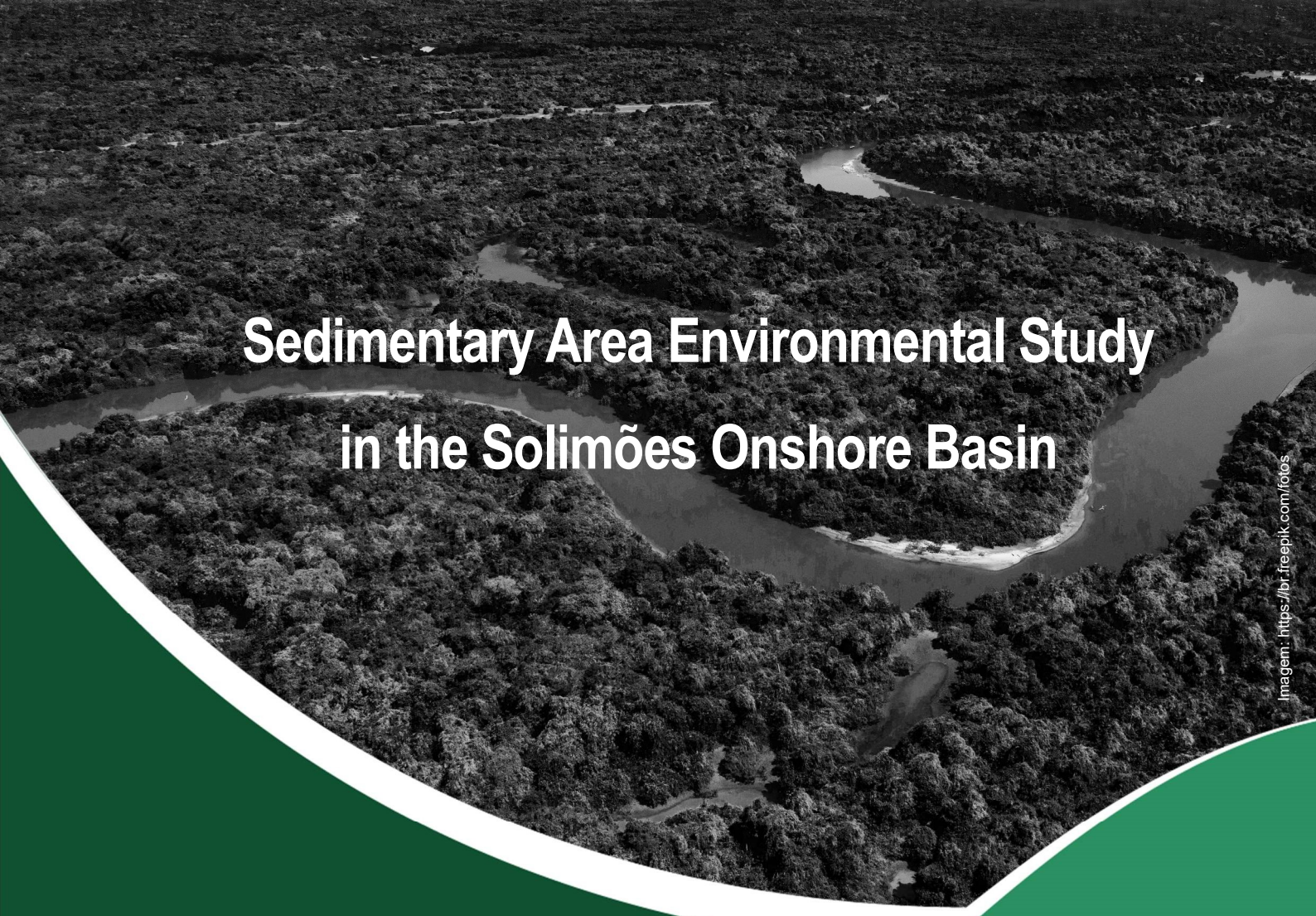
Sedimentary Area Environmental Study in the Solimões Onshore Basin



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Executive Version

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Executive Version

Manaus | Rio de Janeiro - Brazil

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Technician in Charge: Carlos Edwar de Carvalho Freitas [PIATAM/COPPETEC Consortium]

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1 Introduction, Assumptions and Methodological Approach

The Sedimentary Area Environmental Study in the Solimões Onshore Basin (EAAS Solimões) is a document prepared by a multidisciplinary team, intended to subsidize the concession of areas for exploration and production of oil and gas, in addition to pointing out recommendations for the environmental licensing of new petroleum activities in Solimões sedimentary basin.

The Interministerial Ordinance MME/MMA 198, dated April 5, 2012, established the EAAS as the strategic and central instrument for the Sedimentary Area Environmental Assessment (AAAS) process. The AAAS includes monitoring of the EAAS development by an interministerial group named the Monitoring Technical Committee (CTA, in its Portuguese acronym), composed of the Ministry of Mines and Energy (MME), Ministry of the Environment (MMA), National Agency of Petroleum, Natural Gas and Biofuels (ANP), Brazilian Federal Environmental Agency (Ibama), Energy Research Office (EPE), Chico Mendes Institute for Biodiversity Conservancy (ICMBio) and National Water and Basic Sanitation Agency (ANA). There were 33 CTA meetings to monitor EAAS Solimões development.

The AAAS first objective is "to subsidize governmental actions towards the sustainable development and the strategic planning of activities and projects of oil and gas exploration and production". Following the AAAS process, the present EAAS will subsidize the Conclusive Report that will be prepared by CTA and forwarded to the Interministerial Commission, yet to be designated. Figure 1.1 shows all the steps in the AAAS process.

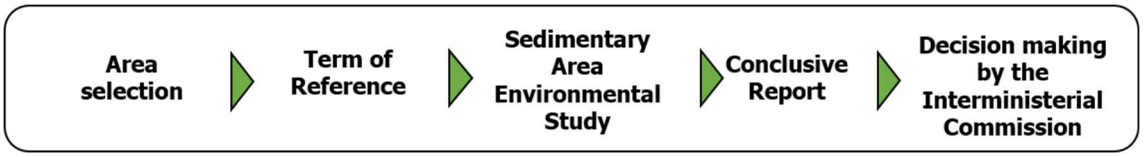

Figure 1.1 - Sequence of the AAAS process.

The EAAS supports the sustainable development of oil and gas resources, under the sustainability concept in its broadest perspective, which includes the environmental, economic and social spheres. However, as it is a strategic study, EAAS does not analyze or authorize specific projects. The implementation of future oil and gas projects will depend on technical and economic feasibility studies, as well as on ordinary environmental licensing processes.

The Solimões sedimentary basin was the first onshore area selected by the MME to be submitted to the EAAS. The strategic objectives for new oil resources in areas of knowledge frontier were: national self-sufficiency and surplus for the export of oil and gas; payments to the Public Administration (royalties and special participations); creation of jobs; Infrastructure development; and planning the concession of areas for exploration.

On account of being a strategic scale study, the EAAS Solimões had three premises. The initial premise was the priority use of secondary data, complemented by primary data, especially for regional social and environmental baseline, for which information was obtained through interviews, meetings and workshops with stakeholders.

