its mouth in the Amazon River to the city of Balbina (AM), where the Balbina UHE is located, amounting to around 320 km in length.

The Uatumã Waterway features, currently, good navigation conditions for small and medium commercial vessels along its entire length.

The Uatumã River, as well as other tributaries on the Amazon River left bank, has dark waters and less relevant erosive processes than those on the Amazon River right bank. The Uatumã river has stretches with meanders fully developed, characteristic of the Amazon River basin. Along the stretch under study, the sinuosity coefficients vary between 1.3 and 1.5. The sinuosity will cause more difficulty for commercial navigation in stretch 17, towards the upstream portion, where the Uatumã River features smaller widths and depths.

In the first 40 km, from the river mouth (stretches 1 to 4), the river shows a medium width of 400 m, with little oscillation. Between stretches 5 and 16, the river has stretches with large widths, characteristic of lakes from stretch 17 up to the end of the waterway, the Uatumã River has minimum decreasing widths that could reach as much as 90 m.

According to data from the BIT – Transport Information and Map Data Bank, the minimum depths of the Uatumã River are 2.1 m, and take place during the drought season (September to February) at the location called Cachoeira Morena, stretch 29.This corresponds to the most critical obstacle of the waterway and leads to a series of rapids, with a declivity of approximately 25 cm/km. During low water periods these rapids may inhibit or even impede commercial navigability, depending on the hydrological conditions. During flood periods the depths are above this value and navigation can take place along the entire waterway, but special attention is needed at all times.

Figure 3.2.6: Uatumá River - Cachoeira Morenano (stretch 29) (Panoramio, 2013)

Besides Cachoeira Morena, there are locations with a large number of fluvial islands which can make the stretch narrower and more sinuous than expected.

Nonetheless, at the end of the waterway there is a power plant (Balbina UHE) with 250 MW of installed power, which was first put into operation in 1989, and is responsible for providing electric power to the largest portion of Manaus (AM).

A bridge, Eng. Fço Nelson Quiroga de Nóbrega, was built approximately 1.5 km downstream of this dam, and its dimensions restrict navigation. However, since both the bridge and the power plant are at the end of the waterway, they do not pose any problem or restriction for navigation of the waterway as a whole.

b) Social and Environmental Vulnerabilities

The Uatumã Waterway has a length of 317 kilometers and is located within the limits of the Jatapu River basin. The Jatapu River basin has an area of 119,401 km², located in the states of Amazon (AM), Pará (PA), and Roraima (RR).

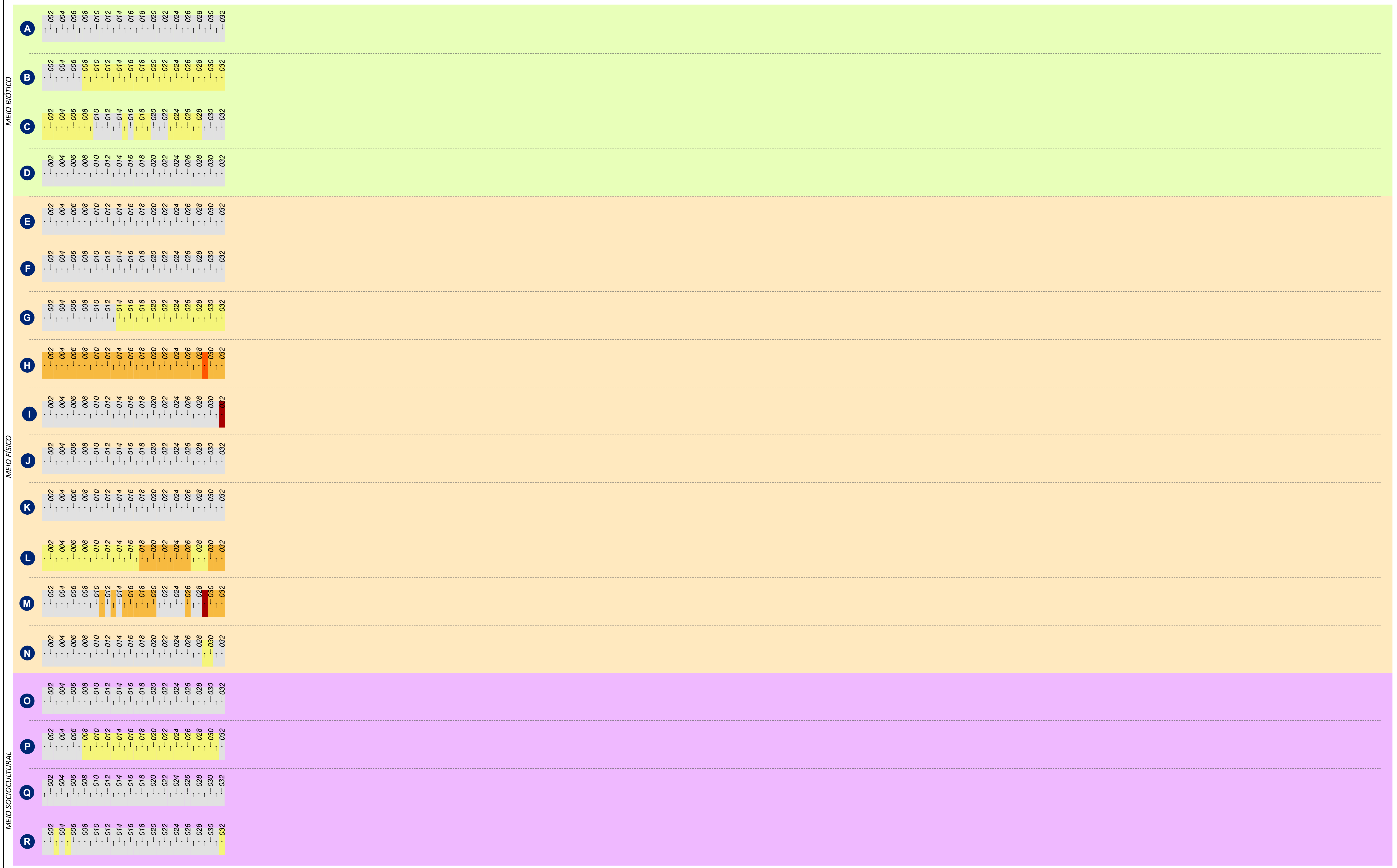
Map 6: Location of the Uatumã Waterway

The limits of the river basin interfaces with 20 municipalities that have a population of 2,337,170 inhabitants (IBGE, 2010). Among them is the capital city of Manaus (AM), which stands out with 77.10% of the total population. Four municipalities are crossed by the study area selected for the Uatumã Waterway, all of them located in the state of Amazonas. In these municipalities the population totals 63,185 inhabitants.

The average FIRJAN index (2010) for the river basin municipalities is 0.56, and the municipality of Manaus (QAM) is the one best positioned, with 0.68, and Faro (PA) has the lowest index (0.44).As for the municipalities included in the area of study, the one that most stands out is Presidente Figueiredo (0.48), where the reservoir of the Balbina power plant is located.

As for the conservationist aspects, the presence of 6 indigenous lands and 2 Integral Protection Conservation units can be observed. These occurrences, however, are away from the waterway area of study. In the waterway area of study which was divided into 32 stretches of 10 km², low deforestation rates are observed. Also, between stretches 008 and 032, in the municipalities of São Sebastião de Uatamã and Presidente Figueiredo, the presence of Sustainable Use Conservation Units and INCRA settlements was observed.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

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- A Unidade de Conservação - Proteção Integral
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- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
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- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME ALMA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

N W E S

ESCALA GRÁFICA

0 50 100 200 km

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3.2.1.7 Negro Waterway

a) Navigability Diagnosis

The Negro River is the largest tributary on the Amazon River left bank. Its spring is in in the Colombian Pre-Andes region, between the Orinoco River and Amazon River basins, and it also connects to the Orinoco River through the Casiquiare channel. In Colombia, it is called the Guainia River. Its main tributaries are the Branco and Vaupés Rivers. In the Manaus (AM) region, it merges with the Solimões River, forming the Amazon River. Its length is approximately 1,700 km between its spring and the confluence with the Solimões River.

The Negro River basin accounts for the rainiest climate of the Amazon River basin, with annual average figures between 2,000 mm and 2,200 mm, reaching levels higher than 3,500 mm in the upper Negro River region. According to the AHIMOC, the flood period in the Negro River is between May and August, and the low water period is between December and February. The average estimated flow is 28,000 m^3/s (see Appendix VII, Item 4.1.3).

The Negro River is located in a region of geological faults, a characteristic feature of the Amazon Depression. The geological formation of alluvial deposits predominates in stretches 1 to 73, and the river bed is predominantly sedimentary. From this segment towards the upstream portion, the rocky formations are more accentuated and also found in the river bed conditions.

The Negro Waterway consists of the stretch from its confluence with the Solimões River to the city of Cucuí (AM), on the Brazil-Colombia-Venezuela border, amounting to approximately 1,250 km in length.

According to the Brazilian Navy, the Negro Waterway is currently navigable from its confluence with the Solimões River, next to Manaus (AM) (stretches 1 and 2), to the city of Santa Isabel do Rio Negro (AM) (stretch 75), with 750 km in length.

In the segment between Manaus (AM) and the mouth of the Branco River (stretch 33), 330 km in length, navigation is feasible and smooth. The average depth varies between 3.0 and 60.0 m. The Negro River mouth, where it meets the Solimões River, is the deepest portion of the entire Negro Waterway and the entire Amazon River, with a depth estimated at 100 meters. There are no records of critical passageways due to the depth of this segment.

The bridge that crosses the Negro River in Manaus (stretch 2) has adequate dimensions for the passing of commercial vessels through the two 200 m stayed spans. There are no other bridges or constructions that pose a problem for navigation.

Figure 3.2.7: Bridge over Negro River (Gazeta Maringá, 2011)

Sinuosity may be a problem for navigation in the existing fluvial archipelagoes, mostly between stretches 9 and 20 and between stretches 34 and 43, composed of a large number of islands that make the course of the navigation route more sinuous and narrower than expected.

Due to these existing archipelagoes, stretches of the Negro River unfold into various channels and "arms" with highly variable widths, and can reach a width of as little as 100 m. The presence of the Anavillas Archipelago (stretches 9 to 20) stands out, the world's largest fluvial archipelago, with more than 800 hundred islands, many of them long and narrow, confusing the navigator who should follow the navigation sketches, and avoid night crossings if not fully familiar with this area.

Figure 3.2.8: The Anavilhanas Archipelago (Caboclo, 2013)

The cyclical variation of the water level in this archipelago can vary up to 10 meters between the periods of low water and floods. The flood period takes place from October to March and the drought period from April to September (http://ppbio.inpa.gov.br/sitios/anavilhanas).

Between the Branco River mouth (stretch 33) and the city of Santa Isabel do Rio Negro (AM) (stretch 75), the Negro River shows navigability conditions that vary along the stretch according to the time of the year, limiting navigation to vessels with 2 m draft during the low water period (October to March). This segment shows rock outcrops that restrict navigation in some stretches, more specifically between the Branco River mouth and Camanaus (AM), in São Gabriel da Cachoeira (AM) (stretch 102), where there are many restrictions.

From the city of Santa Isabel do Rio Negro (AM) (stretch 75) to the end of the waterway upstream portion in the city of Cucuí (AM) (stretch 125), the river does not have proper conditions for commercial navigation. The channel is much better defined, with smaller widths and more sinuous stretches. In this stretch the river shows typical rapids characteristics with variable depths due to rock outcrops, and more accentuated declivities, and it is possible to navigate only during the flood period (May to August) and by small vessels, with more powerful and higher speed engines capable of overcoming the current that may reach as much as 12 knots. According the Brazilian Navy, in this stretch the following critical stretches stand out: corredeiras (rapids) de Camanaus, passagens (passageways) do Tinhana and de Furnas, corredeiras de Curucuri, Corredeiras de Tucubá, Corredeiras de Fortaleza, Pedrais (rock outcrops) between Corredeiras de Fortaleza up to the Uaupés River mouth (located between stretches 75 and 125).

Figure 3.2.9: Camanaus Rapids (stretch 102) (Lentes da Amazônia, 2013)

b) Social and Environmental Vulnerabilities

The Negro Waterway has a length of 1,241 km and its course is within the Negro River basin. This basin is 595,452 km² and is located inside the Amazon biome, between the states of Amazon and Roraima.

Map 7: Location of the Negro Waterway

The limits of the river basin cross the territory of 33 municipalities, 18 in Amazonas and 15 in Roraima. The population of the river basin is 2,677,183 inhabitants (IBGE, 2010) and the capital city of Amazonas state is the most populous, accounting for 67.31 % of the total, followed by Boa Vista, the capital city of Roraima state, with 10.62%. In the selected waterway area, divided into 125 stretches of 10 km², there is an interface with 9 Amazon municipalities, with a total population of 2,067,096 inhabitants, of which Manaus contributes with 87.18% of the total.

The FIRJAN index (2010) for the municipalities crossed by the basin vary from 0.45 in Barcelos (AM) to 0.68 in Manaus (AM) with a general average of 0.54.

The Negro River basin includes 46 Indigenous Lands and 87 UCs, of which 27 of Integral Protection and 60 of Sustainable Use. In the selected area of study there are 6 Indigenous Lands in stretches 01 (next to Manaus), 023 to 026 (municipality of Novo Airão) and 076 to 125 (between the municipalities of São Gabriel da Cachoeira and Santa Isabel do Rio Negro). There are also 15 UCs, of which 6 are of Integral Protection and 9 are of Sustainable Use.The Integral Protection UCs are located in the municipalities of Manaus (in stretches 02, 05 to 028), Novo Airão and Barcelos in Santa Isabel do Rio Negro (stretches 076 to 088), and in the municipality of São Gabriel da Cachoeira (stretches 120 to 123).

It is also worth mentioning that along the entire waterway, alternating between UC and TI areas, there are APCBs of extreme importance.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.

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SOCIOCULTURAL
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Nº dos trechos

nº < Jusante

nº > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

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REFERÊNCIAS

Fontes:
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- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

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3.2.1.8 Branco Waterway

a) Navigability Diagnosis

The Branco River basin is located in the Amazon region, at the North end of the country, bordering Venezuela and Guiana. Its drainage area is approximately 192,000 km². The Branco River is formed by the confluence of the Tacutu and Uraricoera Rivers, thirty kilometers to the north of Boa Vista (Roraima) (RR), the state capital city, and it develops in the North-South direction from its mouth, on the left bank, stretch 33 of the Negro River. The main municipalities crossed by the Branco River are Santa Maria do Boiaçu (RR) (stretch 11), Caracaraí (RR) (stretch 39) and Boa Vista (RR) (stretch 53).

The average absolute temperatures range from 22°C to 28°C. The minimum absolute temperatures occur in areas with more rugged topography to the North and Northeast where they can reach 9°C, and the maximum absolute temperatures, predominantly in the South portion of the state, go as high as 38°C. The rainfall regime, regardless of clearly characterizing the dry and humid periods, shows cyclical irregularities. During normal years the rainfall is concentrated in the period from May to August, 4 months that account for over 60% of the entire annual precipitation. The dry season occurs in the period extending from November to March. The average estimated flow is 3,000 m³/s at the Caracaraí station (see Apendix 7, Item 4.1.4).

The Branco River is located in an area with alluvial deposits and a sedimentary bed up to close to the city of Caracaraí (RR). From this stretch to the upstream portion, the geology is characteristic of the Amazon Depression transition region, a location where the Bem Querer rapids (stretch 41) are located. The river bed in this region is rocky and many rock outcrops can be noticed. In the region where the city of Boa Vista (RR) (stretch 53) is located, the river bed becomes sedimentary again, as a result of the geological conditions of northern Roraima.

The Branco Waterway consists of the stretch from its mouth, in the Negro River, to the municipality of Boa Vista (RR) (stretch 53), totaling approximately 560 km in length.

The Branco River is relatively channeled and has few meanders along its route, resulting in a sinuousity index around 1.10. The minimum widths seen along the Branco Waterway measure approximately 500 m, ranging between 700 and 300 m along its full length. However, the Branco River shows stretches with many sandbanks that, depending on the water level, can considerably change the navigable chute and make the navigation route more sinuous and narrower than expected.

The Branco River shows quite reasonable navigability conditions during medium and high waters, however, during low water the river poses restrictions to navigability, due to insufficient depth. The navigability condition limitations restrict the size of the convoys that travel in the stretch, causing stranding and traffic interruptions.

The Branco River shows two potentially navigable segments:

The first navigable segment is between the Branco River mouth and Bem Querer rapids (stretch 41), comprising a length of approximately 400 km, called the lower Branco River, and has curves that are not too accentuated, but with large depth variations and many sandbanks. This stretch is responsible, along almost its full length, for waterway transport in Roraima state, carrying cargo and ranking as the main waterway route in the Branco River (RR) - Manaus (AM) connection. In this stretch, navigation in the Branco River can be made by larger vessels, even though the minimum depth is subject to large changes over the year, with navigation possible by vessels with 3.50 m draft during high waters and 1.20 m during low waters.

Figure 3.2.10: Unconsolidated superficial sandbanks in the Branco River. (Folha Web, 2009)

The second segment, with a length of approximately 160 km, is known as the upper Branco River, and comprises the stretch between Bem Querer rapids (stretch 41) and the city of Boa Vista (stretch 53). In this section the river shows very little depth, especially in the dry period, when sandbanks, tablelands and rock outcrops come into view. During flood periods, navigation is made by observing occasional restrictions.

Bem Querer rapids, with a length of 24 km, consists of the largest obstacle to navigation in this waterway These rapids impede navigation in the main river chute. The only alternative channel is the furo do Cojubim, where the Brazilian Navy performed rock excavation in 1970, partially improving navigability in this location, however, navigable conditions are still poor due to the existing fast currents and rock outcrops. The minimum depths are lower than 1 m.

Figure 3.2.11: Bem Querer rapids (stretch 41). (Portal Amazônia, 2012)

Depending on the level of water a change could occur in the navigable chute at many locations and stretches once open to navigation could be closed in following year. Landslides are frequent, accumulating material that, unable to be removed by the current, silt up on the river bottom and increase the number of sandbanks.

According to the AHIMOC, between Santa Maria do Boiaçu (stretch 11) and the city of Caracaraí (stretch 39), with a length of approximately 280 km, there are restricted navigation stretches, showing depths shallower than 1 m. During this period, barges remain immobile for periods of up to 3 months (January to March) waiting for the waters to rise.

According to information from the local pilots, the more severe difficulties are found during low waters, in the mouth region, where there are various submerged arms and rocks that are quite often silted up and where the deepest channels are not consistent. Difficulties also occur near Caracaraí (RR), in the existing rock outcrops.

The construction of a hydroelectric power plant is expected in the Branco River. According to the approved hydroelectric inventory by ANEEL, the construction of the Bem Querer UHE is planned by the Programa de Aceleração do Crescimento (Growth Acceleration Program) (PAC), to be built in the location of the current Bem Querer rapids, next to the municipality of Caracaraí (RR), stretch 40. If it is equipped with locks, construction of this UHE will allow connection of the two navigable stretches and access, through the waterway, of Boa Vista (RR) to the rest of the country. The figure below illustrates the division of the water flow falls for the Branco River.

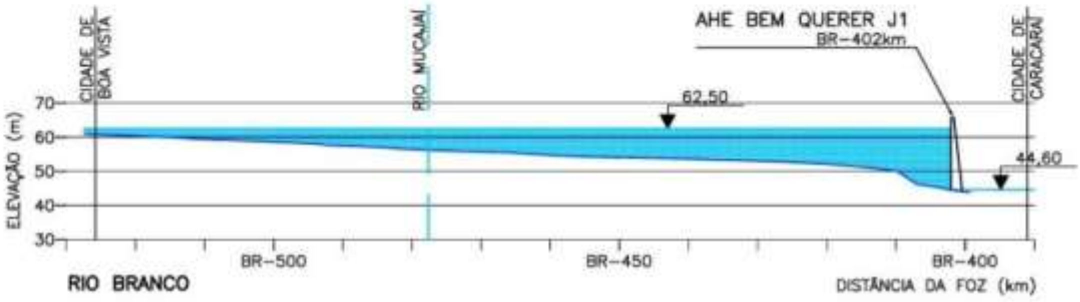


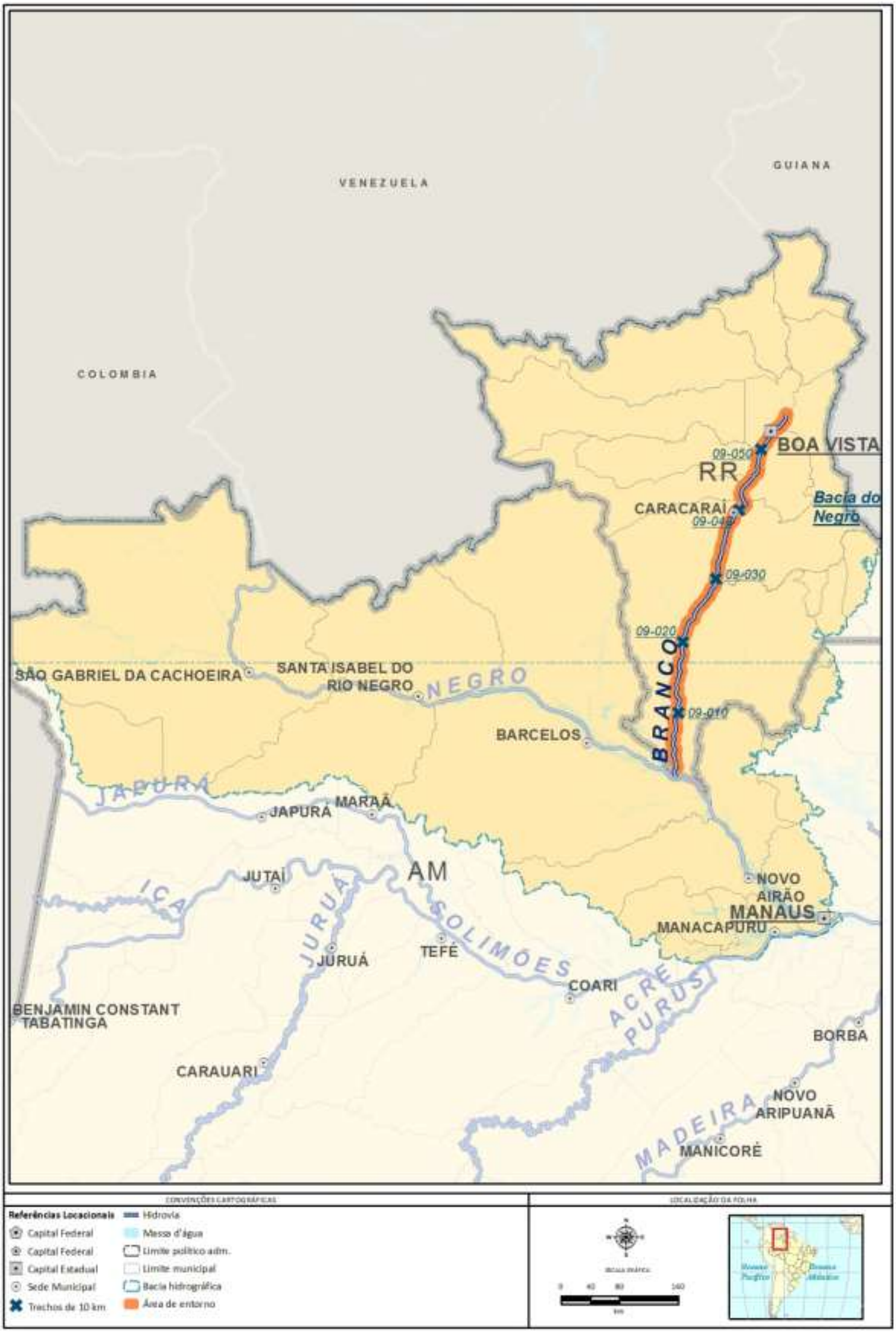
Figure 3.2.12: Longitudinal profile of the Branco River in the stretch of the implementation of the Bem Querer UHE (EPE, 2011)

In the water stretch under study the following bridges were detected: The Caracaraí Bridge (BR-174), located in stretch 38, in the municipality of Caracaraí (RR); and the Macuxis Bridge (BR-401) located in stretch 53, in the municipality of Boa Vista (AC) (stretch 53). The Caracaraí bridge was built in a manner so as to allow the passing of commercial vessels and followed Brazilian Navy guidelines. However, the Macuxis Bridge does not have appropriate dimensions for the passing of commercial convoys, therefore, it restricts navigation.