The second premise guided the delimitation of the Strategic Influence Area (AIE) (Figure 1.2). AIE comprises the Effective Basin and the municipalities and other areas defined by sensitive socioenvironmental factors, which can influence or be influenced by the activities of exploration, production and flow of oil and gas, establishing the limits for the preparation of the Regional Social and Environmental Baseline. The Effective Basin corresponds to the territorial space of the Solimões Onshore Sedimentary Basin which presents potential interest for the exploration and production of oil and gas (EPE, 2017). Based on this premise, the classification regarding the suitability for oil and gas activities is restricted to the Effective Basin.

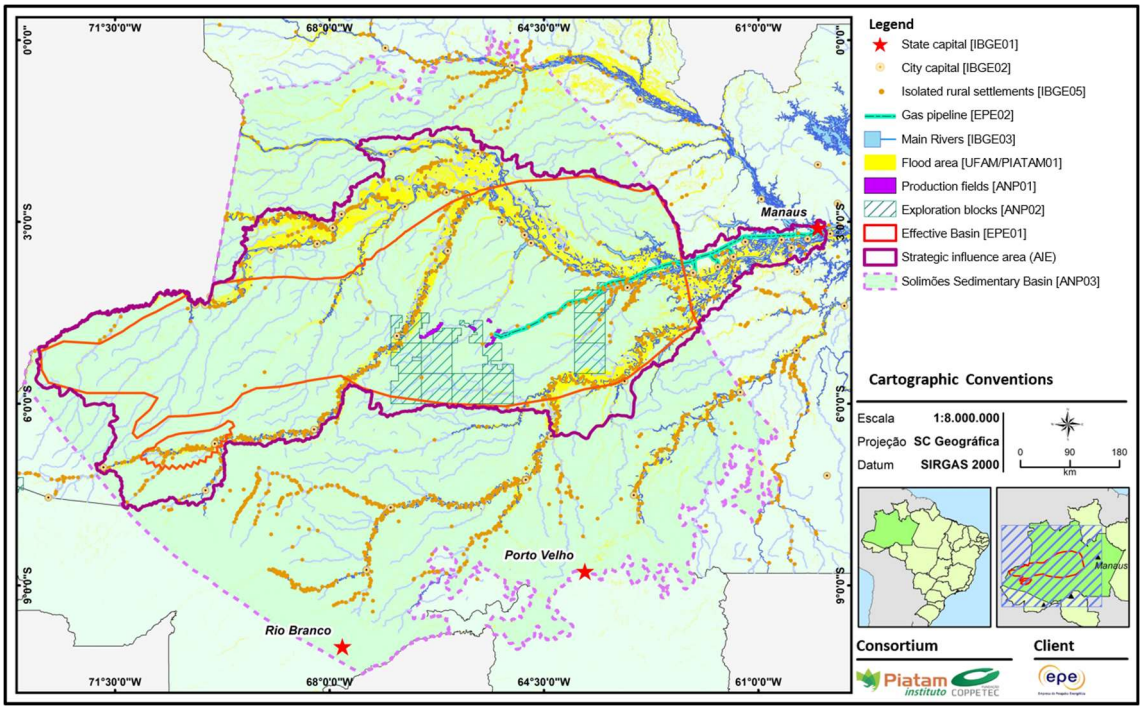

Figure 1.2 - EAAS Solimões Effective Basin and Strategic Influence Area.

Finally, the participation of society was also a premise of EAAS Solimões. Five groups of stakeholders have been identified in the region: Public Administration, Indigenous Peoples and Traditional Communities, Universities, NGOs and Companies. The group "Indigenous Peoples and Traditional Communities" was the focus of greater attention in moments of public participation, due to its marked presence in the study area, but above all due to their socio-cultural specificities, the social vulnerabilities they are subjected to and their direct dependence on natural resources for reproducing their ways of life. As established in Ordinance 198/2012, the study was submitted to an in-person public consultation in the cities of Carauari, Tefé, Coari and Manaus, and to a broad on-line consultation from Dec 20th, 2019, to Apr 3rd 2020. In addition to public consultation, there were other moments of public participation: participatory mapping meetings, context and strategic focus consolidation workshop (workshop 1), strategic options comparison workshop (workshop 2) and informative meetings (Figure 1.3).

Figure 1.3 - EAAS Solimões Participatory Process, in six phases
(Photos had their resolution deliberately reduced to preserve the identity of the participants)

The effort engaged to obtain data / information is summarized in Table 1.1.

Table 1.1 - Summary of data collection

Data Sources	Quantity
Cartographic documents[1]	**49**
Bibliographic documents [1]	**429**
Interviews conducted	**103**
Workshops[2]	**2 (2 days each)**
Participatory Mapping Meetings[2]	**3 (3 days each)**
Informative Meetings[2]	**3 (3 days each)**
CTA meetings	**33**
In-person Public Consultation meetings[2]	**4**

[1] The complete references for cartographic and bibliographic documents can be found in the full version of EAAS Solimões

[2] The number of participants by group of stakeholders is registered in the full version of EAAS Solimões

It is important to highlight that, according to article 28 of the Interministerial Ordinance 198/2012, AAAS conclusions will focus only on areas to be granted, ensuring the continuity of the enterprises or activities licensed or authorized before its elaboration. Likewise, the conclusions of AAAS will not focus on areas that are subject to the assignment of rights, which is the process of transferring the concession from one company to another (e.g., Petrobras divestment process) and which has rules established in contracts still in force.

The EAAS Solimões aimed minimizing Risks and maximizing Opportunities associated with future oil and gas activities in the region. To this purpose, it was necessary to: 1- establish a knowledge base to identify Risks and Opportunities; 2- analyze the impacts of alternative scenarios of increased oil activities in the region on the identified Risks and Opportunities; 3- classify the region's suitability for future oil and gas activities, in order to avoid the main Risks; and 4- develop guidelines, recommendations and action plans to maximize Opportunities and minimize residual Risks (Figure 1.4).