Figure 3.2.13: Macuxis Bridge (stretch 53) (Trindade, 2009)

b) Social and Environmental Vulnerabilities

The length of the Branco Waterway is 555 km, located within the Negro River basin that has an area of 595,452 km², and it is fully included in the Amazon biome.



Map 8: Location of the Branco Waterway

The Negro River basin includes 33 municipalities located in the states of Amazonas (18) and Roraima (15), among which it is worth mentioning the state capital cities of Manaus (AM) and Boa Vista (RR). The total population of these municipalities is 2,677,183 inhabitants (IBGE, 2010), and the capital cities are the most populous, accounting for 67% of the total in Manaus (AM) and 11% in Boa Vista (AC).

Seven municipalities were identified in the Branco Waterway surrounding area, all of them in Roraima, with a total population of 375,323 inhabitants.

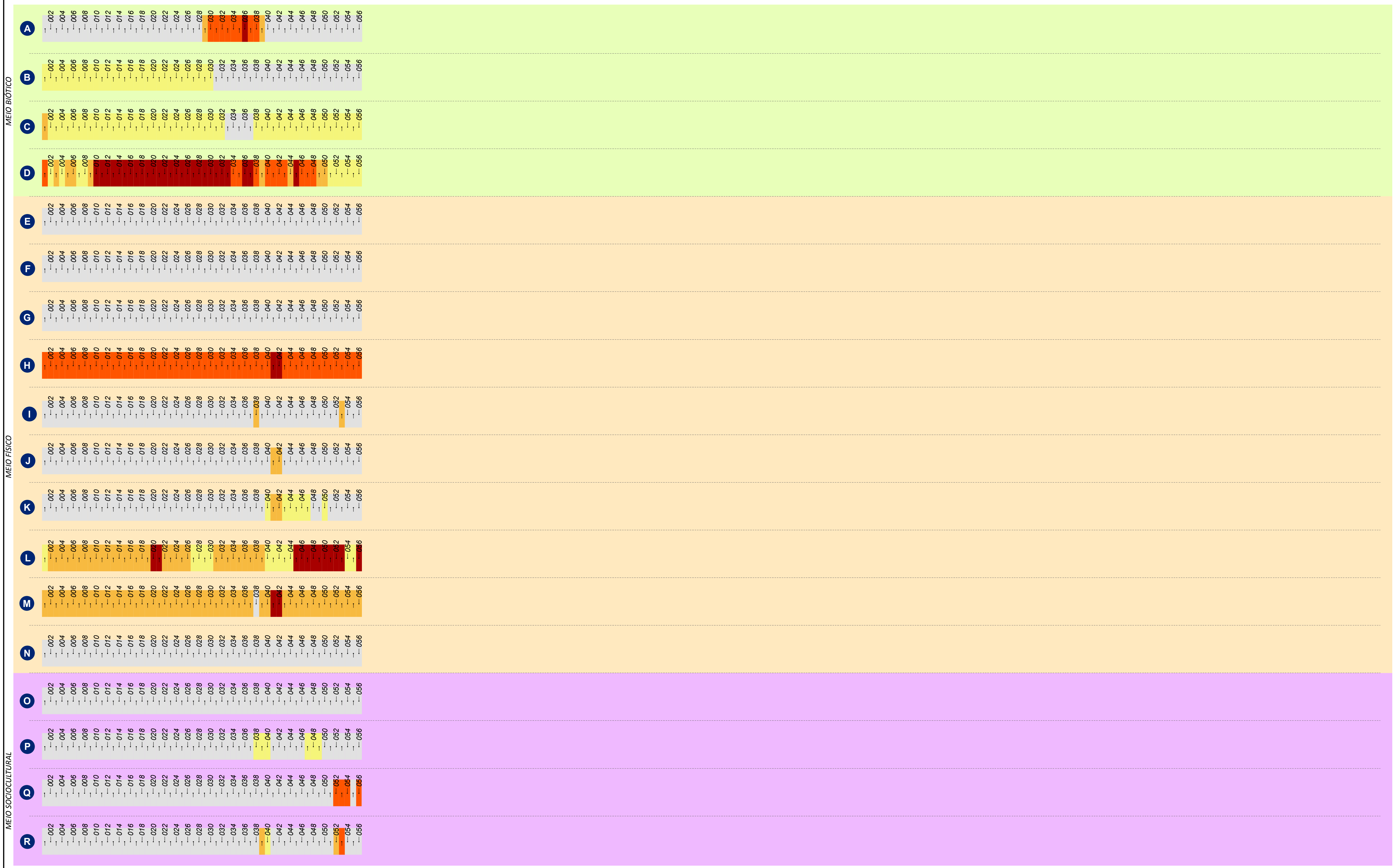
There is a significant variation of the FIRJAN index (2010) in the municipalities of Negro River basin, ranging from 0.38 in the municipality of Uiramutã and 0.76 in Boa Vista. The overall average is 0.52 for this index. When analyzing the municipalities in the waterway surroundings, the situation is slightly better, the index varies from 0.52 in Bonfim to 0.76 in Boa Vista, with a general average of 0.59.

As for the conservationist aspects in the basin areas, there are 30 Conservation Units, of which 15 are of Integral Protection and 15 are of Sustainable Use.

The waterway surrounding area, composed of 56 stretches is, in general, well preserved with regard to plant cover, nonetheless this can restrict direct access to the banks by land and occasionally make the licensing process for navigation support structures more complex, if they become necessary. The most vulnerable stretches are 052 to 054 and 056, at the ends of Boa Vista where the Indigenous Lands are located, in addition to the presence of Integral Protection CUs between stretches 29 to 39 in the areas close to the municipality of Caracaraí (RR).

Another aspect that should be considered is the plant cover that is more accentuated in the middle portion of the waterway, between stretches 010 and 033, between the municipalities of Rorainópolis and Caracaraí (RR).

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais

SOCIOCULTURAL
- N Largura do rio
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

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3.2.1.9 Solimões Waterway

a) Navigability Diagnosis

The Simões River is the main contributor to the Amazon River, and its springs are the same as those mentioned for the Amazon River. When entering Brazil, at the municipality of Tabatinga (Amazonas) (AM), it changes to the called Solimões. Its main tributaries on the right bank are: the Javari River, Jutaí River, Juruá River and Purus River, and, on the left bank, the Içá River and Japurá River.The most important cities are: Amaturá (AM) (stretch 1), Uarini (AM) (stretch 1), Benjamin Constant (AM) (stretch 1), Álvares (AM) (stretch 2), Iranduba (AM) (stretch 4), Manaquiri (AM) (stretch 7), Manacapuru (AM) (stretch 9), Anamã (AM) (stretch 19), Anori (AM) (stretch 22), Codajás (AM) (stretch 28), Coari (AM) (stretch 41), Tefé (AM) (stretch 62), Alvarães (AM) (stretch 64), Fonte Boa (Amazonas) (AM) (stretch 86), Jutaí (AM) (stretch 99), Tocantins (AM) (stretch 114), Amaturá (AM) (stretch 122), Santo Antônio do Içá (AM) (stretch 122), São Paulo de Olivença (AM) (stretch 131), and Tabatinga (AM) (stretch 151), all of them located in Amazonas state. The full length of the river is 1,700km until reaching Manaus (AM), where it meets the Negro River, forming the Amazon River.

The Solimões Waterway extends in a West-East direction from the Brazilian border to the municipality of Manaus (AM), in the northern portion of the country.

The climate in the region is hot humid equatorial with an annual average temperature of 27° C and low thermal amplitude in the rainy period. Even though the air masses in general are dry, it is a quite humid area due to the high evapotranspiration rate. The air relative humidity during the rainy months is 80 to 90% and during the dry period it reaches a minimum of 75%. The relief has little influence on the climate, because the largest portion of the territory has an altitude lower than 200 m. The rainfall rate averages 2,100 mm/year, with its peak between January and May (regional winter), and its minimum in the summer, from July to October.

According to the AHIMOC, the flood period in the Solimões River is between February and March, and the low water period is between July and October. The average flow of the Solimões River, next to its confluence with the Negro River, is around 100,000 m^3/s (see Appendix VII, Item 4.1.2).

The river bed changes frequently, with changes in the navigable channel from one year to another, resulting in the appearance of displacements of sandbanks, islands and bank erosion, which can cause isolated danger spots along the waterway. Due to these changes, vessels can run aground in the stretch between Manaus (AM) and Tabatinga (AM), so in order to have a safer trip, navigation should take place during daylight. Additionally, during dry periods, the formation of beaches and the appearance of rock outcrops may be observed. During the flood period tree trunks and branches represent risks to navigation, and they are mostly concentrated in the deepest portion of the channels where the water current is stronger.

There are stretches with restricted visibility due to ground-clearing fires, heavy rains, and fog that occur mostly in the mornings.

The Solimões River is relatively long and straight and has few meanders along its route, resulting in a low sinuosity index. Only a few stretches show relevant sinuosity. The most sinuous stretches are located between Tefé (AM) (stretch 62) and Tabatinga (AM) (stretch 151). Additionally, the presence of fluvial archipelagoes in some stretches may make the route more sinuous than expected. The minimum widths along the entire waterway range from 500 m to 2 km, however, due to the sedimentation processes, there may be narrower stretches with bottlenecks, imperceptible by the present study.

According to Brazilian Navy and DNIT (Departamento Nacional de Infraestrutura de Transportes) (National Transport Infrastructure Department) data, the Solimões Waterway has depths adequate for commercial navigation during the entire year in the stretch between the municipalities of Manaus (AM) and Tabatinga (AM). There are depth limitations only during the low water period, at some points of the river, and the following are worth mentioning:

- Between Manaus (AM) (stretch 1) and Coari (AM) (stretch 41): Ilha dos Mouras, Costa do Caldeirão, Costa do Calado, Farolete de Manacapuru, Banco da Arraia, Costa da Ajaratuba, Costa o Ambé, Jamacanã, Ilha da Botija and Ilha Cipotuba, where the last two limit the passing of vessels with draft of more than 4.0 m;

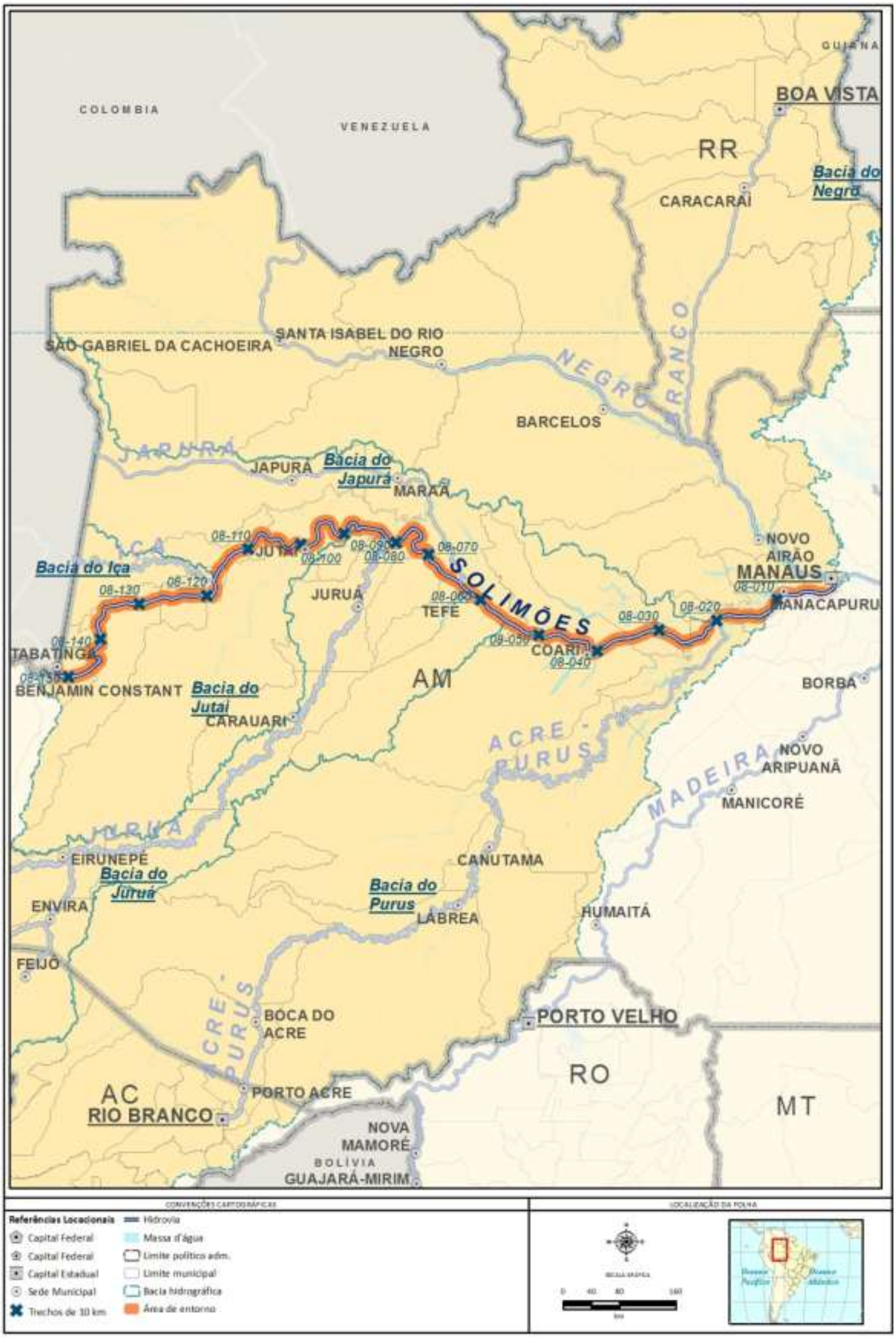
- Between Coari (AM) (stretch 41) and Tabatinga (AM) (stretch 151): Barro Alto, Ilha do Catuá Grande and Ilha do Camaleão, between the Japurá River mouth and Vila Coadi, Ilha do Mari-Mari, Paraná do Macuapanin, between Uará lake and the city of Fonte Boa, where minimum depths of 3.0 m can occur. In Tabatinga there is a significant rock outcrop downstream of Porto de Tabatinga.

There are no dams or bridges that limit navigation in the Solimões River.

The Solimões Waterway is cartographed in the ATLAS DA HIDROVIA DO RIO SOLIMÕES - DE MANAUS A TABATINGA. (Atlas of the Solimões River – From Manaus to Tabatinga).

b) Social and Environmental Vulnerabilities

The Solimões Waterway has a length of 1,523 kilometers, crossing the basin of the Içа, Japurá, Juruá, Jutaí, Negro, and Purus Rivers, which, together, represent an area of 1,443,664 km². These river basins are fully inside the Amazon biome in the northern region of the country.



Map 9: Location of the Solimões Waterway

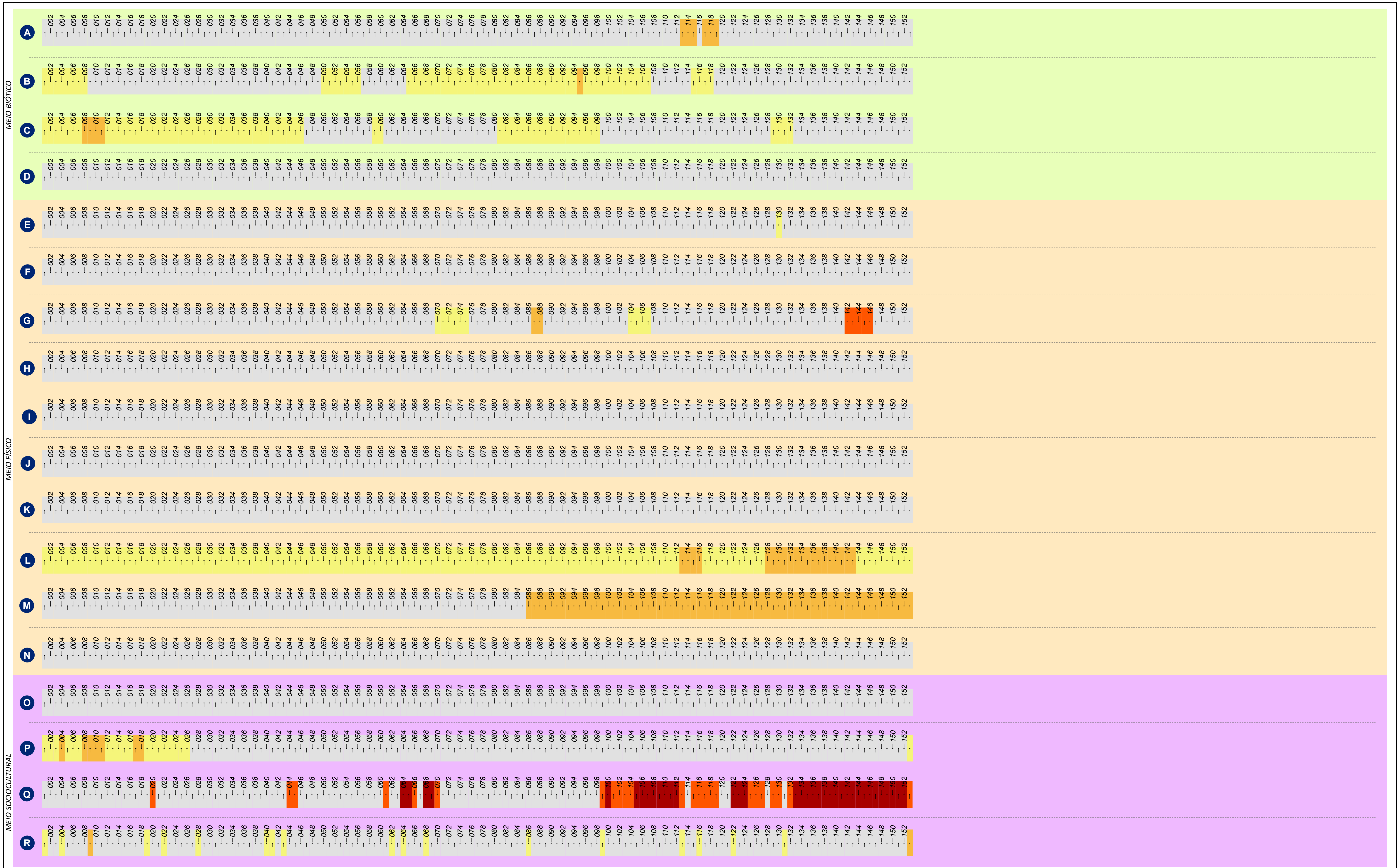
The limits of the river basins cross the territory of 87 municipalities in the states of Acre (22 municipalities), Amazonas (49 municipalities), Rondônia (one municipality), and Roraima (15 municipalities). The total population is 4,681,540 inhabitants (IBGE, 2010), and the state capital city is the most populous in these river basins, accounting for 31.24% of the total. For the waterway surroundings, there are 25 municipalities located in Amazonas state where, again, Manaus is the most populous city, accounting for 72.53% of the total.

In terms of municipal development, the FIRJAN index (2010) varies from 0.34 in Tarauacá (AC) to 0.80 in Porto Velho (RO), showing a general average of 0.51 along the macro-area of these river basins. For the municipalities crossed by the waterway area of study, the FIRJAN index (2010) values are very similar, varying from 0.38 in Beruri to 0.68 in Manaus, with an average of 0.50 for the 25 municipalities of the area of study.

With regard to the conservationist aspects, there are 187 Indigenous Lands in the area, concentrated mostly in the basins of the Negro (24.60%), Purus (22.99%) and Juruá (22.46%) Rivers, where there are also 62 Sustainable Use Conservation Units and 27 Integral Protection Conservation Units.

The waterway area of study was divided into 153 stretches of 10 km² each, where the main point of attention refers to the presence of Indigenous Lands which are located along the waterway, in stretches 020 in the municipality of Anamã, 044 to 045 in the municipality Coari, 061, 064 to 070 covering the municipalities of Uarini and Alvarães, 099 to 113 in Tefé, and 115 to 119 in the municipalities of Santo Antônio do Içá, Tonantins and Jutaí, in addition to stretches 132 to 153 covering the municipalities of São Paulo de Olivença, Tabatinga, and Benjamin Constant.

The distribution of the occurrences with relation to the variables analyzed can be much better observed in the one-line diagram shown below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
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- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

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MA - Muito alta

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N W E S

ESCALA GRÁFICA

0 50 100 200 km

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3.2.1.10 The Purus/Acre Waterway

a) Navigability Diagnosis

The Purus River is one of the main tributaries of the Solimões River, traveling approximately 3,700 km. through Brazilian territory in the states of Acre and Amazonas. It covers twenty-one municipalities, the main ones being: Beruri (AM) (stretch 4), Tapauá (AM) (stretch 55), Pueblo Ribereño (AM) (stretch 102), Canutama (AM) (stretch 107), Lábrea (AM) (stretch 129), Pauini (AM) (stretch 186) and Boca do Acre (AM) (stretch 210). It has a drainage area of approximately 376,000 km². Its spring is located in the hills of the Arco Fitzcarrald, located in the lower Peruvian forest, at an altitude of 500 m., and its mouth is on the Solimões River, close to 200 km. from Manaus (AM).

The Acre River begins in the Amazon Forest and is the main tributary of the Purus River. Its mouth is located near the municipality of Boca do Acre (AM) (stretch 210). The main municipalities along the Acre River are: Boca do Acre (AM) (stretch 210), Brasiléia (AC) (outside the stretch), Xapuri (AC) (outside the stretch) and Rio Branco (AC) (stretch 236).

The climate of the Purus/Acre Rivers is Amazon equatorial hot and humid, with two seasons: dry and rainy. The dry season extends from June to November. The rainy season, called "winter," is characterized by constant rain from December to May. The relative humidity has monthly averages around 80 to 90% with high levels throughout the year. The annual rainfall totals vary between 1,600 mm. and 2,750 mm., and tend to increase in the southeast-northeast direction. The average annual temperature is around 24.5^{o} C., with a maximum around 32^{o} C.

The Purus and Acre Rivers have plain characteristics, containing various meandering stretches and very sharp curves. The configuration of the bed is regularly modified, such that these modifications occur mainly during flooding, causing significant modifications of the beds of the rivers and, consequently, the navigable channel also undergoes regular changes during this period, resulting in difficulties that are aggravated by the collapse of the banks, requiring redoubled care for their navigation. Difficulties such as barriers, generally very high, tree trunks and the formation of banks offer serious restrictions to navigation and, in some cases, navigation can be obstructed. During dry periods, the formation of lagoons caused by isolation of channels along the river is observed. The average flow is 350 m³/s near Rio Branco (AC) and close to 13,000 m³/s near the mouth (see Appendix VII, Item 4.1.10).

The Purus/Acre waterway flows in a southwest-northeast direction from the capital city of Rio Branco (AC) to the Solimões River, and it covers the following segments of the rivers:

- The Purus River, from its mouth in the Solimões River to the city of Boca do Acre (AM) (stretch 210), at the confluence with the waters of the Acre River, totaling close to 2,100 km. in length;

- The Acre River, from its mouth in the Purus River to the state capital of Acre, Rio Branco (AC), with close to 260 km.

These rivers were analyzed together as a single waterway due, primarily, to the continuity the two represent from a navigation point of view.

The importance of this waterway comes from its connection of the Acre state capital, Rio Branco (AC) with the Purus River and, consequently, the Solimões River.

The Purus/Acre waterway is currently navigable throughout its entire length during the rainy period, with only a few critical points. However, during dry periods, the depths are very reduced to the point that navigation by commercial vessels is impossible, mainly upstream of Boca do Acre (AM) (stretch 210).

The Purus/Acre Rivers have widths that vary considerably along their length, from values greater than 800 m., near the mouth of the Purus River, to minimum widths of 40 m., near Rio Branco.

The sinuosity indexes are high. More than 1,400 km. of this waterway have sinuosity indexes above 2, and within the close to 2,360 total km., there are stretches with sinuosity of up to 5. Several cut meanders are seen adjacent to the current course. In addition, due to the fact that this waterway has many sandbanks depending on the water level, there can be alterations in the navigable channel and the navigation route can become more sinuous and narrower than expected. All this sinuosity causes major maneuvering difficulty and great delays in reaching the final destination.

Figure 3.2.14: The Purus River – Meanders (Google Earth, 2013)

According to data from the Brazilian Navy and the Departamento Nacional de Infraestrutura de Transportes (DNIT) (National Transport Infrastructure Department), the Purus River has stretches with minimum depths of 2.5 m. in almost its entire course during the dry period (June to November). This depth condition is verified predominantly up to close to 80 km. downstream of the municipality of Boca do Acre (stretch 210), with minimum values on the order of 1.2 m., to 20 km. from Boca do Acre, passing Igarapé Preto. In the Boca do Acre stretch to Rio Branco, on the Acre River, the minimum depths reach 0.8 m. 90% of the time.

During the flood season, the flows can be more than 25 times greater than the flows during the dry season, such that the depths during the flood season can be greater than 15 m., allowing access by larger vessels.

According to data in the document: "Normas e Procedimentos da Capitania Fluvial da Amazônia Ocidental" (Norms and Procedures of the River Captaincy of the Western Amazon), prepared in 2012 by the Brazilian Navy, various points critical to navigation on the Purus River were confirmed, including: stone outcroppings, occasional stones, low-depth flooded areas, beach extensions with small lakes, and submersed trees, among others. With regard to the Acre River, there are no studies or surveys with the same precision, but based on the homogeneity of the basin, one can extend these conclusions to the Acre River.

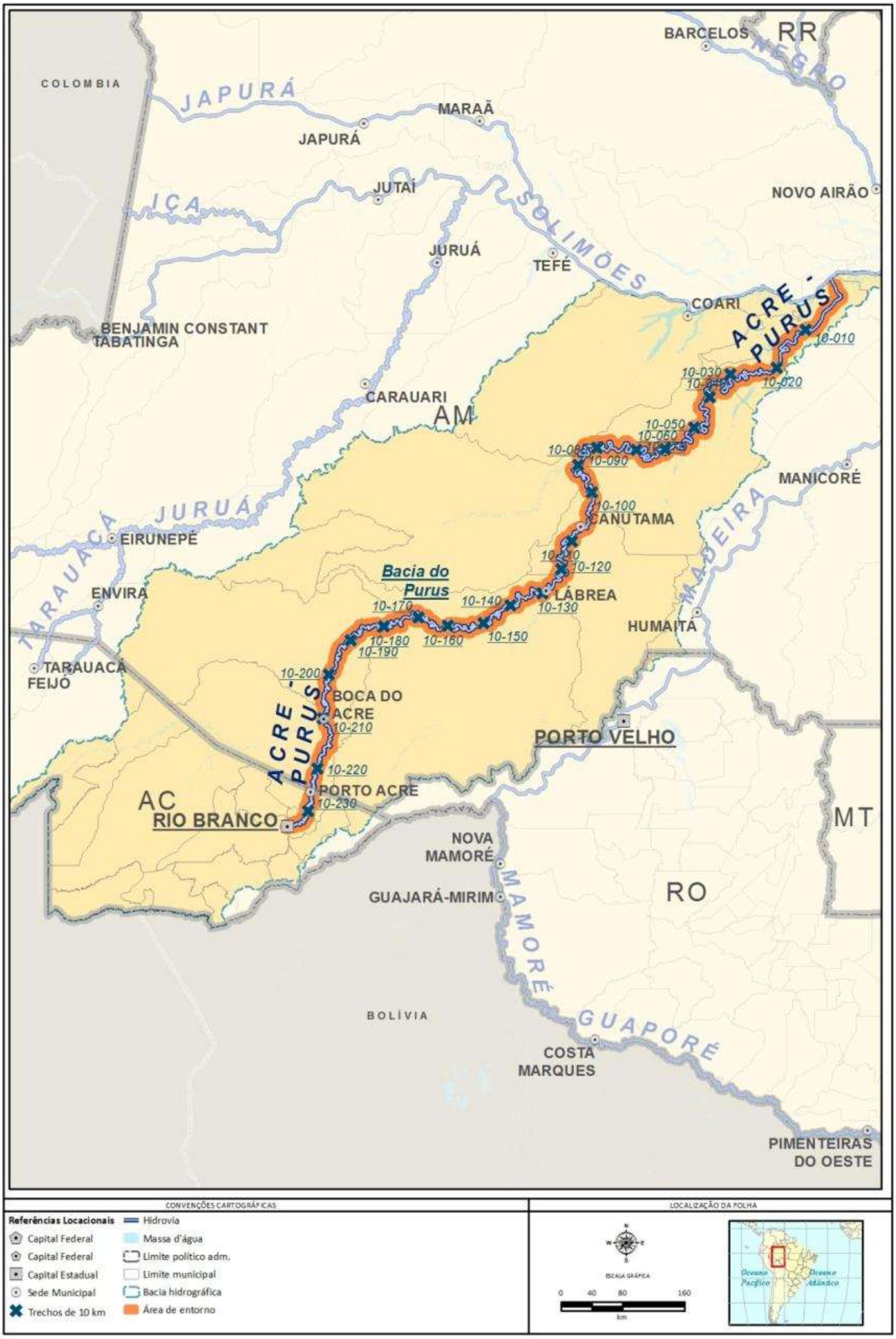
Figure 3.2.15: Curve of the Purus River – Emphasis on the formation of sandbanks (Machado, 2012)

During flooding, the stretch between its mouth in the Solimões, up to approximately 800 km. upstream, has no important restrictions for the vessels typical of the Amazon region. Still, some passages with severe restrictions can occur in the lowlands, due to shoals and stones, narrowing the navigation channels or reducing depths. The most critical point in this stretch is located at the place called "Cachoeira" (waterfall), where there are outcroppings of large amounts of stones, limiting passage of larger vessels. From the mouth of the Acre River to the Iaco port entry, over close to 290 km., the Purus River runs in a narrow bed, where the occurrence of high ravines is observed. During flooding, the immediate speed of the current increases substantially, making navigation in this stretch difficult.

Three bridges and one viaduct were identified in the waterway stretch under study, all located on the Acre River, within the Rio Branco urban perimeter. Since they are located at the extreme upstream end of the waterway, they do not represent an obstacle to navigation.

b) Social and Environmental Vulnerabilities

The total area of the Purus River basin is 401,919 km² and is found completely within the Amazon biome. Located in the northern region of the country, it extends in the southwest-northeast direction, from the Acre state capital, Rio Branco, near parallel 1º S, until meeting the Acre and Solimões Rivers near the municipality of Anori (AM). The Purus/Acre Rivers waterway, specifically, inserted in the Purus River basin, has an extension of 2,342 km., cutting the territory of 10 municipalities in the states of Acre and Amazonas in the northern region of the country.



Map 10: Location of the Purus/Acre Rivers Waterway

The Purus River basin covers 35 municipalities, including the state capitals, Rio Branco (AC) and Porto Velho (RO). The total population of the basin is approximately 1,576,233 inhabitants and the FIRJAN index (2010) varies from 0.38 in the municipality of Beruri (AM) to 0.80 in Porto Velho (RO), with the general average being 0.53, similar to the small municipalities in the northern region. For the municipalities located in the selected area of study (10 km. from the waterway axis), the population, according to the 2010 IBGE census, is 577,000 inhabitants, with the municipality of Rio Branco (AC) being the most populous with 58.23% of the total.

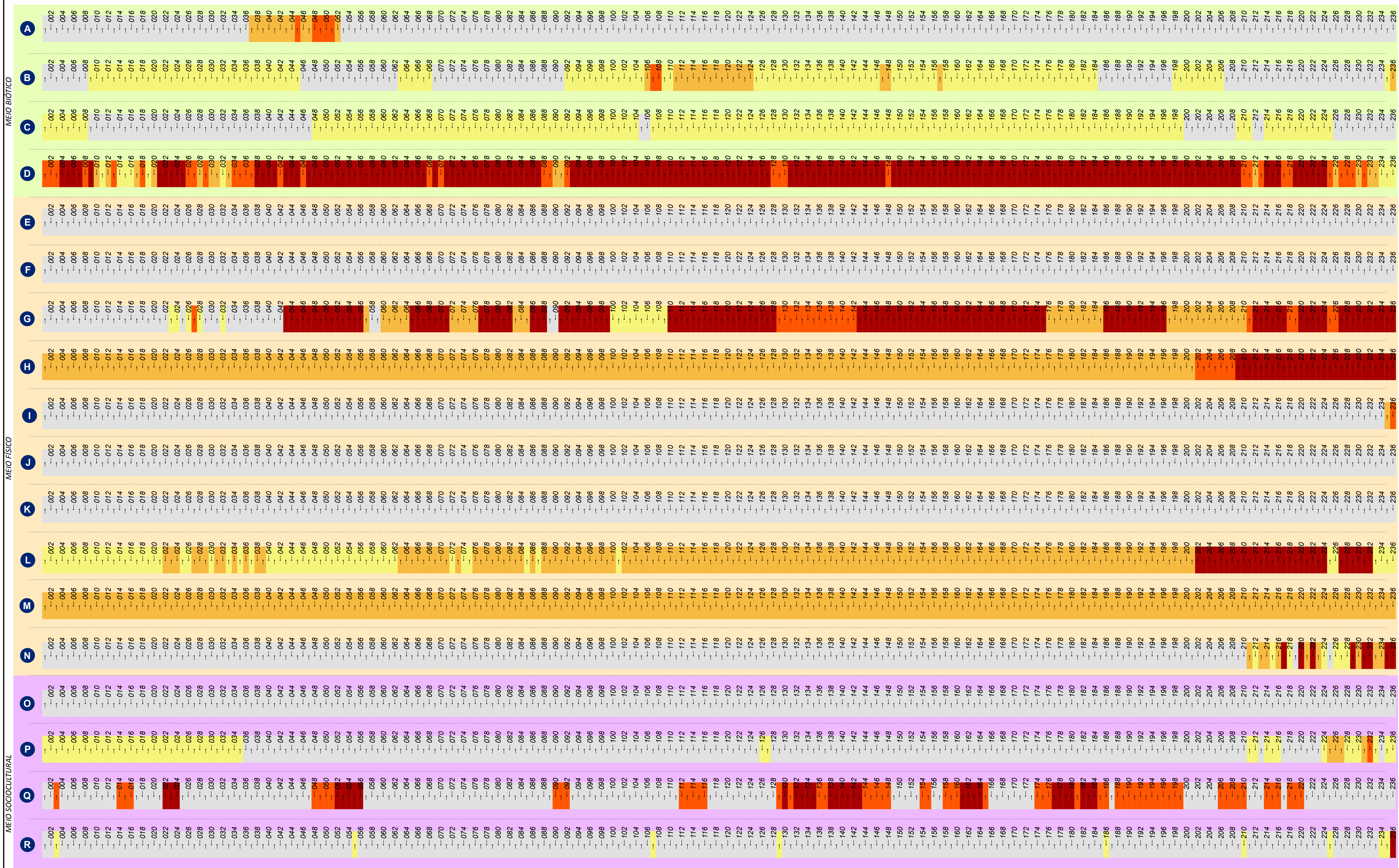
With regard to the areas of conservationist interest, the basin has 30 Unidades de Conservação (UC) (Conservation Units), 7 of which are of Proteção Integral (PI) (Full Protection) and 23 of which are of Uso Sustentável (US) (Sustainable Use), according to data of the Ministério do Meio Ambiente (MMA) (Ministry of the Environment), distributed in the vicinity of the Purus and Acre Rivers. The presence of 72 high or very high priority biodiversity preservation areas is also verified, occurring primarily between the municipalities of Porto Acre and Lábrea.

There are 12 Unidades de Conservação located specifically around the waterway, with 2 of Proteção Integral and 10 of Uso Sustentável, which are dispersed along almost the entire length of the waterway, occurring in stretches 2 to 236. The UC of Proteção Integral stands out in stretches 37 to 52, near the municipality of Tapuá (AM), as do the 3 of Uso Sustentável in the last stretch (236), near the capital city of Rio Branco. It is also in the last stretches of the waterway (233 to 236) that the highest rates of plant cover appear.

There are 43 indigenous lands in the Purus River basin according to FUNAI data (2012). Their distribution occurs in a quite disperse way along the Purus River, being greater between the municipalities of Boca do Acre and Lábrea (AC).

There are quite a few Indigenous Lands around the waterway, a total of 23 being identified, with critical occurrences (high or very high) in stretches 3, 14 to 16, 22 to 25 and 48 to 56 between the municipalities of Beruri (AM) and Tapuá (AM), 90 to 92, 112 to 116, 129 to 143, 144 to 147, 154 to 155, 158 to 164, 174 to 180 and 182 to 199, between the municipalities of Pauni (AM) and Tapuá (AM), and 206 to 210 and 214 to 216, between the municipalities of Boca do Acre (AM) and Lábrea (AM). The INCRA settlements around the waterway also should be mentioned, with occurrences verified in the initial stretches 1 to 35, near the municipality of Beruri (AM) and in stretches 226 and 227 and in 232, between the municipalities of Porto do Acre (AC) and Senador Guiomard (AC).

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia

FÍSICO
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento

FÍSICO
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO ACRE - PURUS	MAI/2013

3.2.1.11 The Japurá Waterway

a) Navigability Diagnosis

The Japurá River is one of the main tributaries of the left bank of the Solimões River, with a length of close to 2,100 km. Of these, 1,367 km. are located within the national territory, in the state of Amazonas. Its spring is located at quite high altitudes to the south of Colombia and its mouth is found in the Solimões River, close to 20 km. from the city of Tefé (AM). The Japurá River flows in the west-east direction from the Brazilian border to close to 200 km. from the mouth in the Solimões River, developing in the northwest-southeast direction to its mouth. The main municipalities along the Japurá River within the national territory are: Maraã (AM) (stretch 22), Japurá (AM) (stretch 39) and Vila Bittencourt (AM) (stretch 71).

The climate is rainy and humid equatorial, with an average temperature of 27º and intercalation of sun and rain. The air humidity varies between 60% and 85%. The rainy season is between May and July, while it is dry from January to March. The occurrence of the rising water phenomenon, caused by a sudden rise in river water level, followed by a quick fall soon after, is common.

The Japurá River area of influence is completely devoid of federal or state highways, cut only by AM-307, still in the planning phase.

The Japurá waterway consists of the stretch from its mouth in the Solimões River to Vila Bitencourt (AM), on the Brazil-Colombia border, close to 710 km. in length.

The Japurá Waterway is regularly navigable over its entire extension during the period of average and high waters, with minimum depths greater than 3 m. These minimum depths fall to 1.50 m. during droughts.

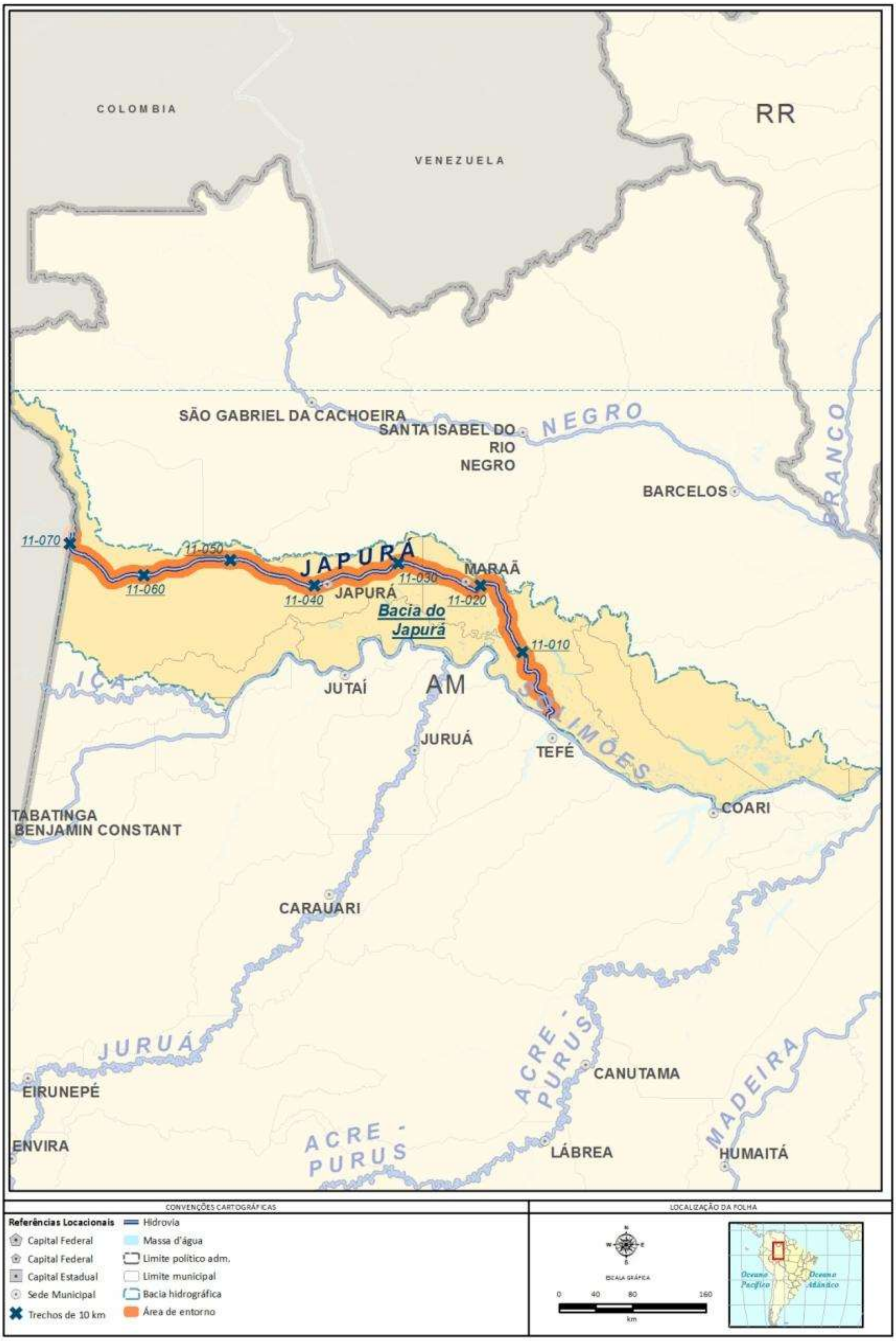
Over most of its course, the Japurá River has the characteristics of plain rivers, with low declivities on the order of 5 cm/km. The Japurá River has a reasonably settled bed, unlike the Içá River that runs parallel to the Japurá River and has many meanders. The sinuosity index oscillates between 1.1 and 1.3. The verified widths of the river chute are large, always greater than 1 km. However, many river arms, river islands and sandbanks are found that can make the route more sinuous and narrower than expected. During flooding, lakes often form on the banks of the Japurá River. The average flow is close to 14,000 m^3/s (see Appendix VII, Item 4.1.11).