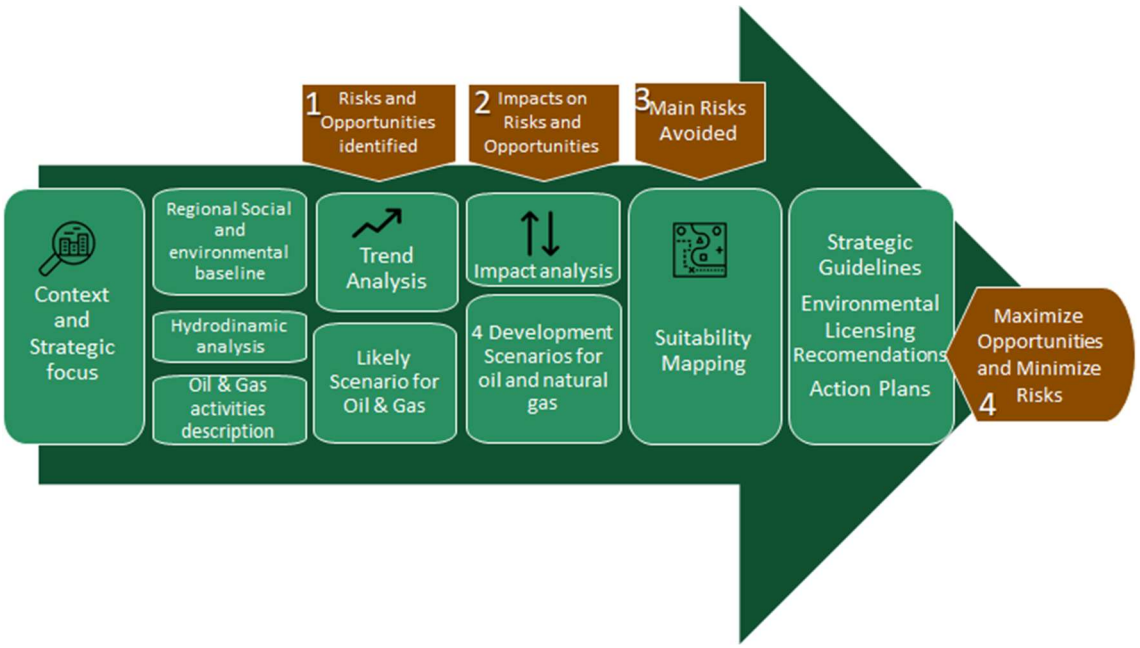

Figure 1.4 - Flow of steps developed during EAAS Solimões.

The Context and Strategic Focus definition sought to ensure that EAAS Solimões focuses on the themes that are relevant to the strategic objectives. The Context can be defined as the socioenvironmental, institutional and normative reality, while the Focus is

the main attention that must be given when analyzing each of these aspects, structured in three tables:

- Strategic Assessment Framework: composed of Critical Decision Factors (CDFs), Assessment Criteria and their Indicators, developed from a strategic approach. Illustrates the socioenvironmental context of the study region, described in the Regional Social and Environmental Baseline. This diagnosis was made with a focus on **Strategic Influence Area** (AIE, in its Portuguese acronym), municipalities or other areas defined by socioenvironmental factors that are subject to the opportunities and risks of expanding the exploration and production of oil and gas;
- Governance Framework: portrays the political and institutional context in the region, as well as the role, responsibilities, relationships and forms of cooperation between identified interest groups, focusing on governance gaps;
- Strategic Reference Framework: comprises the relevant policies, plans and programs in the region, as well as the legal regulations relevant to the Study, focusing on regulatory gaps.

The Oil and Gas Activities Description sought to describe the petroleum resource characteristics and its development history in the Solimões sedimentary basin. In addition, it reports the industry's best practices and the common environmental impacts from these activities.

The Hydrodynamic Base presented the hydrological conditions of Solimões River. Moreover, hypothetical oil spills were simulated through computer modelling for the Solimões River itself and some tributaries. The objective was to understand the behavior of the locally produced oil and to provided inputs for the discussion of impacts associated with accidental oil spills events.

To analyze the interaction between future oil and gas activities in the region and the socioenvironmental context described in the Regional Baseline, Scenarios were developed, which are alternatives for the development of these activities. The Likely Scenario provide the core elements for trend analysis, prepared considering the current situation of each of the Baseline indicators and their likely evolution in the next 20 years. From the Trend Analysis, it was possible to identify Risks and Opportunities, i.e.,

Baseline indicators that would interact negatively (Risks) or positively (Opportunities) to future activities.

The Development Scenarios represent four hypothetical alternatives on the development of oil and gas activities in the region, considering the type of existing resource and the intensity of the activity over the 20-year time frame. Based on the established scenarios, the strategic environmental impacts of the Development Scenarios on the identified Risks and Opportunities were assessed. Strategic Options were also developed, which were comprised by spatial and technological alternatives for the development of the Scenarios. These Options were compared to each other, also considering their effects on the identified Risks and Opportunities.

The main Risks identified were used as indicators of unfeasibility, i.e., areas of the effective Basin where the development of oil and gas activities should be avoided, due to the fact that the technology and the mitigating measures currently known do not allow the impacts to be efficiently avoided.

Subsequently, Strategic Guidelines, Recommendations for Environmental Licensing and Action Plans were prepared in order to minimize other Risks and maximize the Opportunities observed during the previous steps.

2 RESULTS

2.1 Context and strategic focus

The Strategic Assessment Framework defined 42 indicators for the Baseline, belonging to two groups of Critical Decision Factors: 'Land use and social characteristics' and 'Biodiversity and environmental assets'. This Framework illustrates the context and priorities of the assessment, guiding trend analysis and assessment as a whole.

Governance capacity in the region is determined by the presence of institutions, governmental and non-governmental, that act in the socioenvironmental protection of specific groups of the population or in certain areas, as well as in the promotion and development of oil and gas activities. Some areas, especially those far from regional urban centers, lack the operation of governmental institutions.

The presence of inspection and control agencies is concentrated in urban centers. Only the State Prosecution Service (MPE, in its Portuguese acronym) is present in all municipalities. ICMBio is present in five municipalities: Carauari, Jutaí, Manaus, Tapauá and Tefé. The Federal Prosecution Service (MPF, in its Portuguese acronym) is present in Manaus, Tabatinga and Tefé. IBAMA in Manaus and Tabatinga and National Institute for Colonization and Agrarian Reform (INCRA, in its Portuguese acronym) only in Manaus.

Policies, Plans and Programs (PPPs) have mostly national coverage (68%), in contrast to state, regional and municipal coverage. Among these PPPs, 30% are targeted at companies in the oil and gas sector, 42% are aimed at the population of the region, 15% are aimed at the country's indigenous peoples, and 13% are aimed to the environment.

The PPPs were classified in planning, management or development types, and about 48% of them showed to be related to the socioenvironmental and economic development programs of the region. Management policies correspond to 36%, while planning policies represent less than 15%.

2.2 Regional Social and Environmental Baseline

This analysis allowed us to understand the sensitivity of the Solimões sedimentary basin and showed a region of rich diversity, in social, cultural and environmental terms, but also several conflicts concerning land issues and the use of certain resources.

The acknowledgment of this social, cultural and environmental diversity in the region has generated administrative measures seeking to ensure their protection. The territorial expression of state recognition of the value of these areas is expressed in the numbers presented in Table 2.1.

In regard to indigenous peoples, there is a great diversity of identified peoples: Mura, Apurinã, Arara, Munduruku, Kambeba, Miranha, Tikuna, Paumari, Kokama, Matses, Kulina, Matis, Kanamari, Kaixana, Katukina, Deni, Marubo, Hi-Merimã, Korubo, in addition to groups who live in voluntary isolation. In addition, there are situations of insufficiency in the implementation of indigenous rights - especially territorial rights - aggravated by prejudice based on ethnic discrimination. The Hi-Merimã and the Korubo indigenous peoples, who live in isolation, are the most vulnerable. The situation of social and territorial vulnerability is common to all indigenous peoples. In a decreasing scale of

vulnerability are the isolated and the recently contacted indigenous peoples. They are indigenous peoples who inhabit indigenous lands not acknowledged by Government (especially those who are in the process of ethnogenesis - that is, processes of social and political articulation of the identity of ethnic groups traditionally submitted to domination relations), and the indigenous peoples who inhabit the indigenous lands acknowledged by Government. The social vulnerability of indigenous and traditional communities stood out due to the absence or inefficiency of public social policies in the areas of land regularization, education, health, transport, communication, basic sanitation, energy and housing.