The main difficulties for navigation consist of the presence of river islands, sandbanks, stone outcroppings and river arms, that, depending on the river water level, can cause stretches with depths shallower than expected and result in critical stretches for navigation.

There are currently no dams, bridges or other constructions that cause problems for navigation along the Japurá Waterway.

b) Social and Environmental Vulnerabilities

The Japurá Waterway is located in the basin of the same name and extends 707 kilometers within the state of Amazonas and the Amazon biome.



Map 11: Location of the Japurá Waterway

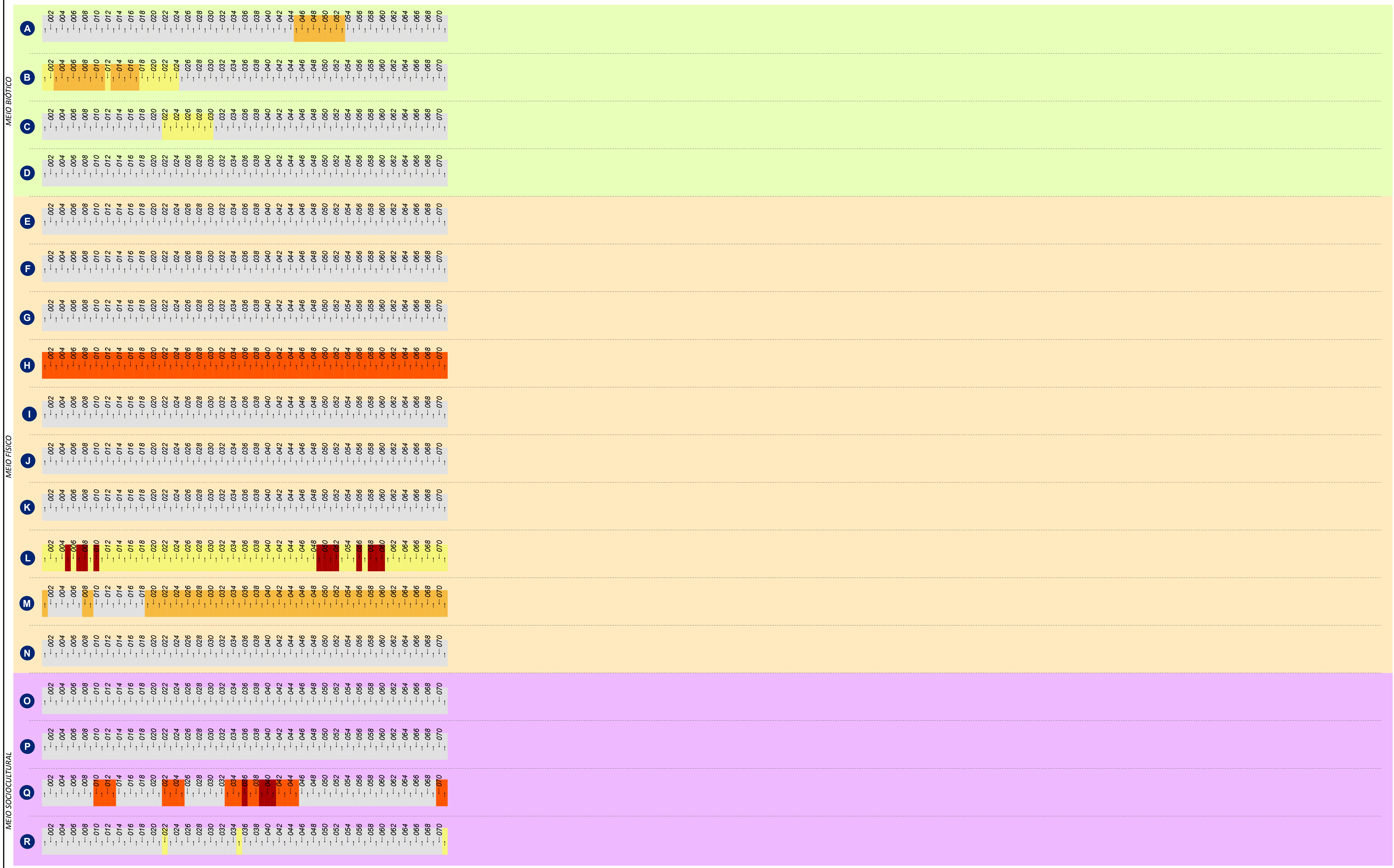
The Japurá River basin has a total area of 107,954 km² covering the territory of 19 Amazonas municipalities that together represent a population of 438,617 inhabitants (IBGE 2010). The area selected for the Japurá Waterway crosses the territory of four municipalities, with a total population of 62,463 inhabitants, with Barcelos being the most populous with 25,718 inhabitants (41%) and Japurá the least populous with 7,326 inhabitants (12%).

The FIRJAN index (2010) varies from 0.43 in the municipality of Uarini to 0.58 in the municipality of Coari, with an average of 0.50 both for the basin municipalities and for the study area.

With regard to the conservation aspects of this basin, there are seven Unidades de Conservação, with two being of Proteção Integral and five of Uso Sustentável, in addition to 21 Indigenous Lands.

The selected study area of the Japurá Waterway is divided into 71 stretches, with the main ones vulnerable to the presence of CUs of Proteção Integral between stretches 45 to 53 in the municipality of Japurá, and Indigenous Lands in the initial stretch and in stretches 10 to 13, 22 to 25, 34 to 45 and 70 to 71, covering the municipalities of Japurá and Mararã.

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante
BA - Baixa
ME - Média
AL - Alta
MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO JAPURÁ	MAI/2013

3.2.1.12 The Juruá Waterway

a) Navigability Diagnosis

The Juruá River is one of the main tributaries on the right bank of the Solimões River and its river basin is located in the Amazon region, in the Northwest of the country. The Juruá River has an extension of approximately 3,280 km. Its spring is located in the Serra das Mercês (Serra da Contamana), at an altitude of 453 meters, at the Brazilian border with Peru. The river crosses the Brazilian border in the state of Acre and its mouth is on the right bank of the Solimões River. The Tarauacá River is the main tributary of the Juruá River. Its mouth is found close to 20 km downstream of the city of Eirunepé (AM) (stretch 159). Within the national territory, the Juruá River is located in the states of Acre and Amazonas. The main cities along the Juruá River are: Carauari (AM) (stretch 59), Itamarati (AM), Eirunepé (AM), Ipixuna (AM), Guajará (AM), Cruzeiro do sul, Rodrigues Alves, Porto Walter and Marechal Thaumaturgo.

The climate of the Juruá River basin is tropical rainy, with average annual rainfall of 2,500 mm. The rainy period starts in November and reaches the highest rates from January to April. The average air temperature is around 24°C, with little thermal variation. The relative humidity of the air generally remains above 90%.

The Juruá waterway consists of the stretch from its mouth in the Solimões River to the city of Cruzeiro do Sul (AC) (stretch 231), close to 2,310 km. in length.

The Juruá River has characteristics typical of Amazon plain rivers, with low declivities and many meanders, occasionally with lagoons and abandoned meanders. There are intense processes of erosion and sedimentation, with the presence of many sandbanks along the entire river course. The configuration of the bed is periodically modified, such that these modifications occur mainly during flooding, causing significant modifications of its bed and, consequently, the navigable channel also undergoes regular changes during this period, resulting in difficulties that are aggravated by the collapse of the banks, requiring redoubled care for its navigation.

The Juruá waterway is currently navigable throughout its entire length during the flood period, with only a few critical points. On the approximately 1,590 km. between the mouth and the city of Eirunepé (AM) (stretch 159), navigation is easier, although there are stretches with stone outcroppings and sandbanks that require special care due to its sinuosity and the tree trunks that float downstream in the middle of the river.

The river has very low average declivities, on the order of 5 cm./km., which are distributed in a homogeneous manner along the waterway course, with no low falls or stretches with sharp declivities.

The minimum widths vary along the river, being close to 300 m., near the mouth, and up to 70 m. in the more upstream stretches. The average flow is on the order of 2,600 m³/s (see Appendix VII, Item 4.1.12).

The Juruá River is one of the most sinuous rivers in the Amazon River Basin. Its bed undergoes large changes and the water level alters due to rapidly rising waters. The sinuosity leaves room for the formation of numerous small lakes that alter the course of the river and create new paths. According to the Brazilian Navy, one must be very careful not to swerve from the main chute (that may change from one year to the next) and enter a small lake that is no longer navigable. In addition, the Juruá has stretches with many sandbanks that, depending on the water level, may further alter the navigable channel and make the navigation route more sinuous and narrow than expected. All this sinuosity causes major maneuvering difficulty and great delays in reaching the final destination. According to the DNIT, the travel time, from the mouth to Cruzeiro do Sul, is more than 14 days.

Figure 3.2.16: Sinuous stretch of the Juruá River. Source: Google Earth

According to data from the Brazilian Navy and the Departamento Nacional de Infraestrutura de Transportes (DNIT), the Juruá Waterway has stretches with minimum depths of 1.0 m. during the dry period. This depth condition is found primarily in the close to 700 km. between the cities of Eirunepé (AM) e Cruzeiro do Sul (AM).

The flows are greater during the rainy season and the average monthly depths can exceed 10 m., allowing access by larger vessels. The variation of the water level at the river mouth, between a flood and the consecutive low water, can reach from 8 to 16 meters. According to the Brazilian Navy, the problem of water swells is common, since, if it does not rain for a single day, the river level can fall by close to two meters. Critical points for navigation were confirmed along the waterway under study, such as rock outcroppings, sandbanks, low-depth flooded areas, and tree trunks floating downstream on the river, among others. Between the mouth and Eirunepé (AM), the main passages surveyed are: Muncuba Beach, Japó Barrier and the barriers of Baçururu, Montesuma, Pedras do Chibauá and Cantagalo. Between Eirunepé

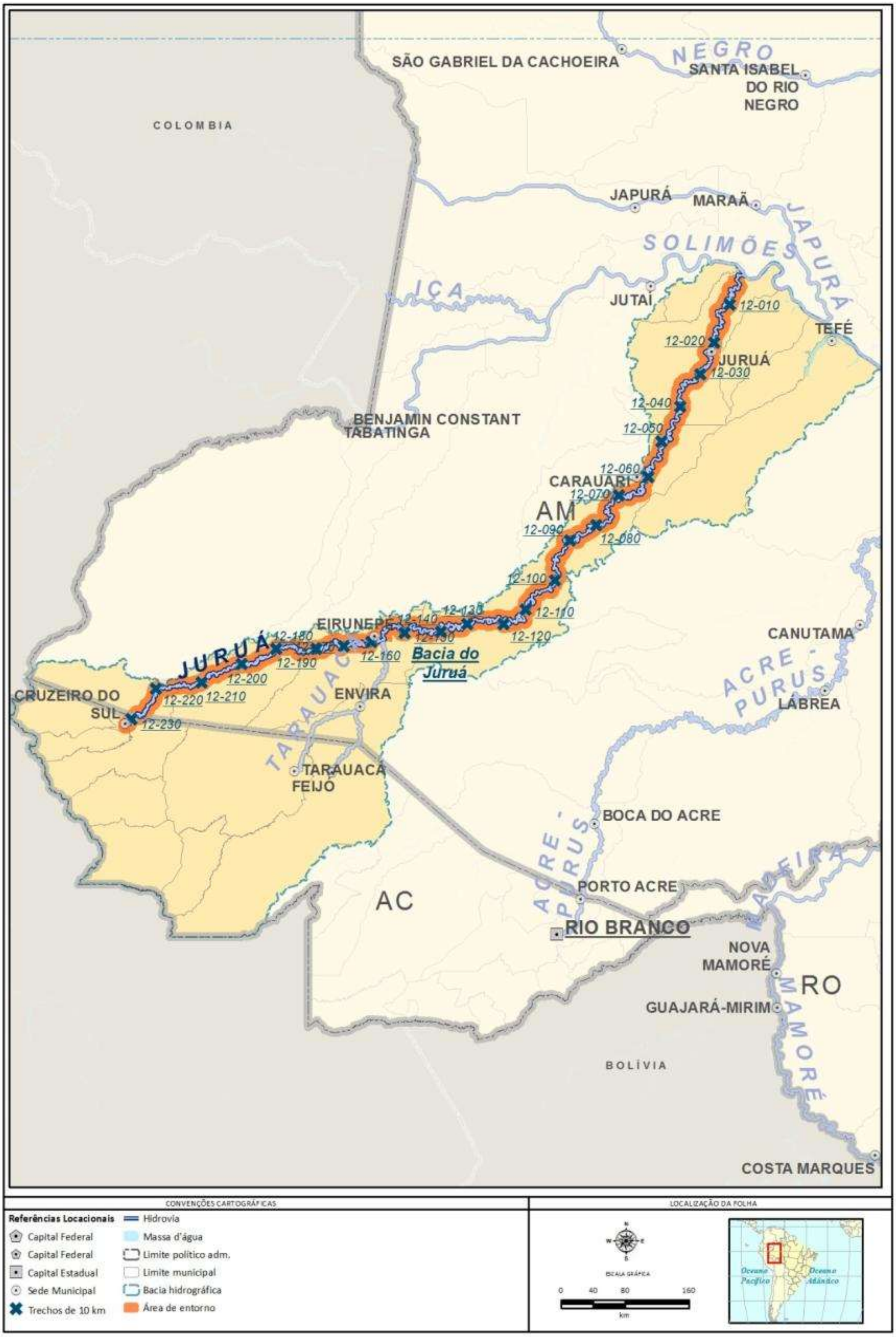
(AM) and Cruzeiro do Sul (AM), the main passage is the Paraná do Javi, which cannot be navigated during the dry season.

The only bridge that crosses the Juruá River is located in the city of Cruzeiro do Sul (AC) and it is the crossing of BR-307. Its dimensions do not restrict commercial navigation.

There are currently no dams or other constructions that cause problems for navigation along the Juruá Waterway.

b) Social and Environmental Vulnerabilities

The Juruá Waterway is 2,308 kilometers long. It is located in the Juruá River basin that has an area of 214,472 km² and it is completely within the Amazon biome.



Map 12: Location of the Juruá Waterway

There are 28 municipalities within the borders of the Juruá River basin, in the states of Amazonas (18) and Acre (10). The most populous cities are Coari (AM) with 75,965 inhabitants and Cruzeiro do Sul (AC) with 78,507 inhabitants (IBGE, 2010). The FIRJAN index (2010) for the municipalities of the river basin vary from 0.34 in Tarauacá (AM) to 0.62 in Cruzeiro do Sul (AC). The average value is 0.49.

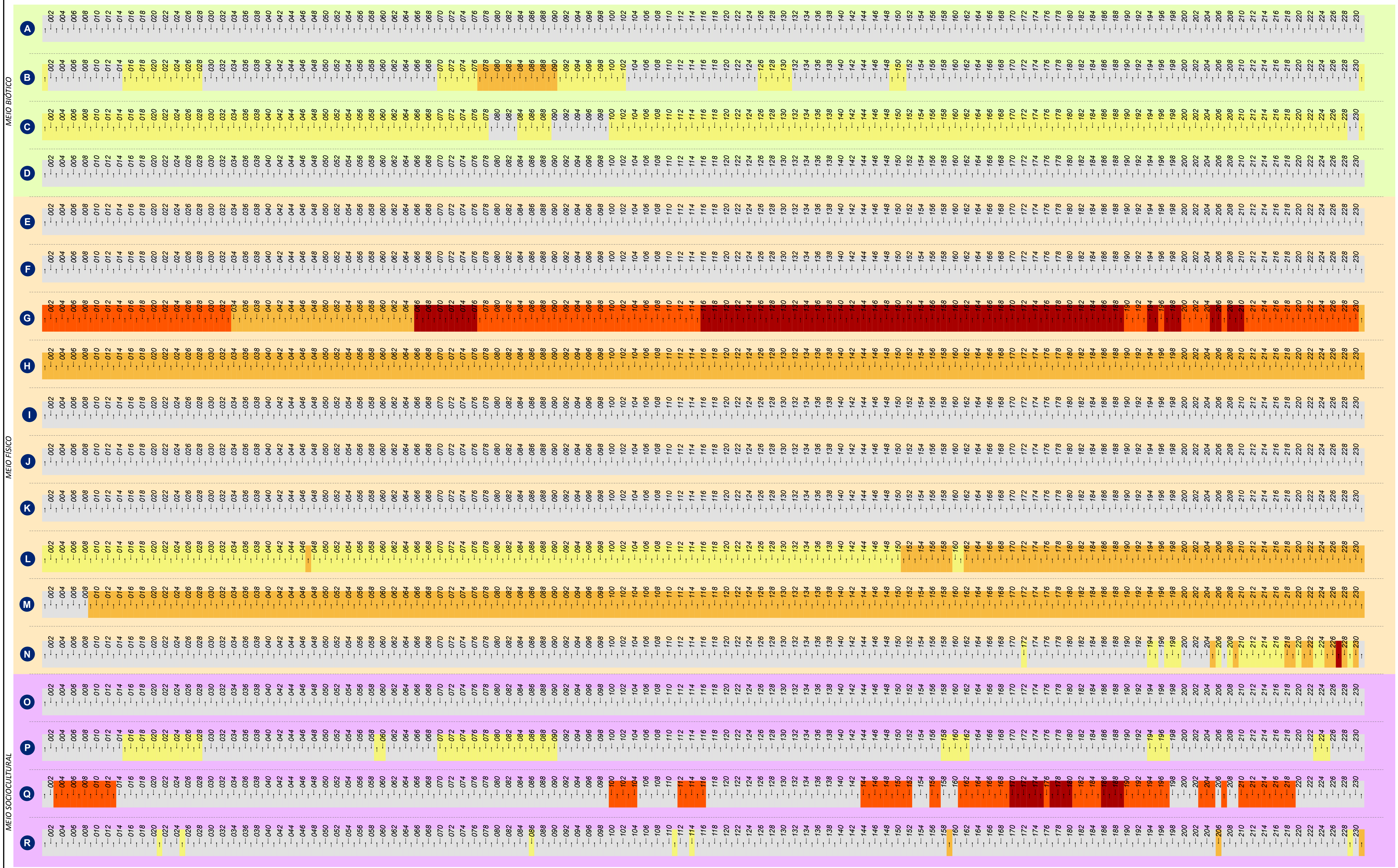
The study area of this waterway crosses the territory of 14 municipalities, with 2 in Acre and 12 in Amazonas. The population of the municipalities in the waterway area of study is 374,306 inhabitants (IBGE, 2010), with the municipality of Cruzeiro do Sul (AC) that which contributes most in terms of population (20.97%). The FIRJAN index (2010) varies from 0.45 in Benjamin Constant (AM) to 0.62 in Cruzeiro do Sul (AC).

With regard to the occurrences of conservation areas in the river basin, there are 14 Unidades de Conservação, 1 of Proteção Integral and 13 of Uso Sustentável, in addition to the presence of 42 Indigenous Lands.

The Juruá Waterway was subdivided into 231 analysis stretches, in which well conserved areas from the plant cover point of view predominate. The presence of APCBs of extreme action priority is noticeable along the banks of the waterway from the final stretch (near the confluence with the Moá River), between Cruzeiro do Sul (AC) and Itamarati (AM), between stretches 100 and 231, and APCBs of high priority between the initial stretches (near the confluence with the Amazon River) to the proximity of the municipality of Carauari (AM), between stretches 1 and 78.

There are 42 Indigenous Lands within the Juruá River basin. For the study area, there are six Indigenous Lands interspersed with the APCBs, occurring along the entire extension of the waterway, notably in stretches 3 to 13, 100 to 105, 112 to 117, 144 to 152, 156 to 157,161 to 197, 203 to 205 and 201 to 219, passing various municipalities including Guajará, Eirunepé and Itamarati.

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos

nº < Jusante

nº > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO JURUÁ	MAI/2013

3.2.1.13 The Içá Waterway

a) Navigability Diagnosis

The Icá (or Putumayo) River is one of the tributaries of the left bank of the Solimões River, with a length of 1,645 km. Within the national territory, the Içá River is found in the state of Amazonas. It flows parallel to the Japurá River and, after crossing the Brazilian border, the Içá River is a natural borderline between Colombia and Peru. Its spring is found in the Andean foothills on Ecuadorian territory, where it is called the Putumayo, after the junction of its forming rivers. Its mouth is near Santo Antonio de Içá (stretch 117 of the Solimões River), roughly 1,200 km. from Manaus (AM). Within the national territory, the river flows in the West-east direction and the main Brazilian municipalities along the Içá River are Santo Antônio do Içá (AM) and Vila Ipiranga (AM).