Table 2.1 - Territorial Units of the Effective Basin and Strategic Influence Area

Territorial Units		Effective Basin			Strategic Influence Area (AIE)		
		No.	Area (km²)	% of the Effective Basin	No.	Area (km²)	% AIE
Conservation Units	Preservation	3	8,471.28	2.7%	6	12,709.60	2.7%
	Sustainable Use	11	53,950.59	17.4%	22	92,489.83	19.%
Indigenous Lands	Acknowledged by Government	35	69,200.98	22.4%	64	105,470.34	22.4%
	Not acknowledged by Government	59	12,638.00**	4,1%	[59-100]*	22,432.66	4.8%
Humanity Natural Heritage		1	19,021.79	6.%	1	32,900.13	7.0%
Quilombola Land		1	4,233.99	1.4%	1	4,497.54	1.0%
Settlements		12	1,610.00	0.5%	36	13,029.89	2.8%
Others (water bodies, cities, vacant lands and private properties)		--	166,550.00	54%	--	233,198.94	75.3%
Effective Basin		**--**	**309,539.27**	**100%**	**--**	**309,539.27**	**65.7%**
Strategic Influence Area (AIE)		**--**	**--**	**--**	**--**	**470,975.73**	**100%**

*Sources: IBGE/FUNAI (2010); CIMI (2017, 2018); Knowledge Management and Participant Mapping Workshops (2018, 2019); *Indigenous lands not acknowledged by Government in the AIE: only 100 were taken into account, i.e., there may be more; **Indigenous lands not acknowledged by Government in the Effective Basin: for 17 lands (of 59) the indicative polygons of the traditional occupation area were not identified, therefore, the total area is larger than presented here.*
Note: The sum of the percentages of territorial units does not total 100% due to territorial overlap between some of the units themselves.

In general, traditional communities located within Conservation Units (UCs, in its Portuguese acronym), quilombola communities and settlements are socially vulnerable, but to a lesser extent in relation to “vulnerable communities”, as referred to in this study (communities outside UCs). Despite invasions, other conflicts and social problems due

to the absence or inefficiency of public policies, those communities in regularized territories are protected in some way. Most of the “vulnerable communities” were detected in the municipality of Carauari, far from the UCs surroundings, in the lower and middle Juruá and Riozinho.

According to stakeholders heard during the participatory process, the oil and gas sector, and its associated services, motivated a migratory flow seeking job opportunities to the urban area of Coari and the surrounding areas. However, it is clear that this sector has historically not been enough to transform the municipality into a pole of regional influence. According to The Brazilian Institute of Geography and Statistics (IBGE, in its Portuguese acronym), until 2007, Coari had not constituted a pole of influence, remaining as a Local Center, whose centrality and performance do not go beyond the municipal territory.

The Strategic Influence Area defined for the EAAS Solimões is formed predominantly by the sedimentary basin of the Solimões River and its tributaries, including the lower stretch of this river until its confluence with Negro River, also covering the city of Manaus. It is a region of great dimensions and remarkable socioeconomic and environmental contrasts. With the exception of the area around Manaus (a city with more than two million inhabitants), and of the banks of Solimões River, from the city of Coari to the confluence with Negro River this is the most preserved region in the Amazon, with much lower deforestation rates than the state of Amazonas.

The landscape is shaped by the large rivers, their tributaries and the floodplain, covering more than 100,000 km^2, in addition to extensive non-floodable areas called *"terra firme"*. Around 84% of the AIE's floodplain area is occupied by water in the aquatic phase of the flood pulse and the vegetation is composed by seasonally flooded forests and meadows, called *“várzea”*. Such formation is present along the channel of large rivers, covering winding channels (meanders) and most of the lakes present in the region. The dynamics of the water entering and exiting in these areas is responsible for the deposition of suspended sediments composed of organic matter and nutrients. The annual intake of nutrients together with the hydrological cycle maintains the great fishing productivity of the *várzea*.

Surface waters are used for domestic supply, including direct consumption by humans. The water quality is, in general, good, and values that diverge from the established

standards for environmental quality are due to natural processes. *Vázeas* are extremely sensitive to environmental accidents due to low elevation. In these areas, there are a large number of lakes, with a high density of fish that are exploited for subsistence by riparian dwellers and commercial fisheries. Low-order channels, locally called “igarapés”, at elevations of up to 280 m, are sensitive ecosystems because they present greater probability of endemism of aquatic fauna. These environments are in greater concentration in the interfluvial region of Juruá, Javari and Solimões rivers.

The Amazon is home to a high biodiversity and high levels of endemism have been observed in several areas. However, the identification of endemic fish species occurred in areas where scientific sampling was more intense, which indicates that sampling gaps in the region represent a limitation for mapping endemic fish. Other aquatic species, such as the manatee (*Trichechus inungis*) and the overexploited fish species, are distributed throughout the study area. Likewise, the sedimentary basin of the Solimões River is home to a number of species of vertebrates and invertebrates, whose natural history, taxonomy and geographic distribution are still uncertain and need to be investigated. Due to the information gaps found and the region's high potential biodiversity, Priority Areas for the Conservation, Sustainable Use and Benefit Sharing of Brazilian Biological Diversity (APCBs, in its Portuguese acronym), recently reviewed by the Ministry of the Environment, were used as indications of areas relevant to biodiversity conservation. The large proportion of APCBs with extremely high biological importance associated with the priority and type of recommended action demonstrates the great importance and lack of knowledge about the distribution of biodiversity in the area of the effective basin.

It was evidenced that the areas of fisheries agreement and management of pirarucu (*Arapaima gigas*) are located mainly in lake systems of the *várzeas* of Solimões and Juruá Rivers, where these governance measures provide conservation and minimize conflicts for the use of this natural resource. Other sensitive ecosystems highlighted in this study were the confluence of rivers (especially between white water and black or clear water rivers - fish breeding sites) and “*tabuleiros*” (turtles’ nesting sites). In addition, two landmark Ramsar sites for AIE are present: Mamirauá and Juruá River Sustainable Development Reserve (wetlands of global ecological relevance, according to the Ramsar Convention).

2.3 Oil and Gas Activities Description

The Solimões Sedimentary Basin has an area of approximately 1 million km^2, about 40% of which are potentially prospective for oil and gas due to its geological characteristics. The basin still has potential for unconventional gas resources with the possibility of shale gas.

The activities of the oil industry in Solimões basin began in the 1950s, and since then there have been about 185,000 km of 2D seismic, 9,000 km^2 of 3D seismic, drilling of 206 exploratory wells and 160 production wells. There are currently 13 exploratory blocks under concession in the region and eight fields discovered with reserves of 6.86 million m^3 of oil and 39.19 billion m³ of natural gas. These volumes correspond to about 0.3% of the oil reserves and just over 10% of the country's natural gas reserves. The relevance of the Solimões sedimentary basin stands out in the onshore production of natural gas, with production about 3.7 and 7.5 times higher than those produced in the main Brazilian basins, Parnaíba and Recôncavo respectively.