The seasons of the year are quite differentiated and the climate is characterized by high temperatures and high rainfall rates, resulting primarily from the proximity of the state to the equator. This is also due to the high temperatures that end up causing high evaporation, transforming it into rainfall. According to the Brazilian Navy, the rainy period of the Içá River is between March and July. The low waters usually start during this last month. The river levels falls rapidly, reaching its minimum at the end of August.

The Içá Waterway is also of great interest to Colombia, Peru and Ecuador, as one of these countries exits to the Atlantic Ocean. The Içá River's area of influence has logistical support from highways BR-307 and AM-374, if they are built.

Over most of its course, the Içá River has the characteristics of plain rivers, with low declivities, high sinuosity and variable widths. In the stretch located on national territory, there are many lakes on the banks, fed by floods.

The Içá waterway consists of the stretch from its mouth in the Solimões River, near the city of Santo Antônio do Içá (AM), to Vila Ipiranga (AM), on the Brazil-Colombia border, totaling close to 350 km. in length. This waterway has good navigability conditions, primarily during the flood period.

The river has large widths, on the order of 500 m., and high sinuosity indexes. Over its close to 350 km., the waterway has sinuosity indexes that vary between 1.2 and 2. The sinuosity leaves room for the formation of numerous small lakes that alter the course of the river and create new paths. The Içá has stretches with many sandbanks and river islands that, depending on the water level, may alter the navigable channel and make the navigation route even more sinuous and narrower than expected. The average flow is close to 7,300 m^3/s (see Appendix VII, Item 4.1.15).

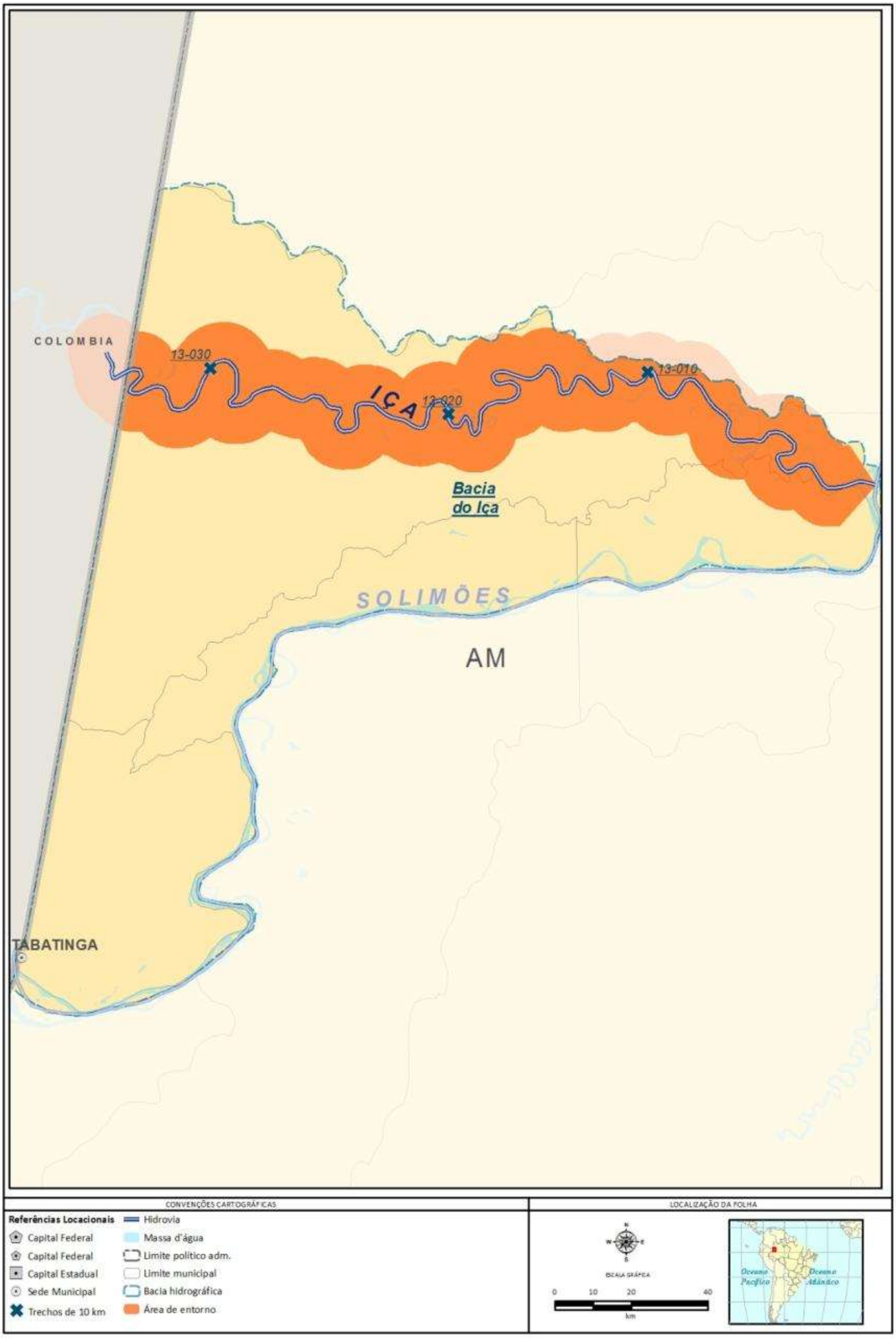
According to the Brazilian Navy, the Içá River has the expected depths from its the mouth to Vila Ipiranga (AM) (stretches 1 to 71), depths of 4.0 m. during the flood season (March to July) and 1.8 to 1.0 m. during the low waters (August to February). Upstream of Vila Ipiranga (AM), outside of Brazilian territory, vessels with drafts of 1.20 m. can still travel from July to October, and those with lesser drafts during the dry season.

The formation of sandbanks is the main factor restricting navigation, primarily during the dry season when the depths are low. According to the Brazilian Navy, the Içá River has numerous river islands near its mouth, which may be impediments to navigation, including Três Cairiris, Grande do Javari and Içá.

There are currently no dams, bridges or other constructions that cause problems for navigation along the Içá Waterway.

b) Social and Environmental Vulnerabilities

The Içá Waterway is 348 kilometers long, located in the river basin of the same name, with an area of 19,192 km². This basin is located completely within the state of Amazonas and in the Amazon biome.



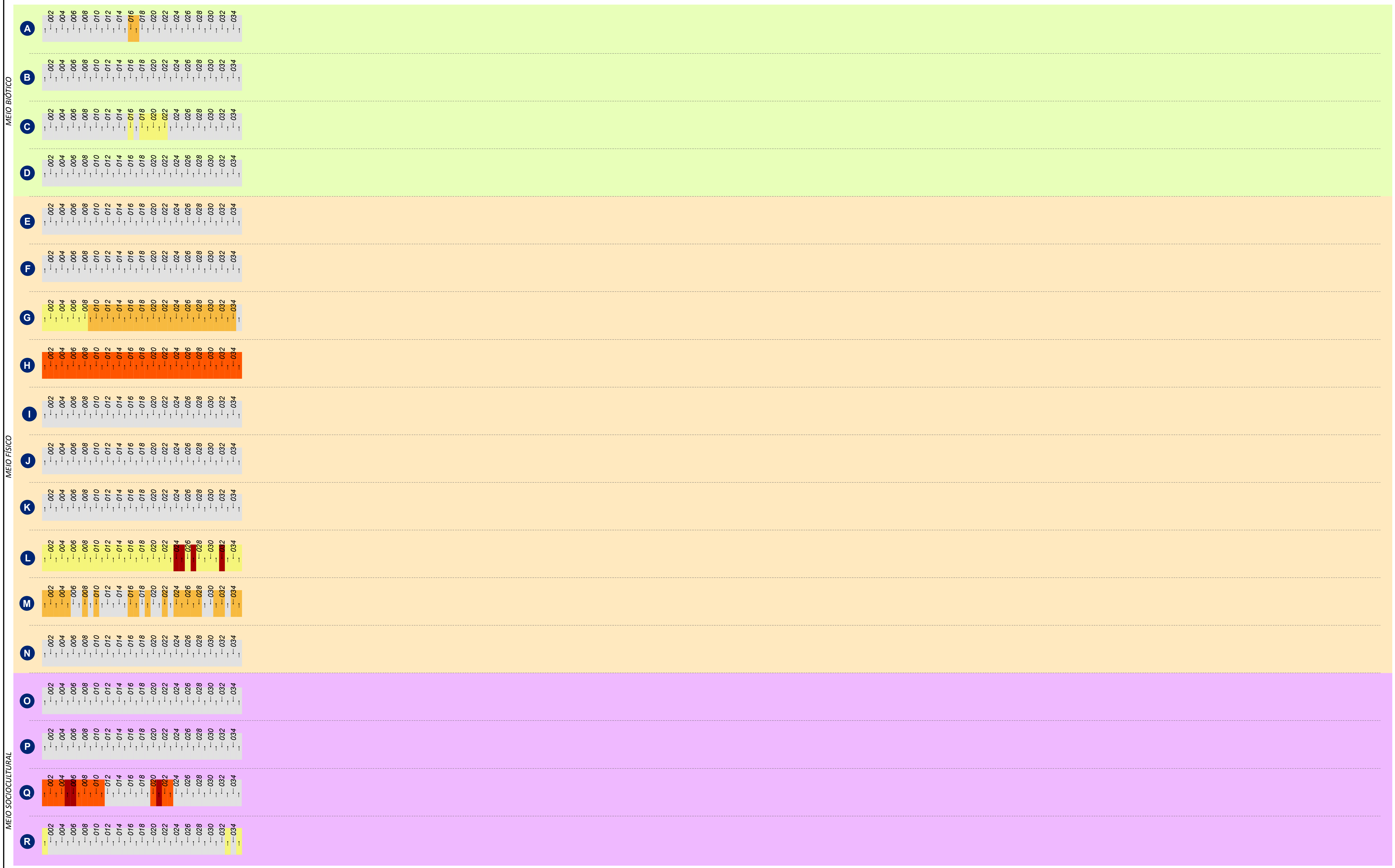
Map 13: Location of the Içá Waterway

The Içá River basin encompasses the territory of seven municipalities with a population of 174,458 inhabitants (IBGE, 2010). The selection of the study region has four municipalities, with Tabatinga being the largest in terms of population, responsible for 44% of the 117,642 inhabitants residing in these municipalities. The average of the FIRJAN index (2010) for the municipalities in the basin and for the municipalities of the study area is 0.52.

With regard to the conservationist aspects for this basin, the presence of nine indigenous lands stands out. Five of these are located in the Iça Waterway study area that was divided into thirty-five 10 km² stretches. These TIs are located in the initial stretches of the waterway, 1 to 11, and in its central portion between stretches 20 and 23, covering the municipalities of Santo Antônio do Iça and Tocantins.

Another aspect that should be considered is the presence of a Unidade de Conservação de Proteção Integral between stretches 16 and 17 in the municipality of Santo Antônio do Iça.

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

N W E S

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO IÇA	MAI/2013

3.2.1.14 The Tarauacá Waterway

a) Navigability Diagnosis

The Tarauacá River is the main tributary of the Juruá River that, in turn, is a tributary of the Solimões River. The Tarauacá River flows through the states of Acre and Amazonas. Its spring is found in the Brazilian and Peruvian Amazon forest, flowing in a south-north direction. Its mouth is located on the right bank of the Juruá River, near the city of Eirunepé (AM). The main tributary is the Envira River that flows into its right bank, near the city of Envira (AM) (stretch 18). The main municipalities along the Tarauacá River are: Envira (AM) (stretch 18) and Tarauacá (AC) (stretch 41).

The climate of the Tarauacá River basin is tropical rainy, with yearly rainfall rates varying between 2,000 mm. and 2,500 mm. The rainy period starts in November and reaches the highest rates from January to April. The average air temperature varies between 22°C and 26°C, with little thermal variation. The relative humidity of the air remains above 90%.

The Tarauacá River has characteristics typical of Amazon plain rivers, with low declivities and many meanders, occasionally with abandoned meanders. There are intense processes of erosion and sedimentation, with the presence of many sandbanks along the entire river course.

The area of influence of the Tarauacá River will encompass the future installation of the AM-329 that parallels the river.

The Tarauacá Waterway consists of the stretch from its mouth in the Juruá River to the city of Tarauacá (AC), close to 410 km. in length.

The Tarauacá River is currently navigable only by small vessels along the entire waterway, with minimum depths of 1.20 m.

The Tarauacá River has minimum widths that vary quite a bit along its entire length and [it] has minimum widths greater than 100 meters in only a few stretches. The Tarauacá River has high sinuosity indexes. Over its roughly 410 km., the waterway has no stretches with sinuosity less than 2.0. In addition, the Tarauacá River has many sandbanks that, depending on the water level, may alter the navigable channel and make the navigation route even more sinuous and narrower than expected, resulting in navigable distances that are much greater than the straight-line distances and causing greater maneuvering difficulty and long delays in reaching the final destination. The average flow is close to 820 m^3/s (see Appendix VII, Item 4.1.13).

According to data from the Brazilian Navy and the Departamento Nacional de Infraestrutura de Transportes (DNIT), the Tarauacá River has stretches with minimum depths of 1.2 m. during the dry period. This depth condition is found in its entire length. During the flood season, the level rises substantially and can reach depths of 30 m.

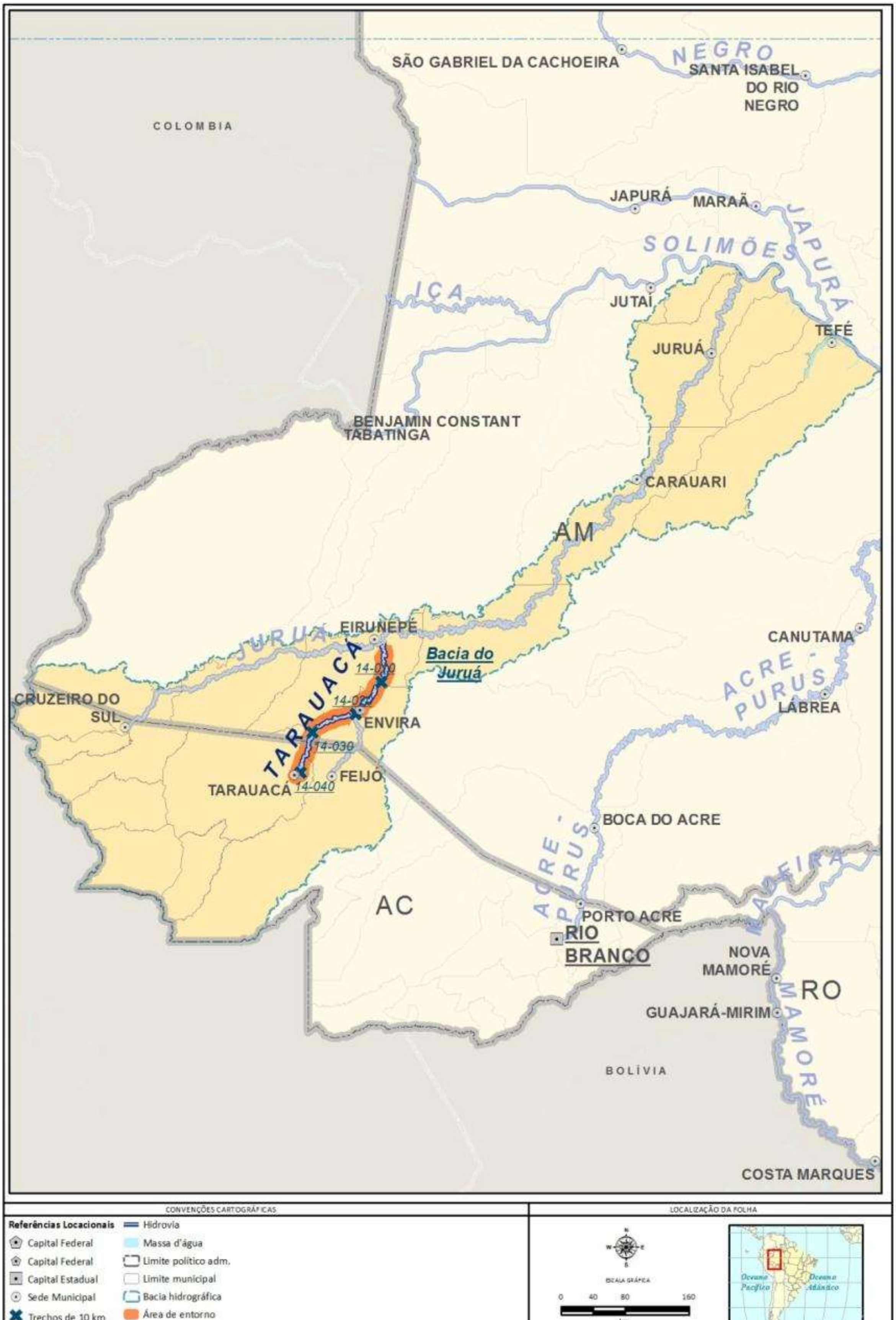
The formation of sandbanks and the low depths are the main factors restricting navigation, primarily during the dry season when the depths are low.

Only one bridge was identified in the waterway stretch, at the extreme upstream end of the waterway (stretch 41), in the city of Tarauacá (AC). It does not impede navigation.

Figure 3.2.17: Bridge over the Tarauacá River (stretch 41) (Batista, 2013)

b) Social and Environmental Vulnerabilities

The Tarauacá Waterway is 406 kilometers in length and is located in the Juruá River basin (described previously in the presentation of the Juruá Waterway) and in the Amazon biome.

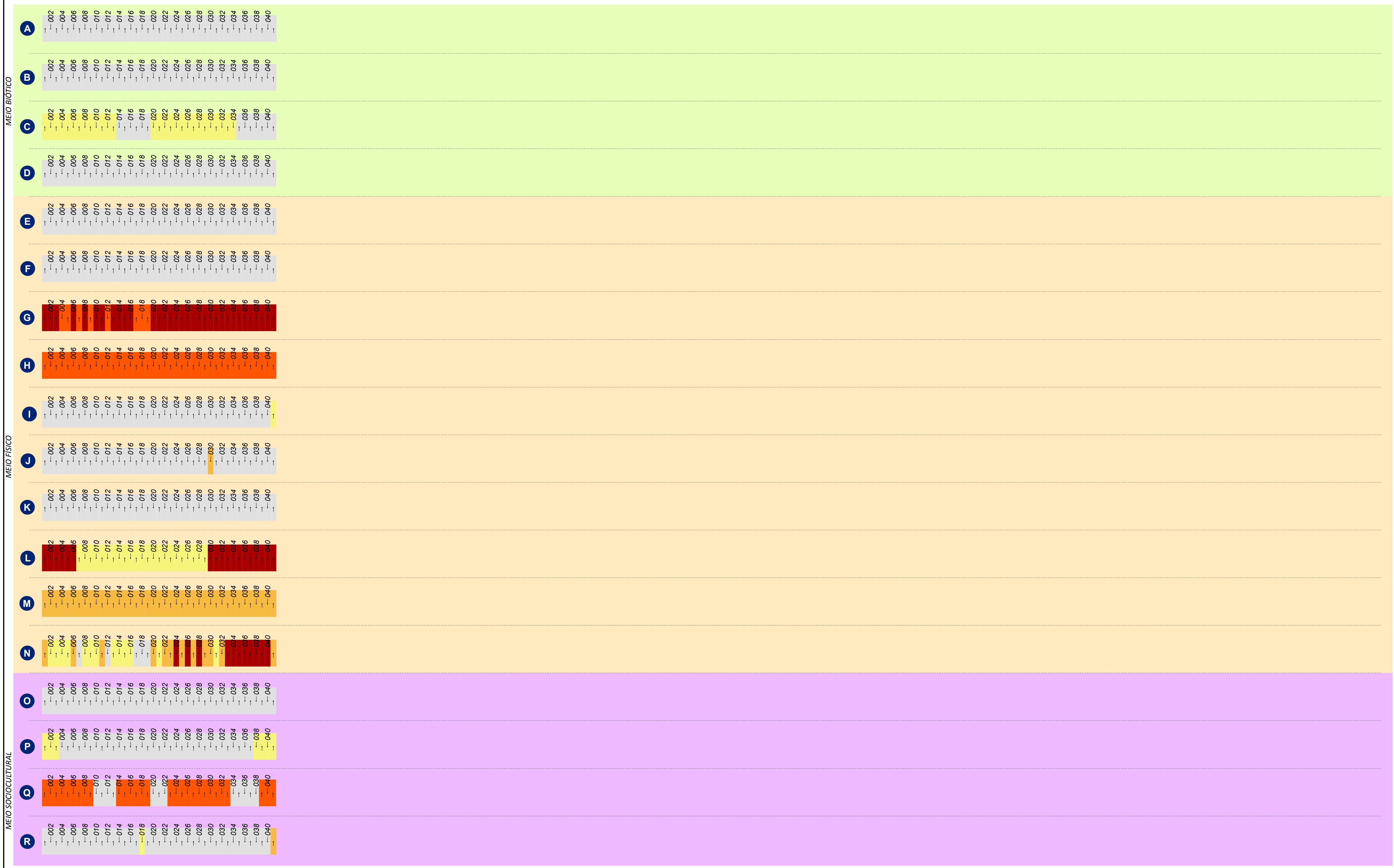


Map 14: Location of the Tarauacá Waterway

The study area of the waterway crosses the territory of four municipalities, two in the state of Acre and two in the state of Amazonas. The total population of these municipalities is 115,005 inhabitants (IBGE, 2010) and the FIRJAN index is 0.45.

The study area of the waterway is divided into 41 stretches of 10 km² where the plant cover is well preserved. There are also five Indigenous Lands along the waterway, located in stretches 1 to 9 in Eirunepé (AM), 14 to 20 and 23 to 33 in the municipality of Envira (AM), 39 to 41 in the municipality of Tarauacá (AC).

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

N° dos trechos
n° < Jusante
n° > Montante

Escala de ponderação dos temas
1 - 5 (baixa - alta)
IN BA ME AL MA

IN - Insignificante
BA - Baixa
ME - Média
AL - Alta
MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES
ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO TARAUACÁ	MAI/2013

3.2.1.15 The Envira Waterway

a) Navigability Diagnosis

The Envira River is the main tributary of the Tarauacá River that, in turn, is a tributary of the Juruá River. The Envira River flows through the states of Acre and Amazonas. Its spring is found in the Brazilian and Peruvian Amazon forest, flowing in a south-north direction. Its mouth is located on the right bank of the Tarauacá River, near the city of Eirunepé (AM). The main municipalities along the Envira River are: Feijó (AC) and Envira (AM).

The climate of the Envira River basin is tropical rainy, with yearly rainfall rates varying between 2,000 mm. and 2,500 mm. The rainy period starts in November and reaches the highest rates from January to April. The average annual temperature varies around 25°C, with little thermal variation. The relative humidity of the air remains above 90%. The Envira River is an important water contributor to the Tarauacá River. The dry period is characterized by very reduced flows when compared to the flows during the flood period. The average flow in Feijó (AC) is 450 m^3/s (see Appendix VII, Item 4.1.14).

The Envira River has characteristics very similar to those of the Tarauacá River, typical of Amazon plain rivers, with low declivities and many meanders, occasionally with abandoned meanders. There are intense processes of erosion and sedimentation, with the presence of many sandbanks along the entire river course.

Similar to the Tarauacá River, the Envira River will benefit from installation of the AM-329.

The Envira Waterway consists of the stretch from its mouth in the Tarauacá River to the city of Feijó (AC), close to 150 km. in length.

The Envira River is currently navigable only by small vessels along the entire waterway, with minimum depths of 1.20 m.

The Envira Waterway has minimum widths that vary from 40 to 130 m. throughout its length. The river has high sinuosity indexes. Over its close to 150 km., the waterway has average sinuosity indexes of 2.2. In addition, the Envira River has many sandbanks that, depending on the water level, may alter the navigable channel and make the navigation route even more sinuous and narrower than expected, resulting in navigable distances that are much greater than the straight-line distances and causing greater maneuvering difficulty and long delays in reaching the final destination.

According to data from the Brazilian Navy and the Departamento Nacional de Infraestrutura de Transportes (DNIT), the Envira River has stretches with minimum depths of 1.2 m. during the dry period, which can be even lower in localized stretches due to sandbanks. This depth condition is found in its entire length. During the flood season, the level rises substantially and can reach depths of 30 m.

The formation of sandbanks and the low depths are the main factors restricting navigation, primarily during the dry season when the depths are low.

The Envira River has one bridge, in the more upstream segment of the waterway, at the city of Feijó (AC) (stretch 15). It does not impede navigation.

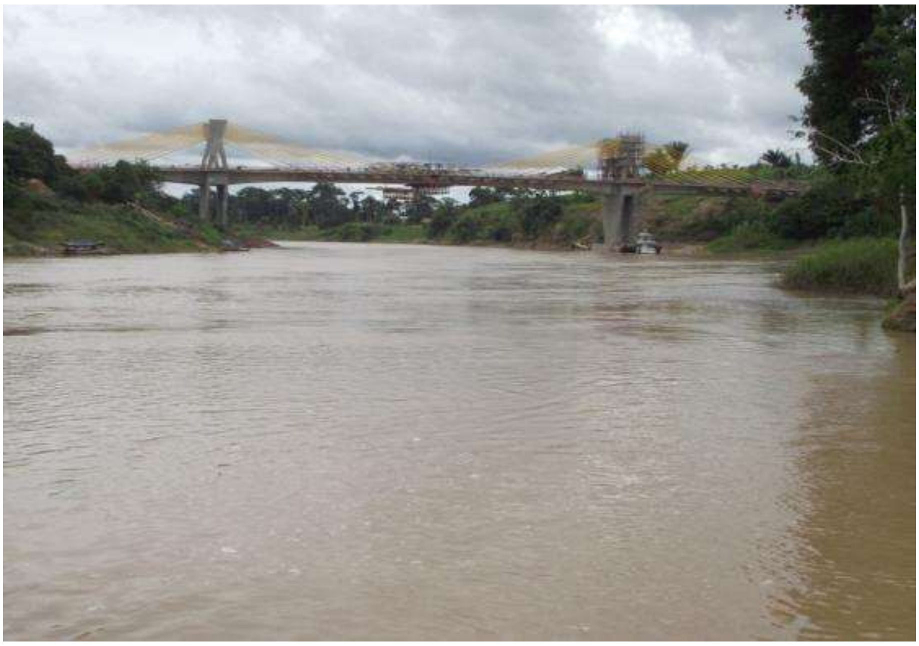
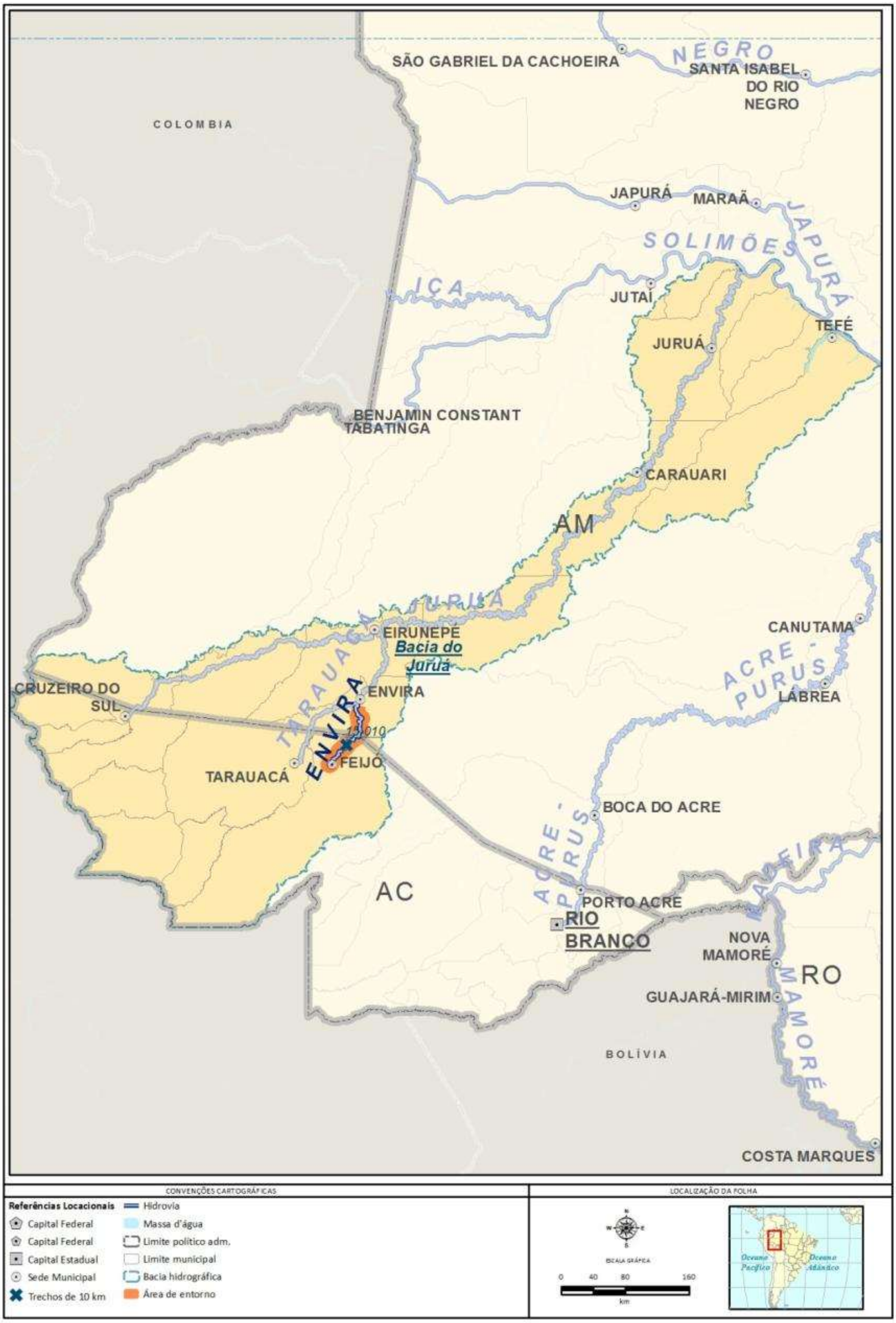


Figure 173.2.18: The BR-364 bridge over the Envira River, stretch 15 (Skyscrapercity, 2013)

b) Social and Environmental Vulnerabilities

The Envira Waterway, a tributary of the Tarauacá River, with a length of 144 km., is located in the Juruá River basin (described previously in the presentation of the Juruá Waterway).

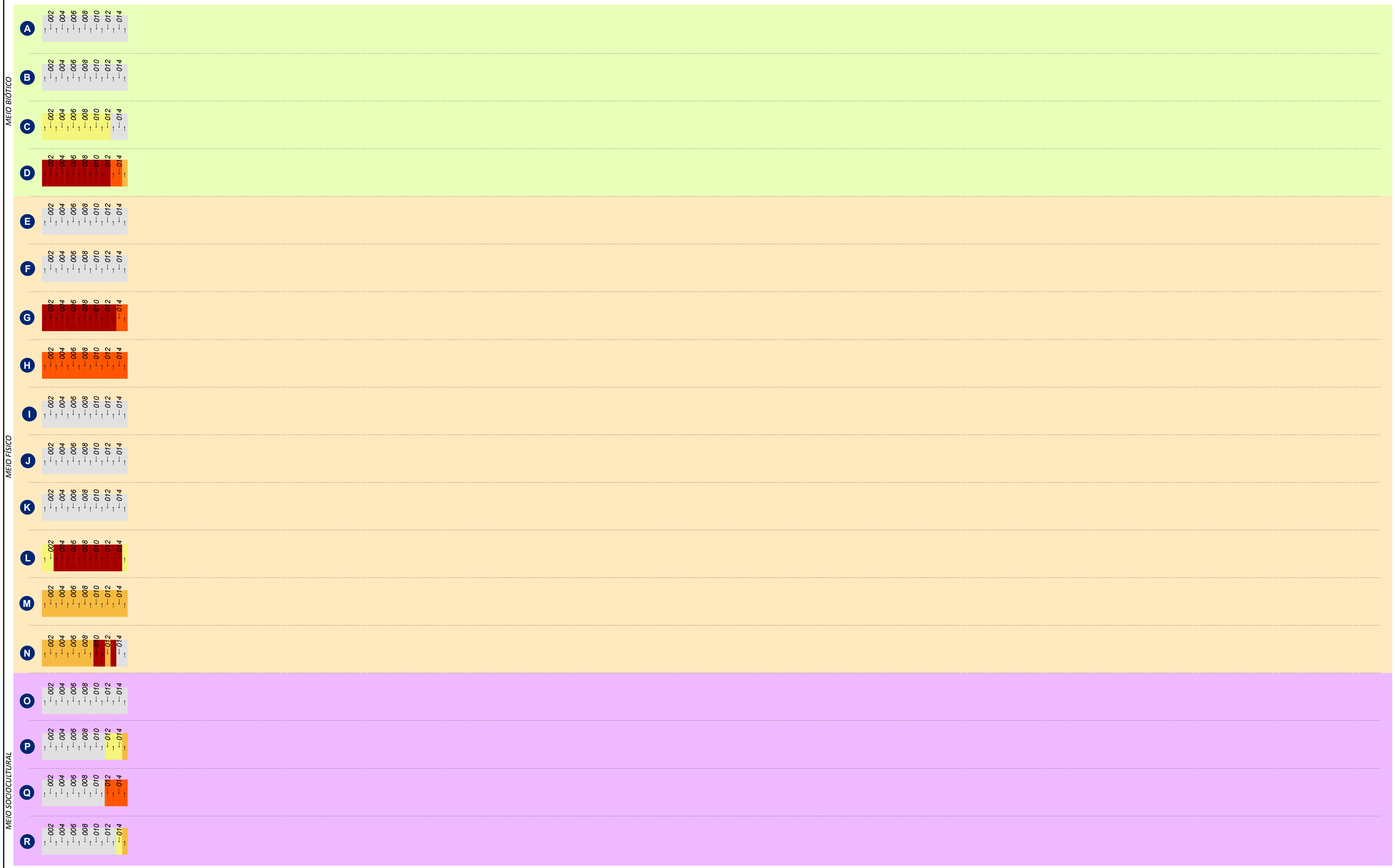


Map 15: Location of the Envira Waterway

In the study area are found the territories of two municipalities, with one in Amazonas and one in Acre. These municipalities have a population of 47,850 inhabitants (IBGE, 2010).

The area surrounding this waterway was subdivided into 15 stretches of 10 km. The presence of one Indigenous Land stands out in the municipality of Feijó (AC), in its final stretches (12 to 15). All the surroundings of the waterway have preserved areas of plant cover.

The distribution of the occurrences in relation to the variables analyzed can be better observed in the one-line diagram presented below.



CONVENÇÕES CARTOGRÁFICAS

BIÓTICO
- A Unidade de Conservação - Proteção Integral
- B Unidade de Conservação - Uso Sustentável
- C Áreas Prioritárias para Conservação da Biodiversidade
- D Desmatamento do trecho

FÍSICO
- E Mineração - Lavra e garimpo
- F Espeleologia
- G Sinuosidade
- H Profundidade
- I Empecilhos à navegação (construções)
- J Energia do rio
- K Leito do rio
- L Assoreamento
- M Anteparos naturais
- N Largura do rio

SOCIOCULTURAL
- O Comunidades quilombolas
- P Assentamentos INCRA
- Q Terra indígena
- R Ocupação lindeira

Nº dos trechos

n° < Jusante

n° > Montante

Escala de ponderação dos temas

1 - 5 (baixa - alta)

IN BA ME AL MA

IN - Insignificante

BA - Baixa

ME - Média

AL - Alta

MA - Muito alta

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

0 50 100 200 km

LOCALIZAÇÃO DA FOLHA

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

DIAGRAMA UNIFILAR DA CRITICIDADE DOS MEIOS: FÍSICO, BIÓTICO E SOCIOCULTURAL

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1: 5.850.000	RIO ENVIRA	MAI/2013

3.2.2 Economic Aspects

3.2.2.1 Current inland waterways transport

Commodities

In table 3.2.1 three kinds of flows on the Amazon/Solimões River are distinguished: international maritime flows, coastal transport (cabotage) and inland waterway transport.

Table 3.2.1: Navigation on the Amazon/Solimões River in 2011

Type of navigation	Volume (1.000 tons)	Performance (1.000 tonkm)
Sea going	20.006	18.668.651
Coastal	19.356	22.272.212
Inland waterway transport:	9.872	5.638.315
Regional *(within a state)*	2.608	1.021.405
National *(between states)*	7.198	4.611.614
International	3	5.297
Total	**49.234**	**46.579.178**

As can be seen in table 3.2.1 a total of almost 10 million tons is transported by *inland water transport* on the Amazon/Solimões in 2011. Within (large) states 2.6 million tons is transported. 2.4 million tons is transported downstream, mainly on the corridor Coari – Manaus. This is natural gas and oil to supply the Manaus refineries and the LPG market in neighbouring states. Total transport between states (mainly between Amazonas and Pará) is 7.2 million tons. This volume for the larger part consists of soy and – in the corridor Manaus to Belem - transport of roll-on roll-off trailers. *Coastal shipping* consists of the transport of bauxite, followed by oil products and containers.

Passengers

In contrast to the rest of Brazil, in the Amazon region passenger transport over water still is very important. The main reason is the extensive water system and the limited number of roads in this vast area. For a large number of destinations transport over water is the only means of transport.

The Amazon region is sparsely populated with a limited number of large cities and mostly small indigenous villages. Organized transport by waterway along the Amazon is an important mode of transportation for the inhabitants. In the Amazon region two main types of passengers transport can be distinguished.

- Short distance transport; most river or lake crossings operated by ferries. Travel times are low and the number of passengers is high. In some cases these ferries can also be used by cars.

- Long distance transport; transport between cities upstream or downstream the river. These are executed by smaller vessels and have long travel times. The number of passengers is relatively low per ship.

In 2011 around 5.4 million people used long distance passenger routes between the main cities in the Amazon region: Manaus, Belém, Santarém, Macapá and Porto Velho. Another 6.6 million passengers used ferries to cross the rivers in the Amazon Basin.

In 2011 the region counted 106 passenger terminals connected by 222 shipping lines. Officially 420 vessels are registered to transport passengers, averaging 70 passengers each one way.

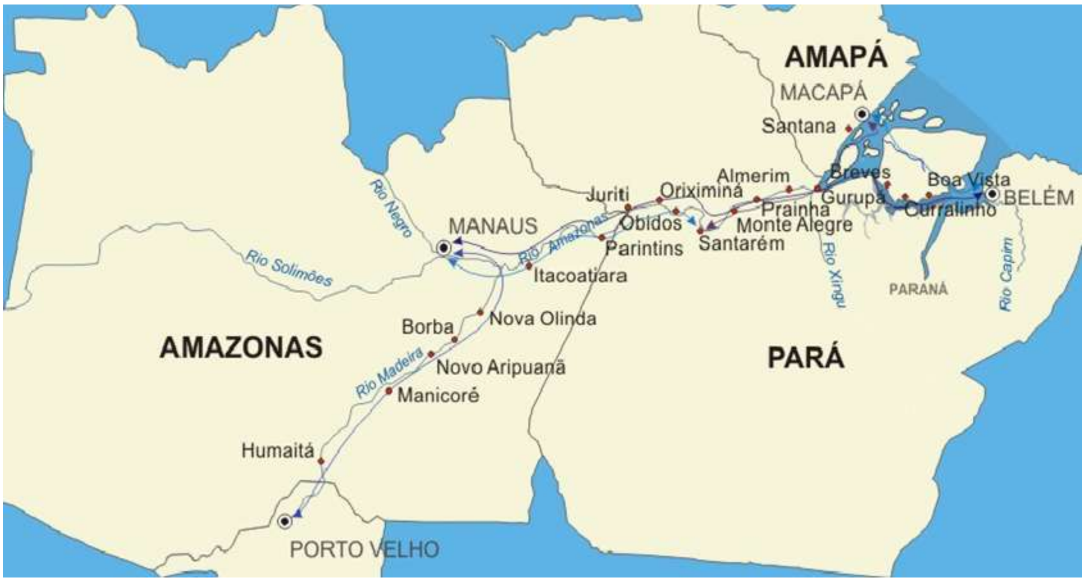


Figure 3.2.19: Main passenger terminals in the Amazon Region

More detailed information concerning passenger transport in the Amazon region can be found in Section 23 of this report (Appendix VI Economy part B).

3.2.2.2 Planned developments

The infrastructure network in the Amazon region is not widely developed. Next to the main waterways Amazon, Tapajós and Madeira there are a few highways in the region. Public railways do not exist yet.

In the Master plan for the port of Santarém[46], forecasts for the development of the port of Santarém are presented. Table 3.2.2 gives the results from this study. It becomes clear that a large increase is expected in the exports of agricultural commodities and likewise in the imports of fertilizers, following expected production developments in Mato Grosso. All of these commodities in principle are suited for transport by inland water.

[46] Plano Mestre port of Santarém preliminar (Antaq 2012)

Table 3.2.2: Forecasts for the port of Santarém (in 1000 tons)

	2010	2015	2020	2025	2030
Soy	699	4.225	5.360	6.351	7.297
Corn	122	332	603	921	1.360
Fertilizers	0	431	760	1.056	1.369
Wood	50	67	86	110	134
Oil products	132	174	201	228	255
Containers	46	88	147	205	264
Containers (1000 TEU)	5	10	17	24	31
TOTAL	**1.048**	**5.317**	**7.157**	**8.870**	**10.679**

3.2.2.3 Future inland waterways transport

This paragraph summarizes the base case forecasts for inland waterway transport in the Amazon/Solimoes river basin. More detailed information is provided in the background reports concerning commodities and river basins.

For regional water transport on the Amazon River in 2011, mainly consisting of chemical and oil products, we assume a growth equal to the GDP growth, based on the macro-economic scenario used in the national mining plan 2030. In table 3.2.3 the forecasts for 2015, 2023 and 2031 are given.

Table 3.2.3: Forecasts for regional transport Amazon/Solimões river (in 1.000 tons)

	2011	2015	2023	2031
Chemical products	1.915	2.328	3.439	4.357
Oil products	552	671	991	1.256
Ro-Ro	102	124	183	232
Other commodities	39	47	70	89
Total	**2.608**	**3.170**	**4.684**	**5.933**

For national transport (mainly agricultural commodities and ro-ro) both volumes and relative increase is larger than regional transport. Transport forecasts are in line with related agricultural commodities forecasts. Fertilizers are only imported in small amounts in 2011. We assume a growth potential up to 25% of imports for Mato Grosso. This is the same percentage as exports from those regions via Amazonia ports.

Table 3.2.4: Forecasts for National transport Amazon/Solimões river (in 1.000 tons)

	2011	2015	2023	2031
Soy	2.498	4.303	5.595	6.886
Ro-Ro transport	2.395	2.911	4.301	5.448
Oil products	820	997	1.473	1.865
Corn	803	1.565	1.998	2.351
Fertilizers	38	649	769	823
Other commodities	645	784	1.158	1.467
Total	**7.198**	**11.209**	**15.294**	**18.840**

Concerning coastal shipping the expected volumes are stated in table 3.2.5. Bauxite is the main commodity. The forecast for bauxite are taken from the National Mining Plan 2030. For all other products, except containers a growth equal to expected GDP growth is assumed. For containers the growth is one percent per year higher than GDP growth.