The model adopted in the seven fields currently in production, all operated by Petrobras, comprises the interconnection of smaller fields in a central processing hub located close to the larger fields, known as the Petroleum Province of Urucu. The flow of oil and gas is carried out through multiphase pipelines, poly-pipelines, gas pipelines and ships with the support of terminals. The oil is sent to the Isaac Sabbá Refinery (REMAN), in Manaus, and natural gas is sent to 8 delivery points located in the municipalities of Anamã, Anori, Caapiranga, Coari, Codajás, Iranduba, Manacapuru and Manaus.

Regarding the possibility of future exploratory activity in the basin, 18 blocks are being evaluated for the second stage of the Open Acreage and must undergo a Public Hearing before the publication of the Bidding Notice. In this context, considering a short/medium term horizon, exploratory activity in the region will be restricted to the area of the blocks granted, currently operated by the company Rosneft Brasil.

2.4 Scenarios and Strategic Options

The Likely Scenario portraits the oil and gas production volumes of total reserves expected to be produced in the next 20 years. The data points to a drastic volume drop in the period that could alter socioeconomic and environmental relations in the region. The most immediate effects are the reduction of royalties' revenues from the exploitation

of oil and gas. The Likely Scenario analysis shows that in 2030 these revenues does not reach 200 million reais for the entire Solimões Basin, which means up to 70% drop relative to 2020 considering the more optimistic context in oil and gas prices.

The development scenarios are hypothetical scenarios built based on industry development estimates over a 20-year horizon. The scenario construction methodology used oil and gas production curves produced by EPE as a basis for predicting the intensity, nature and extent of E&P activities in the region under study (Figure 2.1). It´s worth noticing that "medium activity" and "high activity" refer to E&P of conventional resources. In addition, shale gas exploration requires a larger number of production wells.

In view of the conditions established for the production and royalties' projections for the Solimões sedimentary basin in the Likely Scenario and any plans, programs and policies planned or in progress for AIE, a summary describes the current situation and the trend line for each indicator analyzed in the Baseline. In addition to the textual description of the trend line, the indicators were also analyzed from the perspective of three factors:

- Trend Line Direction - improvement (>), maintenance (=) or deterioration (<) of the status of the indicator (a summary of the Trend Line);
- Relationship with the O&G industry - negative (-), neutral (0) or positive (+), depending on the expected impacts of petroleum activities in general on the status of the indicator;
- Influence of the Likely Scenario - negative (-), neutral (0) or positive (+), depending on the expected impacts of the expected oil activities under the Likely Scenario on the status of the indicator.

The trend analysis for the FCD Indicators on Territory Use and Social Characteristics showed that the Direction of the Trend Line quite varied between improvement, maintenance and deterioration. Most indicators show a negative relationship with the O&G industry. Eight indicators had positive outcomes, and among them, four were impaired by the decrease in production associated to the Likely Scenario and therefore were considered *Opportunities* – aspects that can be positively enhanced in the face of oil and gas activities.

Concerning the FCD Biodiversity and Environmental Assets, the Trend Line Direction generally showed maintenance or deterioration on the indicators' status. The relationship

with the O&G industry was neutral or negative and the influence of the Likely Scenario was considered neutral for all indicators.

The *Risks* identified in the present study, i.e., aspects that tend to suffer negative impacts from O&G activities, are the indicators that showed a negative relationship with the activities, to different degrees. Therefore, the indicators identified as *Opportunities* and *Risks* were grouped, according to their thematic relation, for the analysis of the strategic impacts of the Scenarios and for the comparative analysis of the Strategic Options (Table 2.2).

For the Impacts Analysis of the Development Scenarios, the strategic impacts were analyzed over the Risks and Opportunities, which were considered the receptors of the effects generated by the oil and gas activities. It is important to highlight that the development scenarios are hypothetical and are not associated with specific localized activities, and therefore, the nature of this analysis is purely qualitative and comparative. The impact magnitude from each Scenario was obtained from the estimated data of Seismic survey, Exploratory wells, Production wells and Production volumes shown in Figure 2.1.

Table 2.2. Diagnostic Indicators identified as Risks and Opportunities for future oil and gas activities in the effective Solimões Basin.

	Indicador	Direction of the trend line	Relation with the O&G industry	Influence of the Likely Scenario	
1	Municipal Budget	<	+	-	OPPORTUNITIES
1	Hospital structure and supply of hospital beds	<			
1	Basic sanitation	>			
2	Employment level	<			
1	Traditional use areas	=	-	0	RISKS
1	Lands traditionally occupied by indigenous peoples	<			
1	Isolated indigenous / indigenous peoples	>			
2	Conservation Areas	<			
2	Natural heritage	=			
2	Traditional communities	<			
2	Settlement Projects - PAS and Quilombola Land	<			
3	Resolution of land conflicts	=			
3	Social Organization	=			
3	Cultural rituals and practices	>			
4	Lakes and *várzeas*	<			
4	Demographic dynamics	=			
4	Distribution of overexploited fish species	<			
4	Water quality	=			
4	Areas of occurrence of manatee (*Trichechus inungis*)	<			
4	Chelonian spawning sites (turtles)	<			
4	Pirarucu fisheries and management agreement areas (*Arapaima gigas*)	<			
4	Fish breeding sites	=			
4	*Terras caídas*	<			
5	Endemic fish species	=			
5	First and second order streams	=			
6	Aquifer	=			
6	Water supply	=			

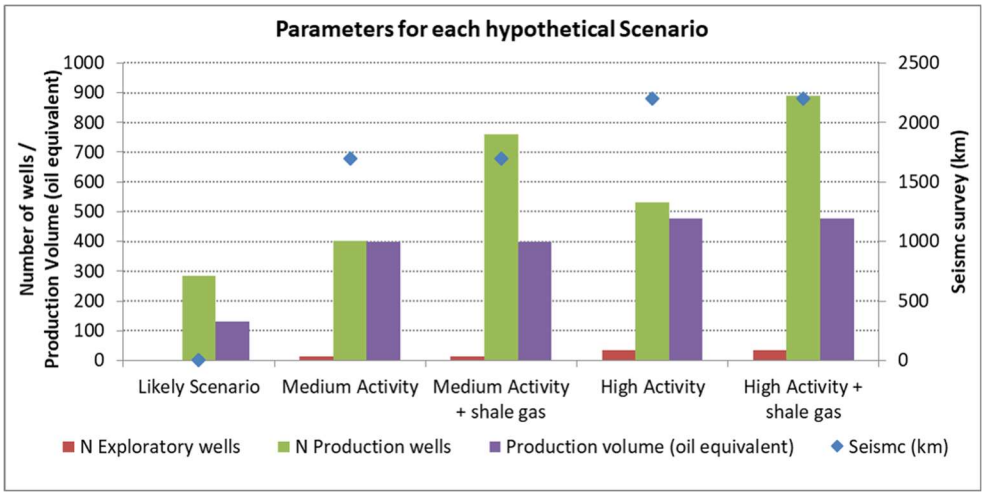

Figure 2.1 - Total estimated parameters for the hypothetical scenarios of future oil and gas activities in the Solimões Effective Basin
(Numbers for the development scenarios are values for the Likely Scenario + additional numbers)

The environmental impact analysis established which impacts would affect each indicator and how the impact magnitude varies depending on the development phase. By applying specific values for each situation and adding the results, it was possible to divide them into three classes, based on the value found for the Likely Scenario - VR (lower than four times VR = light green for positive effect and yellow for negative; between four- and five-times VR = medium green for positive effect and orange for negative; and greater than five times VR = dark green for positive effect and red for negative) (Table 2.3).