Table 3.2.5: Forecasts for coastal shipping (cabotage) Amazon/Solimões River (in 1.000 tons)

	2011	2015	2023	2031
Bauxite	14.294	19.551	26.371	37.218
Oil Products	2.592	3.151	4.655	5.897
Containers	2.283	2.882	4.594	6.287
Chemical products	106	129	190	241
Other commodities	81	98	145	184
Total	**19.356**	**25.811**	**35.955**	**49.827**

Regarding passenger transport on the Amazon Rivers, a further increase in long distance travel is expected based on the population growth of the relevant states. For ferry crossing we assume a growth of the trips on the basis of growing population. On the other hand the number of bridges is likely to increase, as is the number and quality of roads. We assume that both developments offset each other and keep the number of crossing constant over time.

Table 3.2.6: Passenger forecast Amazon River (in million passengers)

	2011	2015	2023	2031
Long distance	5,40	5,99	6,94	7,59
Ferry	6,60	6,60	6,60	6,60
Total	**12,00**	**12,59**	**13,54**	**14,19**

In table 3.2.7 the total forecast of both commodities and passengers transport is stated.

Table 3.2.7: Total forecast for Amazon/Solimões River (except sea shipping)

	2011	2015	2023	2031
Regional (1.000 tons)	2.608	3.170	4.684	5.933
National (1.000 tons)	7.198	11.209	15.294	18.840
Coastal (1.000 tons)	19.356	25.811	35.955	49.827
Total commodities (1.000 tons)	29.162	40.190	55.933	74.600
Passengers (# million)	12 mln.	12,59	13,54	14,19

3.2.3 Transport System

3.2.3.1 Infrastructure

This item describes the infrastructure existing in the Amazon waterway system that, as mentioned in Chapter 3.2.1, includes the Acre, Branco, Envira, Içа, Japurá, Jari, Juruá, Paru, Tarauacá, Trombetas, Uatumã, Xingu, Amazon, Negro and Solimões Rivers.

The Amazon waterway system is connected to others, such as the Tapajós, Madeira and Tocantins, and is an extremely important route for the North logistic corridor, not only for transport of cargo, but also for that of passengers.

a) Waterway/River Infrastructure

The physical characteristics of the Amazon waterway complex were already mentioned in Chapter 3.2.1. Consequently, only the existing ports/terminals and federal highways relevant to the region will be described.

Ports/Terminals

The database resulting from the PNIH was used for analyzing the Amazon Waterway System terminals, supplemented with information collected during interviews and from recent reports. This base lists 104 terminals, 41 of which have no current information on their status and 52 are in operation. The number of terminals by status can be seen in the table below.

Table 3.2.8: Status of the Ports of the Amazon Waterway System (Source: Developed based on the PNIH database, 2013).

Status	Quantity	Percentage
Under construction	5	5%
Operating	52	50%
Planned	6	6%
No information	41	39%
Total	**104**	**100%**

The analysis of the current status was made based on data of the ports/terminals classified as "operating" and the others were not considered.

The Amazon waterway system includes a total of 52 ports/terminals in operation, with 35 classified as public ports, 13 private-use terminals, 2 organized ports and 2 cargo transshipment stations.

Although there is a large number of public terminals, these were dimensioned to receive break-bulk cargo for regional consumption, as well as for passenger transport. This is also applicable to the organized ports (the Port of Manaus and the Port of Macapá) that are part of the system.

In general, one can state that the private terminals have better conditions for moving large volumes of cargo. The main ports by location were described in the items below.

Coari

Currently, the Solimões TUP in Coari receives part of the production of the Solimões basin (located in the oil-producing province of Urucu) by pipelines, where the cargo is loaded and shipped to the Manaus TUP. The Refinaria Isaac Sabbá (REMAN – Refinaria de Manaus) (Isaac Sabbá Refinery) is located in this area (the Manaus TUP). Its main products are LPG, gasoline and fuel oils.

The table below shows the cargo flows that originate from this terminal. It is worth emphasizing that there is no unloading of cargo coming from inland navigation.

Table 3.2.9: Cargo Shipped from Coari, by Destination and Commodity, in 1,000 tons (Source: ANTAQ report – Transporte de cargas nas Hidrovias Brasileiras 2011) (2011 Cargo Transport on Brazilian Waterways)

Commodity	Destination	2011
Chemical products	Manaus	1,915
Oil products	Porto Velho	42
Total		**1,957**

Manaus

The municipality of Manaus has various terminals and one organized port that, according to the ANTAQ statistical yearbook of 2011, did not move any cargo.

The total extension from the mouth of the Amazon, where the draft is limited to 10 m., to the Negro River in Manaus is approximately 1,500 kilometers, constituting a natural navigation route. The stretch from the Negro River to the ports is approximately 13 kilometers, the width is 500 m. and the depth is 35 m., under restrictive conditions.

The table below shows the main operating terminals that move cargo that has the IWT as an origin or destination in the Manaus region.

Table 3.2.10: Main Operating Terminals in the Manaus Region

Port/Terminal	Type	Location	Land Connections
Manaus TUP (Transpetro) - Manaus	Mixed Private Use Terminal	The Negro River	BR-319
Chibatão 2 TUP	Mixed Private Use Terminal	The Negro River	BR-319
Super Terminals TUP	Mixed Private Use Terminal	The Negro River	BR-319

The Chibatão TUP is the largest port complex in the state of Amazonas and specializes in moving containers and handling roll-on/roll-off vessels.

The Super Terminals TUP is dedicated to moving containers, receiving primarily those coming from cabotage and ocean going navigation.

The table below shows the cargo transported by inland navigation that originates from or is destined for the municipality of Manaus. The total movement was approximately 6.1 million tons.

Table 3.2.11: Cargo Transported by Inland Navigation in the Municipality of Manaus in 2011, in 1,000 tons (Source: ANTAQ report – Transporte de cargas nas Hidrovias Brasileiras 2011)

	Origin Manaus	Destination Manaus
Coari		1,915
Belem	1,093	1,342
Santarém	436	14
Porto Velho	467	275
Manaus	257	257
Other ports	36	
Total	**2,289**	**3,803**

Table 3.2.12: Cargo Shipped by Type in 2011, in 1,000 tons (Source: ANTAQ report – Transporte de cargas nas Hidrovias Brasileiras 2011)

Cargo	Total Movement
Chemical products	1,915
Ro/Ro	2,200
Oil products	1,191
Soybeans	255
Cement	67
Parts	218
General cargo	97
Trucks	95
Other commodities	54
Total	**6,092**

Based on this table one can see that the predominant flows are of chemical products and oil products, as well as general cargo for ro-ro vessels.

Itacoatiara

The municipality of Itacoatiara has the Hermasa TUP that receives cargo coming from its terminal in Porto Velho, for export (bulk agricultural products), and from import cargos (fertilizers). This terminal, although it is a mixed TUP, only moves its own cargo, and if, on occasion, it does so for third parties, it will charge high rates for use of its infrastructure.

The table below shows the movement of cargo in 2011 at this port, by origin and destination.

Table 3.2.13: Cargo Shipped by Origin and Destination in 2011, in 1,000 tons (Source: ANTAQ report – Transporte de cargas nas Hidrovias Brasileiras 2011)

	Origin Itacoatiara	Destination Itacoatiara
Porto Velho	38	2,432

Table 3.2.14: Total Cargo Movement, in 1,000 tons (Source: ANTAQ report – Transporte de cargas nas Hidrovias Brasileiras 2011)

Cargo	Total Movement
Soybeans	1,783
Corn	650
Fertilizers	38

Highways

The main highways that are part of the Amazon waterway system are described below.

BR-156

BR-156 is a longitudinal Brazilian federal highway located in Amapá. Is starts in the municipality of Laranjal do Jari, goes to the state capital city of Macapá and ends in Oiapoque, where is awaits completion of the connection to the bridge over the Oiapoque River, finished in August 2011, that will connect Brazil by land to French Guiana.

There are 595 km. between Oiapopque and Macapá, and 369 km. between Macapá and Laranjal do Jari (stretch via the city of Santana), totaling 964 km. of road, which cuts through the Cerrado and the Forest. Of these, only 347 km., between Macapá and Calçoene, are paved. The rest of the road is still unpaved. This highway has been under construction since the 1940s and there is no forecast for when it will be finished.

The stretch of highway that connects Macapá (AP) to Laranjal do Jari (AP) runs parallel to the Amazon Waterway in its more downstream stretch, in addition to connecting the point most upstream of the Jari Waterway to the Amazon Waterway. It has a segment that competes with this system. In spite of its route location, the highway is not paved and cargo traffic is impossible. Since the road becomes impassable during rainy periods, it can only be considered a route competing with the Jari and Amazon Waterways when it is duly paved.

BR-163

BR-163 is a Brazilian longitudinal highway. It is 3,467 km. in length, with almost 1,000 km. paved. It connects Tenente Portela, in Rio Grande do Sul, to Santarém, in Pará. It is a highway that integrates the South with the Center West and North of Brazil, being paved to the city of Guarantã do Norte, in Mato Grosso, 728 km. from the state capital city of Cuiabá, in the extreme North of the state. From there in the direction of Santarém (PA), it has 1,010 km. of dirt road. It is of fundamental importance to the shipment of production from the Pará part of Brazil's northern region.

On the north side of the Amazon River, there are also stretches between Alenquer and the locality of Onças, in Oriximiná, as well between Cachoeira Porteira on the Trombetas River and the end of the highway, right after the junction with BR-210, also in Oriximiná. This last stretch has a total of 233 km. and is among the most isolated highway stretches in Brazil.

Highway BR-163 may become a competitor to the Trombetas Waterway, however the stretch that connects Onças to Cachoeira Porteira, which would be the segment directly competing with the Trombetas River, is in the planning phase, without a forecast completion date. The existing segment between Cachoeira Porteira and the junction with BR-210 forms a complementary segment to the Trombetas Waterway planned in this study. However, it is an extremely isolated stretch and unpaved, making it impassable for cargo vehicles.

BR-174

BR-174, also known as the Manaus-Boa Vista, is a longitudinal highway that connects the Brazilian states of Roraima and Amazonas to Venezuela, over a total of 974 km. Its ends are the cities of Manaus and Pacaraima. It is the only connection between Roraima and the rest of the country, being its largest and principal highway. Although it was started during the military dictatorship, the completion of its paving and signaling occurred only in 1998.

Over its almost 1,000 km. it crosses regions of Amazon forest and Cerrado, in addition to large agricultural fields. Starting at Km. 0, it crosses the cities of Manaus (AM), Presidente Figueiredo (AM), Rorainópolis (RR), Caracaraí (RR), Iracema (RR), Mucajaí (RR), Boa Vista (RR), Amajari (RR) and Pacaraima (RR). BR-174 ends at the Brazil—Venezuela border. It continues by way of Venezuelan Highway 10, towards the capital Caracas. BR-174 thus, constitutes the only land border between Brazil and Venezuela, making it a significant tourist route.

Leaving Manaus, it crosses AM-240 that connects to Vila de Balbina (AM). It then enters the Waimiri-Atroari indigenous reserve that extends for 123 km. Further North, it passes the city of Rorainópolis, at Km. 500, where there is a junction with Highway BR-210. Continuing on to the left, it crosses the Branco River over a bridge at the city of Caracaraí (RR). Further on, there is a new junction with the BR-210. The highway is closed at the Waimiri-Atroari indigenous reserve between 6:30 p.m. and 6:00 a.m. the next day.

Its route could be considered competing with the Nero and Branco Waterways, connecting Manaus (AM) to Boa Vista (RR). The highway is composed of a single roadway over its entire extension, well paved and with bridges. The pavement worsens considerably in the stretch that crosses the Waimiri-Atroari indigenous reserve where the traffic is restricted, however the stretch still has pavement in acceptable conditions for truck traffic.

BR-210

BR-210, also known as the North Perimeter, is a Brazilian federal highway designed to meet the needs of the states of Amazonas, Pará, Amapá and Roraima. So far only stretches in these last two states have been constructed. In Roraima, BR-210 has 411.7 km. constructed today, from the Jatapu River to Missão Catrimani. All this stretch is paved, although many segments are in a critical state of repair. The stretch from the Repartimento River to Missão Catrimani was deactivated in 2004 due to the lack of bridge maintenance and ravine slides. From Missão Catrimani, the road was built to the Demini Indigneous Station in the state of Amazonas.

It was started in Amapá in 1973, taking advantage of the 102 km. already built for ICOMI to explore the Serra do Navio. Leaving Macapá, the project was suspended in 1977 after 170 km. were constructed that today end within the Waiãpi Indigenous Land.

The currently existing segments of BR-210 cannot be considered competitors with the Amazon basin waterways, however, if completed, it would be capable of representing an alternative. Currently, only some stretches were constructed and the rest, already designed, do not have dates for initiation of their construction works.

BR-307

BR-307 is a Brazilian diagonal federal highway. Theoretically, it starts in the municipality of Marechal Thaumaturgo (AC) and continues to the district of Cucuí (AM). It was designed during the military dictatorship and is expected that it will never be completed, since the Brazilian government has been adopting environmental conservation policies in recent years. In addition, the route of BR-307 crosses regions inhabited by isolated indians, particularly in the region of the Javari Valley (the Cruzeiro do Sul - Ataliaia do Norte stretch).

If constructed, it would be an alternative, supplementing BR-210, which also has not been built, to the Amazon basin waterways, primarily the Juruá, Içá, Solimões, Japurá, Negro, Branco and Amazon Waterways.

BR-319

BR-319 is a Brazilian diagonal federal highway that connects the cities of Manaus (AM) and Porto Velho (RO), in the northern region of Brazil. Along its route, the highway passes by the Brazilian states of Amazonas and Rondônia. BR-319 is the only highway connection between Manaus and the state of Roraima, and the rest of Brazil. The stretch between Manaus and the locality of Havelândia (at the municipal border between Manicoré and Beruri) is concurrent with BR-174.

It is the main access to several cities in the South of Amazonas, such as Humaitá, Lábrea, Manicoré, Careiro, Manaquiri, Autazes and Careiro da Várzea. It is 880.4 km. in length, of which 859.5 are in Amazonas and 20.9 in Rondônia.

BR-391 was inaugurated in 1973 during the Brazilian military regime, within the context of the colonization of the Amazon. Some years later, the highway became impassable in practice. In 2005, the federal government announced the recovery of BR-319. The work began in 2008, with two work fronts starting at the extreme ends of the highway.

Although it is a highway competing with cargo transport on the Madeira and Purus Rivers, since it runs parallel to both, it is not considered an option, since the greater part of its extension does not have conditions to support regular traffic.

BR-320

The Transamazonian Highway (BR-230) is a Brazilian highway designed during the Emílio Garrastazu Médici administration (1969 to 1974). It was one of the so-called “pharonic works" due to its gigantic proportions, undertaken by the military regime. It is the third longest highway in Brazil, 4,223 km. in length, connecting Cabedelo, in Paraíba, to Lábrea, in Amazonas, cutting through seven Brazilian states: Paraíba, Ceará, Piauí, Maranhão, Tocantins, Pará and Amazonas. It is classified as a transverse highway. In large part, mainly in Pará and Amazonas, the highway is not paved.

Planned to better integrate northern Brazil with the rest of the country, it was inaugurated on August 27, 1972. Initially designed to be a paved highway with a length of 8,000 km., connecting the northern and northeastern regions of Brazil with Peru and Ecuador, it has not undergone any major modifications since its inauguration. Afterwards the design was modified to 4,977 km. to Benjamin Constant, however construction was interrupted in Lábrea, reducing the total to 4,223 km. Since it is not paved, traffic on the Transamazonian Highway is impractical during the rainy season in the region (from October to March).

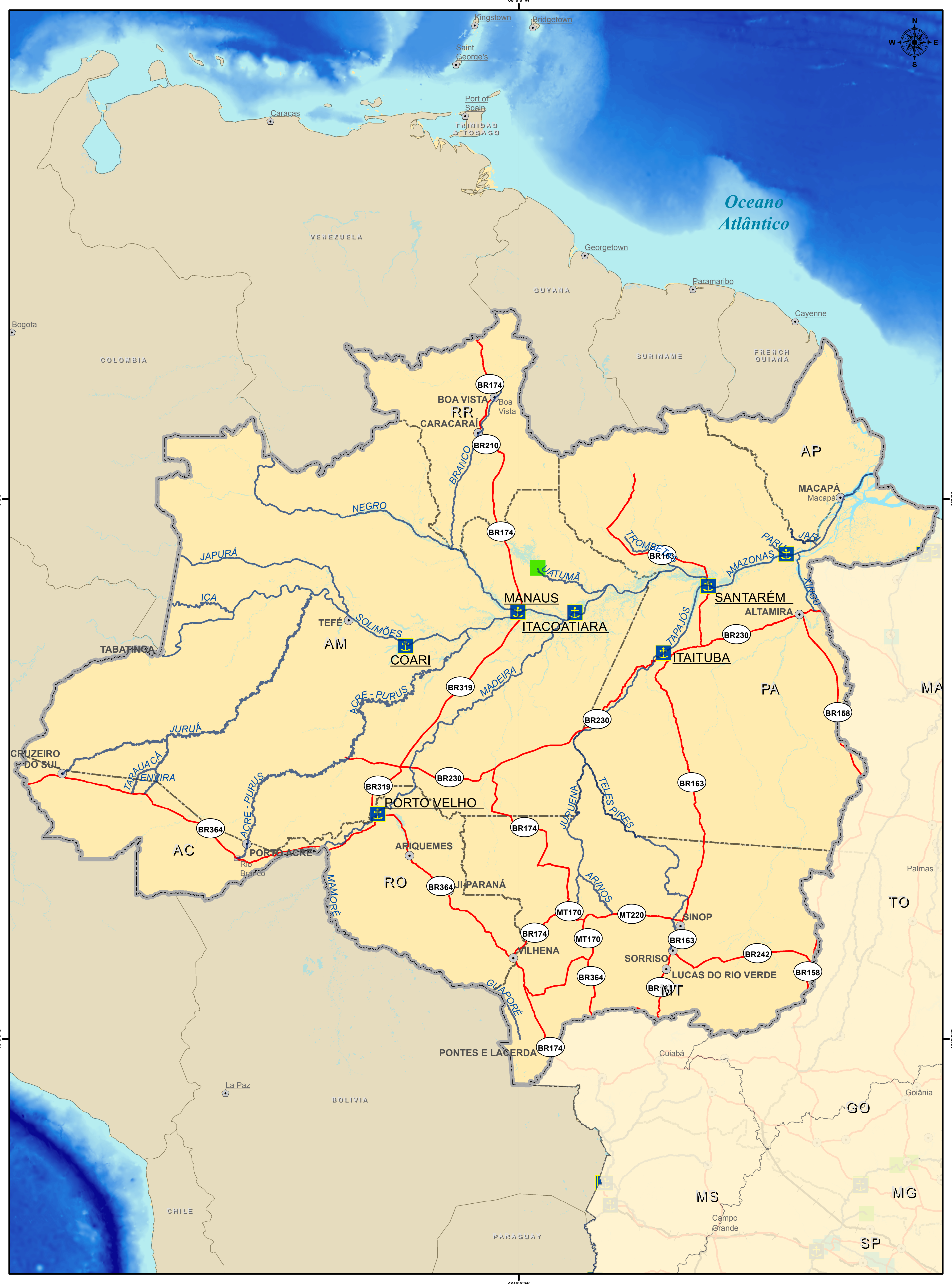
In its design, BR-320 would cut the Japurá, Purus, Madeira, Tapajós and Xingu Rivers, running parallel to the Amazon River. In addition to its huge extension and ability to connect various Amazon basin waterways, BR-320 would Interconnect the waterways of other river basins, since it also cuts the waterways of the Itacaiúnas, Araguaia, Tocantins and Parnaíba Rivers.

BR-364

BR-364 is an important diagonal highway in Brazil, which starts in Limeira (SP), at Km. 153 of SP-330, proceeding by SP-310 to Km. 292 where it enters SP-326 going to the border with Minas Gerais. Then it passes through Goiás, Mato Grosso, Rondônia and Acre, ending in Rodrigues Alves, in the extreme West of this state. It is consequently a highway of fundamental importance for shipment of the production of the entire North and Center West region of the country.

Currently, BR-364 is paved to the municipality of Manoel Urbano, 244 km. from Rio Branco. The largest and most complicated part is partly paved. This is the stretch between Manoel Urbano and Feijó (approximately 100 km.), already released for regular traffic. In contrast, from Feijó to Cruzeiro do Sul, it already has asphalt paving. The efforts of the federal and state governments to complete this BR and the consequent interconnection of the municipalities in the extreme West of the state of Acre with the rest of the country encountered several difficulties that range from climate problems, seeing how the work can only begin with the arrival of the Amazon Summer (which consists of the months from July to the end of October), to environmental embargoes, in view of the fact that the cited BR cuts through environmental parks and indigenous lands.

When it is duly completed, the stretch of BR-364 that cuts through the state of Acre will also cross the waterways of the Juruá, Tarauacá, Envira, Purus/Acre and Madeira Rivers, providing an alternative to the transport of cargo and passengers in the state of Acre.



CONVENÇÕES CARTOGRÁFICAS

- Capital Estadual
- Limite político adm.
- Hidrovia
- Massa d'água
- Portos e terminais
- Cidades principais

Barragem existentes
- Barragem sem eclusa
- Barragem com eclusa

Infraestrutura de transportes
- Rodovias
- Ferrovias

REFERÊNCIAS

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 80 160 320 km

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

LOCALIZAÇÃO DA FOLHA

Oceano Atlântico

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

TRANSPORT CHARACTARISTICS HIDROVIA DO AMAZONAS

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:11.000.000	- BRASIL -	JUL/2013

3.2.3.2 Characteristics of the Existing Fleet and the Operating Companies

a) Vessels

The navigation companies that operate in the Amazon waterway system also are active in others, such as the Madeira, Tapajós and Tocantins. This report will only describe those of most importance to the system.