The Strategic Options considered spatial, technological and temporal alternatives under the premises of each development scenario (Figure 2.2). Each development scenario has new infrastructures requirements that could be placed on existing production fields and exploration blocks. On other not granted areas, only a new complex (similar to the Province of Urucu) would be possible for all scenarios, being one hypothetical field in the medium activity scenarios for E&P of conventional resources and two hypothetical fields forming a complex in scenarios of high activity for conventional resources. For the development of this complex, considering that the prevalent resource is natural gas, it was established that in areas up to 50 km away for the Arara - Coari Complex gas pipeline, production will be carried by this gas pipeline. In other sites, where the gas production would be more than 50 km away from the Arara Complex, the most feasible option was natural gas liquefaction and transportation by ferry boat. Representatives from different segments of society also gave opinion about these strategic options on a specific workshop and helped assessing risks and opportunities.

Table 2.3 - Comparative assessment of the strategic impacts of the Development scenarios

		Strategic Indicators / Impacts	Medium Activity	Medium Activity + Shale Gas	High Activity	High Activity + Shale Gas
Opportunities	1	Municipal Budget				
		Hospital structure and supply of hospital beds				
		Basic sanitation				
	2	Employment level				
Risks	1	Traditional use areas				
		Lands traditionally occupied by indigenous peoples				
		Isolated indigenous / indigenous peoples				
	2	Conservation Units				
		Natural heritage				
		Traditional communities				
		Settlement Projects - PAS and Quilombola Land				
	3	Resolution of land conflicts				
		Public civil actions				
		Social Organization				
		Cultural rituals and practices				
	4	Lakes and *várzeas*				
		Demographic dynamics				
		Distribution of overexploited fish species				
		Water quality				
		Areas of occurrence of manatee (*Trichechus inungis*)				
		Chelonian spawning sites (turtles)				
		Pirarucu fisheries and management agreement areas (*Arapaima gigas)*				
		Fish breeding sites				
		Terras caídas				
	5	Endemic fish species				
		First and second order streams				
	6	Aquifer				
		Water supply				

Table 2.3 can be transposed into a matrix of risks versus opportunities for comparing development scenarios, as shown below:

Table 2.4 - Scenario Risks and Opportunities Matrix

		Risks		
		Low	**Intermediate**	**High**
Opportunities	**Low**	Medium Activity Scenario	Medium Activity and Shale Gas Scenario	
	Intermediate		High Activity Scenario	
	High			High Activity and Shale Gas Scenario

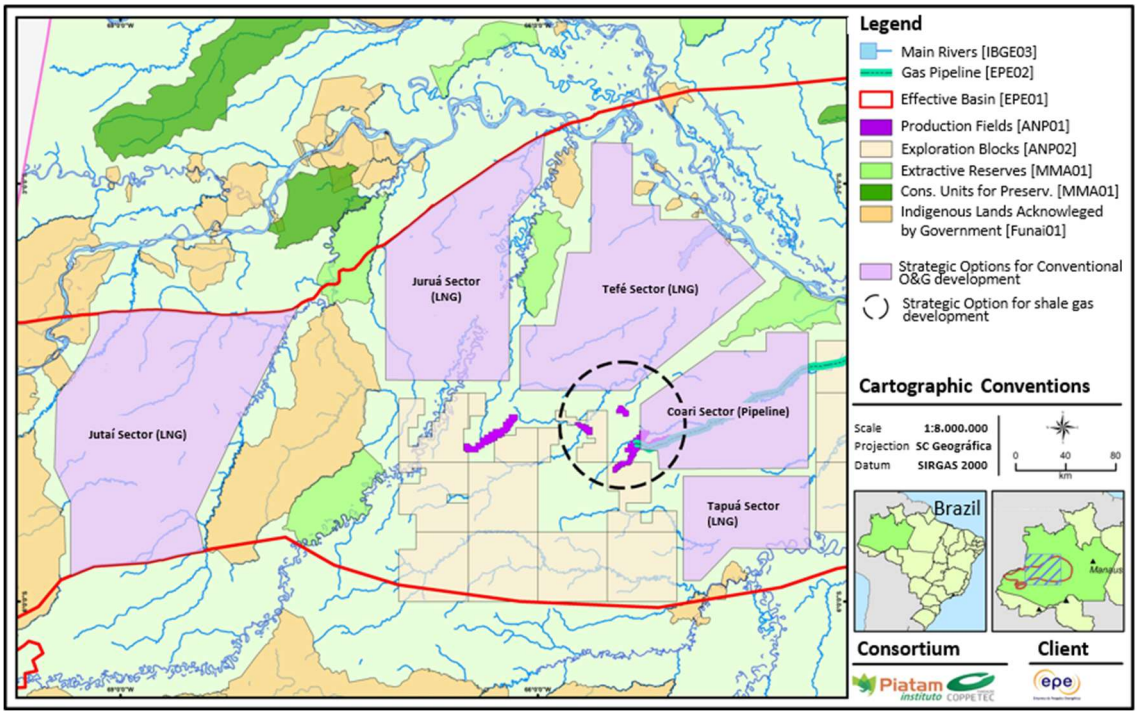

Figure 2.2 - Strategic Development Options for conventional resources and shale gas.

2.5 Suitability mapping

The sedimentary area suitability classification aimed to point out fit, unfit or in moratorium areas for the future exploratory blocks granting (in accordance with Interministerial Ordinance MME/MMA No. 198/2012). Below is the description of each class:

a) **Fit Areas**: identified areas where socioenvironmental conditions and characteristics are compatible with oil and gas exploration and production activities and projects, using the best industry practices;
b) **Unfit Areas**: identified areas that has highly relevant environmental assets and the requirement for conservation is incompatible with the non-mitigable impacts and risks associated to oil and gas exploration and production;
c) **Areas in Moratorium**: identified areas where there is important scientific knowledge gaps or relevant socioenvironmental conflicts. In this case, further studies and technological development of more environmentally appropriate alternatives are necessary for the decision regarding suitability for oil and gas exploration and production.

Under the perspective of compatibility between the existing oil and gas exploration and production technology and the socioenvironmental characteristics of the sedimentary area, four territorial assumptions were established for classifying the Effective Basin in areas that are fit, not fit and in moratorium for future E&P activities:

1. The areas of the Effective Basin will be classified as fit, unfit or in moratorium considering the activities of exploration and production of oil and gas and not the outflow or transmission of the produced resource. In other words, it is accepted that the structures and logistics for outflow or transmission may be allocated in areas that are unfit and in moratorium, as well as the transit of vessels for supplies, equipment and people;

2. As established in article 25 of Ordinance 198/2012, “Regardless of the classification indicated by AAAS, it will be possible to carry out exploratory activity by the Federal Government aiming to deepen the degree of knowledge about a given area, as long as it is submitted to the specific licensing process, subject to approval by the competent environmental agency”;

3. The final results of this EAAS do not apply to areas currently under engagement (granted areas), in order to ensure legal security for operators;

4. Considering assumptions that set limit to land use, some areas were defined *a priori* as unfit. Those areas are territorial units where the exploitation of mineral resources is expressly prohibited in legal mechanisms or pending regulation:

    a. Conservation Units assigned for Preservation: Law 9.985/2000 (known as SNUC Law) allows only the indirect use of natural resources and situations provided for in this Law, for this group of Conservation Units.

    b. Extractive Reserves (defined by the SNUC Law as Resex): SNUC Law prohibits the exploitation of mineral resources in this category of Conservation Unit.

    c. Indigenous Land acknowledged by Government: the development of mining activities within Indigenous Lands is pending regulation by the National Congress.