Due to the large number of navigation companies in the Amazon river region (64), it was not possible to determine the routes followed by all of them, but it was verified that the 10 largest (ranked in order of total capacity) operate 72% of the total capacity of the fleet. The table below shows the characteristics of the main navigation companies in the fleet.

Table 3.2.15: Characteristics of the Main Navigation Companies (Source: Prepared based on the ANTAQ Statistical Yearbook, 2011)

Company	Total barge capacity (in tons)	Minimum barge capacity (in tons)	Maximum barge capacity (in tons)	Number of barges	Maximum draft (m)	Average age (years)
Transportes Bertolini	187,657	700	3,181	90	4.08	10,9
Hermasa Navegação Da Amazônia S.A.	158,392	930	7,500	71	5.21	10,6
Companhia De Navegação Da Amazônia - CNA	89,074	125	4,851	50	3.95	15,8
J. F. De Oliveira Navegação Ltda	51,547	211	2,500	33	3.34	15

b) Pusher Tugboats

As can be observed in the table below, the main companies that have pusher tugboats for river transport are Bertolini, J. F. De Oliveira Navegação and CNA.

Table 3.2.16: Characteristics of the Pusher Tugboats of the Main Navigation Companies (Source: Prepared based on the ANTAQ Statistical Yearbook, 2011)

Company	Average Power	Number of tugboats	Average age (years)
J. F. De Oliveira Navegação Ltda	777	39	12,9
Transportes Bertolini Ltda	731	49	10,1
Companhia De Navegação Da Amazônia - CNA	629	19	19,5
Hermasa Navegação Da Amazônia S.A.	1,987	8	14,5

Hermasa operates up to 20-barge convoys of bulk agricultural products. For ore transport, convoys are limited to nine. On average, the companies have 1.5 barges per pusher tugboat, as can be observed in the figure below. In general, the larger companies have more barges per pusher tugboat in relation to the smaller ones, since the convoys used are also larger. The majority of the smaller companies only operate one barge and one pusher tugboat.

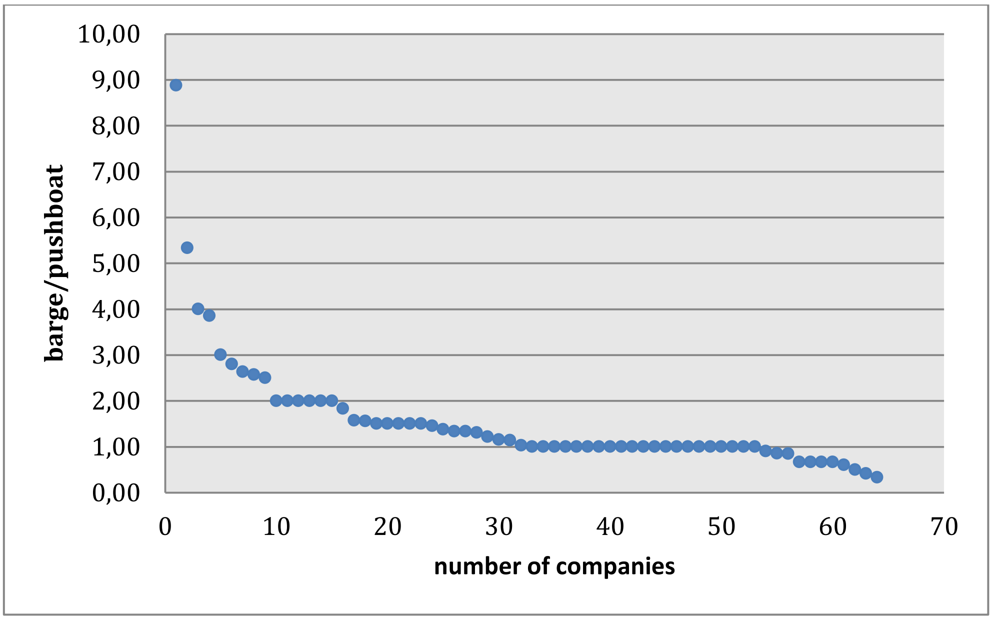


Figure 3.2.20: Number of barges per pusher tugboat in relation to the existing fleet in the Amazon region.

3.2.3.3 River Information Management System

Chapter 3.2.4 extensively addressed the competencies and responsibility of the institutions responsible for maintenance of the waterway, with AHIMOC being the principal one.

Monitoring and restrictions on some of the rivers that make up the Amazon waterway complex are presented below. This information was taken from the document titled “Normas e Procedimentos da Capitania Fluvial da Amazônia Ocidental” (Norms and Procedures of the River Capitaincy of the Western Amazon).

The Amazon River

Border between the states of Amazonas and Pará to Itacoatiara: information on the “river level gauge” readings can be obtained from the river agencies of Itacoatiara or Parintins.

Itacoatiara to Manaus: information on the “river level gauge” readings can be obtained from the CFAOC.

The Solimões River

Currently, the Atlas de Cartas Náuticas (Atlas of Nautical Charts) issued by the DHN is a reference for navigators, however, since the river bed changes frequently, with alteration of the navigable channels from one year to the other, due to displacement of the Banks, navigation sketches may provide more updated information than the nautical charts available.

Some restrictions to night navigation were found. Between Manaus and Coari, navigation is ideally during the day. This is also the case of the stretch between Coari and Fonte Boa.

The Negro River

The Negro River is mapped by sketches issued by the DHN to the city of Santa Isabel do Rio Negro (AM).

Restrictions to night navigation are found in some stretches, for example, in the section where the bridge over the Negro River is located, in Manaus. In this region, vessels above 2,000 TPB may only use the main channels for transposition of the bridge, during the day.

The Branco River

One must monitor the variation of the river water level daily in order to navigate on this river. The gauges are maintained by the Companhia de Pesquisa de Recursos Minerais (CPRM) (Mineral Resources Research Company) (the Brazilian geological service). On the other hand, reading of the gauge is performed by the Companhia de Água e Esgoto de Roraima (CAER) (Water and Sewage Company of Roraima) in Boa Vista and by the Fishermen Association in Caracaraí.

The Acre River

Navigation of ships and convoys with ferries should only take place during the day. Information on "river level gauge" readings can be obtained from the river agency of Boca do Acre.

3.2.3.4 Intermodal Competition

The analysis of intermodal competition does not show major problems in this waterway system, since there are no railways and the existing highways do not have conditions for cargo transport.

3.2.4 Governance and institutions

The Amazon Waterway System is used to transport passengers and cargo directed primarily toward the large regional centers - Belém and Manaus. And, therefore, it is a route of great importance, since there are large existing cities on its banks and is also the confluence of other navigable water courses, such as the Madeira and Teles Pires-Tapajós. Being widely navigable over a large part of its course, the Amazon Waterway System shows a large movement of cargo (primarily grains and ores) and passengers.

Given the great importance of this waterway system, various institutional agents are present in its port and waterway management, with some more central than others. These players can be seen in the figure below. It is worth stressing that such assignments reflect the content anticipated by the legal text that defines them, not portraying, in some cases, their real work.

Table 3.2.17: Formal Attribution Matrix of Amazon Waterway Agents

	Port administration	Inspection	Waterway maintenance*	Licensing Process	Regulation
Waterway Administration (WA) – AHIMOC					
State Superintendency – SNPH					
Port/River Captaincy					
IPAAM					
DNIT/DAQ					
ANTAQ					
IBAMA					
SEP					

*Performance of dredging, rock excavation, signaling.
**This block includes all agents consulted by IBAMA in the licensing process (Fundação Palmares, FUNAI, INCRA, IMCbio, IPHAN and the Public Prosecutor's Office).
Source: Consórcio Arcadis Logos, 2012

Below we will see how each institution acts, and how they relate, always striving to indicate the specificity of each. Their formal attributions are found detailed in Attachment I.

The AHIMOC (Attachment I) is an agency linked to the DNIT (Attachment I) by means of the Convênio de Apoio Técnico e Financeiro para Gestão das Hidrovias e Portos Interiores com a CODOMAR (Agreement of Technical and Financial Support for Management of Waterways and Inland Ports with CODOMAR) (No. 007/2008/DAQ/DNIT), responsible for the promotion and development of the activities of execution, maintenance, monitoring and inspection of studies, works and services of the Amazon and Madeira waterways, as well as for certain river ports that have been assigned by the DNIT. Currently, according to information of the AHIMOC directorate, however, the administrator has the Madeira Waterway as its principal area of operation. This has occurred because the Amazon Waterway is widely navigable by large vessels during the entire year, needing less intervention. In spite of this, between the mouth of the Amazon and the areas near the municipality of Manaus, the river has proper signaling and beaconage, the responsibility of the Administradora das Hidrovias da Amazônia Ocidental (Waterway Administrator of the Western Amazon), facilitating navigation.

Another institution identified is the Superintendência Estadual de Navegação, Portos e Hidrovias (SNPH) (State Superintendency of Navigation, Ports and Waterways) (Attachment I) of the state of Amazonas, which is an autarchy of the state government responsible for the administration of ports within the state, as well as the development of passenger ferry services between the municipalities of Nova Olinda do Norte and Autazes. The main work front of the SNPH is the ferry service, administering only ports connected with this activity.

The licensing of civil and hydraulic works, as well as that for support terminals was, until quite recently, the responsibility of IBAMA (Attachment I). According to Interministerial Decree no. 419, of October 26, 2011, IBAMA reports to the bodies intervening in the object of FUNAI, Fundação Cultural Palmares (FCP) (Attachment I), INCRA (Attachment I), ICMBio (Attachment I) and IPHAN (Attachment I) licensing, when necessary, during the licensing process. The licensing of waterway maintenance works in Amazonas is the responsibility of the Secretaria de Estado do Meio Ambiente e Desenvolvimento Sustentável (Secretariat of State for the Environment and Sustainable Development), by means of the Instituto de Proteção Ambiental do Amazonas (IPAAM) (Institute of Environmental Protection of Amazonas) (Attachment I), responsible for coordinating and executing the state's environmental control policy. Furthermore, the IPAAM is responsible for licensing river ports in the state of Amazonas.

Also linked to the Secretaria de Estado do Meio Ambiente e Desenvolvimento Sustentável (SDS), more specifically to the Secretaria Executiva Adjunta de Recursos Hídricos (SEARH) (Executive Assistant Secretariat of Water Resources), is the Comitê da Bacia Hidrográfica do Rio Tarumã-Açu (Committee of the Tarumã-Açu River Basin), the only basin committee found, by means of internet searches, in the Amazon waterway system. The committee has been functioning since June 6, 2006 and was officially established through Decree 29.244, of October 19, 2009, with operations in the Tarumã - Açu River basin, in the municipality of Manaus, in the state of Amazonas. Besides approving the Plano de Recursos Hídricos da Bacia, the purpose of the committees is to mediate conflicts over water use, in the first administrative instance, to establish mechanisms and suggest values to be charged for water use.

Still at the state level, the Agência Reguladora dos Serviços Públicos Concedidos do Estado do Amazonas (ARSAM) (Regulatory Agency for Public Services Conceded in the State of Amazonas) is a special regime autarchy created by State Law No. 2.568/99, that exercises its function according to the policies and guidelines established by the state. It is responsible, among its other duties, for inspecting, measuring, controlling and regulating the quality of the collective intermunicipal passenger highway and waterway services. Also identified with respect to the waterway model is the Secretaria de Estado de Infraestrutura (SEINFRA) (Secretariat of State for Infrastructure) (Attachment I) that acts to formulate public infrastructure policies in priority areas such as transport, seeking to make the implementation of infrastructure programs and projects feasible in order to promote the sustainable development of the state of Amazonas. It is SEINFRA's responsibility to promote investment in the opening and conservation of the network of side roads essential for the circulation of the population and shipment of production. As well as to control the state port and navigation sector and to monitor, inspect and receive engineering works and services in the interest of direct administration, jointly with the Comissão Geral de Projetos e Fiscalização de Obras (General Commission of Projects and Inspection of Works).

In order to promote joint actions for harmonious development of the Amazon basin, the eight countries involved in the basin (Bolivia, Brazil, Colombia, Ecuador, Guinea, Peru, Suriname and Venezuela) signed the Amazon Cooperation Treaty (TCA) on July 3, 1978. The treaty took effect in 1980, and with the evolution of the environmental theme, together with the intensification of the challenges confronted in the Amazon region and the perception of unsatisfactory institutional operation of the TCA, the bases were formed for Amazon cooperation to be strengthened by means of an international organization, with a permanent secretariat and its own budget.

Aiming to strengthen the process of cooperation and South American unity, the presidents charged their ministries of foreign relations with the task of preparing a new OTCA strategic agenda, strengthening it institutionally. The 2010-2020 Strategic Agenda reflects the priorities of the Amazon countries, in accordance with the political and social reality of the region. The Strategic Agenda of the organization encompasses lines of action into the Brazil 2022 Plan, led by the Secretaria de Assuntos Estratégicos (Secretariat for Strategic Matters). The thematic areas of operation of the ITCA include indigenous affairs; the environment; infrastructure, tourism, transportation and communications; health and education, science and technology.

For this, the following commissions were created, namely the, Comissão Especial de Saúde (CESAM) (Special Health Commission), Comissão Especial de Assuntos Indígenas (CEAIA) (Special Indigenous Affairs Commission), Comissão Especial de Meio Ambiente (CEMAA) (Special Environmental Commission), Comissão Especial de Turismo (CETURA) (Special Tourism Commission), Comissão Especial de Educação (CEEDA) (Special Education Commission), Comissão Especial de Ciência e Tecnologia (CECTA) (Special Science and Technology Commission) and Comissão Especial de Transporte, Infraestrutura e Comunicações (CETICAM) (Special Transportation, Infrastructure and Communications Commission), with this last one directly involved in the waterway issue, responsible for the programs and projects aiming to create strategies to promote transportation in its different modalities; to prepare general planning and projects for river transport on the Amazon River to promote commerce and contribute to the well-being of the region; to promote the creation of a land transport system (roads and railways) and foster regional air transport; to facilitate telecommunications; to conduct preliminary feasibility studies and studies on priority inter-ocean passages and to identify intermodal alternatives for connecting the basins of the Amazon, Orinoco and Prata Rivers.

Also in regard to international management of the Amazon, it is worth mentioning the Iniciativa para a Integração da Infraestrutura Regional Sulamericana (IIRSA) (Initiative for Integration of South American Regional Infrastructure) (Attachment I), which makes the Amazon axis one of its axes for integration and development and has discussed at the international level some of the important fronts for integration of Brazil, Peru, Colombia and Ecuador.

To accomplish these activities, the IIRSA created seven work groups focused on the “Amazon Axis,” which are:

- Group 1 – Access to the Putumayo Waterway: The strategic function of this group is to improve the logistics of national integration between the productive areas of southern Columbia, the Nariño region, with the Amazon regions of Putumayo and Amazonas and their integration with northern Ecuador; to improve the logistics of integration between Brazil and Peru; and to leverage the interconnection of the interior of the continent with the Pacific basin.
- Group 2 – Access to the Napo Waterway:The stategic function of this group is to strengthen Ecuadorian national integration of an Amazonian nature, the provinces of Napo and Ornellana, with the mountain and coastal region, and center and North of

the country and consolidate the opportunity for an international Ecuadorian Amazon integrating Waterway to Manaus.

- Group 3 – Access to the Huellaga – Marañón Waterway: The function of this group is to improve the logistics of access to the Huellaga and Marañón waterways and their ports, to consolidate the coast – mountain – forest integration corridor in the northern region of Peru and its regional complementation with the state of Amazonas in Brazil; and to permit the articulation of these zones with the South and Southeast regions of Ecuador.

- Group 5 – Access to the Ucayali Waterway: The strategic function of this group is to increase the competitiveness of the coast – mountain – forest integration waterway in the central corridor of the Peruvian territory, interconnecting the main urban Center of the country, the South-central zone and the states of Acre and Amazonas in Brazil.

- Group 5 – Access to the Solimões (Amazon) Waterway: The purpose of this group is to consolidate a paved route to improve the transport logistics from/to the North of Mato Grosso through the river ports on the Tapajós and Amazon Rivers with capacity to carry out long distance logistic operations to the Atlantic and Pacific Oceans.

- Group 6 – The Amazon Waterway Network: The strategic function of this group is to improve the navigability conditions of the rivers in the Amazon basin to promote the sustainable development of the region in its economic, social and environmental dimensions and gradually generate long distance and bi-oceanic transport flows.

- Group 7 – Access to the Morona – Marañón – Amazon Waterway: It's purpose is to improve the logistics of national integration between the Ecuadorian provinces of Guayas, Canãr, Azuay and Morona Santiago, as well as El Oro, Loja and Zamora – Chinchipe to consolidate the opportunities for international integration of the southern half of Ecuador and the Northeast of Peru with the state of Amazonas in Brazil, through a Waterway to Manaus.

In addition to these objectives, Groups 1, 2, 3 and 4 also aim to make the interconnection of the interior of the continent with the Pacific basin possible.

These groups presented a total of 58 projects with investments estimated at 5.4 billion dollars. Of all these projects, 17 were focused on river transport, with 9 directed to improving river navigability, 2 related to the construction of new river ports and 6 connected to improvements of the existing river ports, generating an approximate investment of 0.4 billion dollars specifically in this area.

After surveying all the improvements for this axis, eight anchor projects were identified. They are:

Table 3.2.18: Project Portfolio of the Amazon Axis

Groups	Anchor Projects	Estimated Investments (million US$)	Type of Financing	Scope	Project Status
1	**Tumaco – Pasto – Mocoa – Porta Assis Highway (CO)**	373,0	Public	National	Underway
2	**Francisco de Orellana Port (CE)**	105,3	Public	National	Pre-execution
3	**Tarapoto – Yurimaguas Road and Port of Yurimaguas (PE)**	219,5	Public/Private	National	Underway
4	**Tingo Maria – Pucallpa Road and Port of Pucallpa (PE)**	345,6	Public/Private	National	Underway
5	**Cuiabá – Santarém Road (BRA)**	900,0	Public	National	Underway
6	**Navigation improvements in the Solimões – Amazon system (BRA)**	0,0	Public	National	Completed
6	**Environmental and social aspects of the upper basin of the Amazon Rivers (CO-ECU-PE)**	0,7	Public/Private	Tri-national	Design
7	**Morona cargo transshipment port (ECU)**	51,0	Public	National	Design
TOTAL		**1.995,1**			

Source: IIRSA - Cartera de Proyectos IIRSA 2010: Eje del Amazonas (2010 IIRSA Project Portfolio: Amazon Axis)

Among the anchor projects, two encompass Brazil: the navigation improvements of the Solimões – Amazon system and construction of the Cuiabá-Santarém road. The first, according to the document, was already completed, generating better navigability conditions and, thus, greater demand for the waterway. The second Project also aims to increase demand for the waterway. The idea is that by constructing the paved Cuiabá – Santarém road, access to the Solimões waterway will improve, thus increasing the flow of cargo to its river ports and, subsequently, for export.

3.2.5 Amazon Waterway System SWOT

Strenghts	Weaknesses
• Most of the rivers in the region are navigable during the rainy season. • The Amazon and Solimões Rivers are navigable by commercial convoys the entire year. These rivers are very wide and deep and not very sinuous. • The Trombetas River is navigable by marine vessels between its mouth and Porto Trombetas. • The majority of rivers in the region have low declivity. • There is a cooperation treaty in the Amazon region (TCA), signed by all members of the waterway system (including international members), which addresses issues of infrastructure, environment, tourism, health, transport, education, indigenous communities, etc. • There is little competition from other transport modes. • There is significant transport of cargo in the region (close to 9.8 million tons: soybeans, corn, chemical products, oil products and ro-ro), as well as of passengers (1 million passengers are transported per month). • The ports of Itacoatiara and Santarém are important for the export of soybeans and corn.	• The Amazon rivers have great variation in water level over short spans of time. • During the dry season, natural obstacles appear on the Rivers beds, such as rocks and sandbanks that can limit navigation conditions. • There are few intermodal connection alternatives to support waterway transport in the region. • The Solimões River is shallow during the dry season. • The tributary rivers on the right bank of the Amazon River have high levels of sedimentation. • The tributary rivers on the left bank of the Amazon River have areas with the presence of rocks. • AHIMOC faces operational difficulties, imposed by lack of access to financial and human resources (due to an agreement signed between the DNIT/DAQ and CODOMAR). • Planning of future interventions in the region must take into account the high concentration of environmental protection areas, such as indigenous communities and Integrated Protection Conservation Units. The Negro, Solimões, Purus/Acre and Iça Rivers have greater social and environmental vulnerability to future interventions. In the Tarauacá, Envira e Juruá Rivers there is a significant occurrence of indigenous communities. There is vast plant cover around the Rivers of the region. These aspects should be adequately considered when planning any interventions necessary for expansion of the regional waterway structure.

Opportunities	Threats
• A dam is planned for construction on the Branco River, allowing navigation from Manaus to Boa Vista. • The rivers in the region can facilitate and expand trade relations between Brazil, Peru, Colombia and Venezuela. • IIRSA dedicates special attention to the region, planning investments to foster more integration among the countries. • Since most of the rivers in this waterway system are used as transport routes, there is already a port structure, demanding, possibly, less interventions and, consequently, resulting in less impact on communities and forests along the rivers. • Since the Amazon is an area of preservation important to the country, strengthening inland waterway transport tends to reduce the need to construct new roads that have greater environmental impact than the use of waterways. • Agricultural production is moving toward the North of the country. This provides the ports in the Amazon region with a good growth opportunity. • Tourism and passenger transport in vessels are important in the region. Expansion of waterway transport of cargo can positively influence (security) the transport of passengers and local tourism, as long as it is planned in an integrated manner.	• Since the Amazon WS is, potentially, an international WS, international agreements (Brazil-Colombia-Venezuela-Peru) need to be negotiated to avoid, among others, illegal transport of cargo along the waterway. • Intensification of inland navigation can encourage a change in land use around the Rivers, which can conflict with planned zoning for the region, which provides for, in large part, sustainable use of the land (ZEE).

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