To establish indicators of unsuitablity and moratorium, the Regional Social and Environmental Baseline and the *Risks* revealed from the trend analysis were observed, seeking for the most sensible areas.

Then, the unfitness indicators selected represent the main *Risks* submitted to *Strategic Impacts*, namely:

- Lands traditionally occupied by indigenous peoples;
- Isolated Indigenous Peoples;
- Conservation Units of Sustainable Use; and
- Rivers, Lakes and *Várzeas*.

The moratorium indicators translate demands for protection of territory, indicating areas of existing or potential conflicts. Based on this understanding, areas in moratorium are the immediate surroundings of lands traditionally occupied by indigenous peoples and also of the only APCB with priority action for the settling of a conservation unit of sustainable use in the study area.

Unfitness and moratorium indicators were jointly mapped and the remaining areas, where neither occurred indicators of one category nor of the other, were considered fit areas. A prevalence of unsuitability indicators was considered over the moratorium indicator, i.e., areas with overlap between these two types of indicators were classified as unfit.

After overlapping all the indicators, the isolated fit areas less than 625 km^2 were considered unfit. This value represents a quarter of an exploratory block (which has 2,500 km^2) and its isolation signals that the activities developed there could be subject to conflicts around it that would be capable of making them unfit in the short or medium term.

Figure 2.3 shows the suitability classification of the Effective Basin for oil and gas activities. Table 2.4 shows the total area obtained for each class.

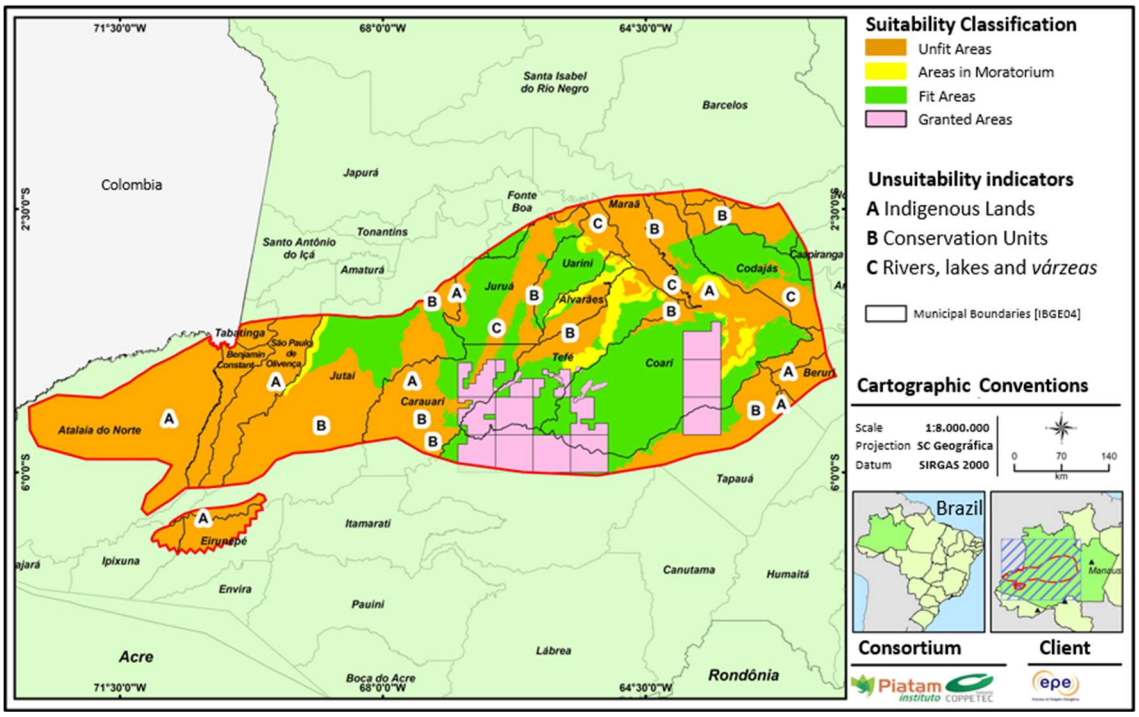

Figure 2.3 - Suitability mapping.

Table 2.4 - Total Area for each Class

Class	Area (km^2)	Proportion
Unfit Areas	**179,229**	**57.9%**
Fit Areas	**86,047**	**27.8%**
Granted Areas	**33,074**	**10.7%**
Areas in Moratorium	**11,188**	**3.6%**
Effective Basin Area	**309,538**	**100%**

The fit area was divided into sub-areas (Figure 2.4), making it possible to prepare specific Licensing Recommendations. It is important to highlight the impossibility of including the exact exploration sites in the EAAS, since this study precedes the establishment of new projects on non-granted areas. The sub-areas are compatible with the Strategic Options of this EAAS, with two exceptions: a) the strategic option “Tefé Sector” was divided into two fit sub-areas: Uarini and Tefé; and b) there is no correspondence between the Codajás sub-area and any strategic option, since it is suspected that this region has low oil and gas potential and, therefore, the offer of blocks in this area was disregarded within the study's horizon. For the Suitability Mapping stage, this area was considered fit, as it did not present indicators of unsuitability or moratorium.

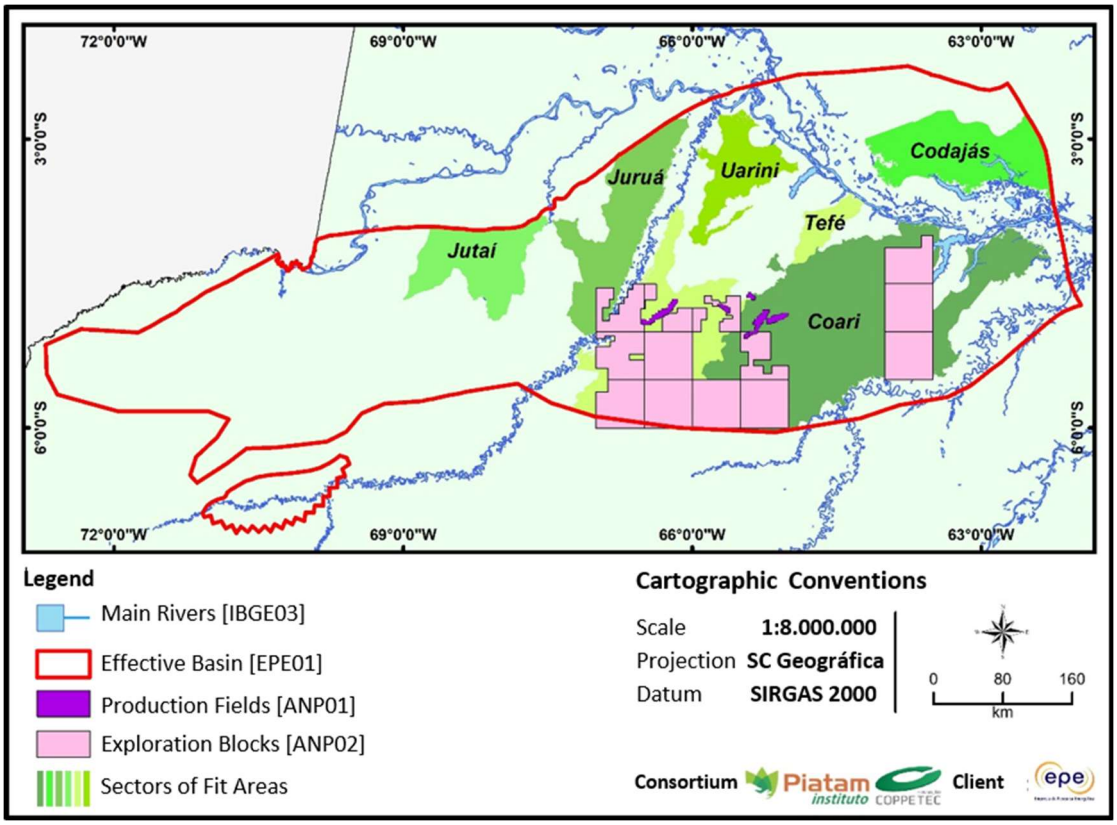

Figure 2.4 - Delimitation of fit sub-areas.

The Suitability Mapping gathered relevant socioenvironmental aspects assessed and aimed to reduce strategic *Risks* for future exploratory Blocks in fit areas. However, some issues require additional guidance to enhance benefits, such as: a) maximize *Opportunities* and minimize residual *Risks*; b) optimize the governance of oil and gas activities; c) optimize socioenvironmental management; d) fill information gaps about oil

and gas activities; e) fill knowledge gaps regarding biodiversity and socio-cultural complexity. These five aspects led to the preparation of the **Strategic Guidelines,** the **Recommendations for Environmental Licensing,** and the **Action Plans**.

It is noteworthy that, throughout the study, opportunities were identified across the indicators analyzed in the Baseline, i.e., issues that demand improvements so that the reflexes of oil and gas activities in the region can generate benefits for local socioeconomic development. These transversal Opportunities were addressed in the Strategic Guidelines (Table 2.5) and in the Action Plans and are related to public management, knowledge improvement, communication and public-private partnerships.

2.6 Strategic Guidelines

Table 2.5 Strategic Guidelines

Strategic Guideline	Purpose	Responsibility
Consider the suitability classification in the offer of exploratory blocks	Respect the suitability classification of this EAAS	ANP
Review the exploratory blocks eventually returned, before being re-offered	Avoid conflicts in the reoffer of areas, for the development of E&P activities	MME and ANP
Consider the APCBs with an indication for the creation of a Conservation Unit or Indigenous Land (TI) in the process of granting exploratory blocks	Avoid conflicts in the development of E&P activities in areas where UCs and TIs will be implemented	ANP
Implement integrated actions of activities' inspection	Optimize the allocation of human resources and increase the inspection efficiency	ANP, IPAAM, Ministry of Labor
Promote the use of natural gas produced in the basin in the municipalities of the area	Decrease the cost of products derived from the processing of natural gas produced in the Solimões basin to the local consumer	EPE
Guide the allocation of royalties	Foster life quality improvement in the region	State and Municipal Secretariats, Legislative Assembly of Amazonas or City Councils
Strengthen transparency mechanisms (platforms, participatory budgeting, accountability, auditing, ombudsman)	Increase transparency in the application of royalties and special participations	Court of Auditors of the State of Amazonas; Amazonas City Councils and State Legislature.
Promote Training Programs, especially for technical courses related to the main activities of the oil and gas industry, in the AIE municipalities	Increase the participation of local labor in activities	Government agencies, SENAI and Operators

Table 2.5 Strategic Guidelines (continuation)

Strategic Guideline	Purpose	Responsibility
Create a Forum to discuss regional socioenvironmental issues involving petroleum activities	Improve the governance of socioenvironmental issues related to oil and gas in the region	MME, MMA, ANP, ANA, SEPLANCTI, SEMA and IPAAM
Implement inclusive communication strategies about E&P activities and the application of royalties and special participation in the region	Increase the transparency of data on the activities of the oil and gas industry and the application of the payments to the Public Administration	State Secretariat for the Environment, State Secretariat for Infrastructure, Ipaam, Municipalities, Operators and ANP
Publicize ombudsman system	Clarify doubts and obtain public perception about the activities of the oil and gas industry	ANP
Prioritize the offer of areas considering the risks and opportunities identified in the present study	Maximize opportunities and minimize risks associated with E&P activities	ANP
Promote public policies that improve the living conditions of the rural population	Decrease the rural-urban migratory flow	State and Municipal Governments
Promote public policies that mitigate the negative effects of the migratory flow	Minimize the burden on urban infrastructure	State and municipal government
Strengthen the Working Group on ILO 169	Although Free, Prior and Informed Consultation is mandatory in force, the need to establish guidelines for the application of Convention 169 of the International Labor Organization is recognized, respecting the forms of political organization of each traditional people	Office of the President's Chief of Staff (coordination)
Assess the pertinence of creating a follow-up mechanism for EAAS referrals	Improve referrals for the review of this EAAS and preparation of other studies, in order to make them more effective	MME and MMA

2.7 Recommendations for Environmental Licensing

To contribute to the processes conducted by the Amazonas Environmental Protection Institute (IPAAM, in its Portuguese acronym), this section presents recommendations for the environmental licensing of oil and gas activities. Considering that specific studies and actions are necessary in the various phases of this industry, two types of recommendations are presented: general recommendations, applicable to all phases and specific recommendations, regarding each phase - Seismic survey, Exploratory drilling, Production, Natural gas processing, Transport and Decommissioning.

Being the legal responsible for the environmental licensing, IPAAM must define the most appropriate licensing step where to include each recommendation, being as a request for the environmental study or constraints to grant new licenses.

2.7.1 General recommendations, applicable to all phases

- Implement controls to prevent the introduction of exotic species, such as the inspection and control of equipment and materials and the prohibition of domestic animals at bases and facilities.

- Develop and execute the Program for the Recovery of Degraded Areas (PRAD, in its Portuguese acronym) using native species, from seed banks collected from the region, in order to include the ecological groups present.

- Educate the workforce considering the socioenvironmental aspects of the region, in particular: to promote environmental education and sex education, to prevent child prostitution, to foster a positive interaction with indigenous and traditional communities, to deter the hunting of wild animals.

- IPAAM is recommended to request FUNAI for the most recent records of isolated indigenous peoples in the area of interest for exploration.

- Identify areas of traditional use, indigenous lands, traditional communities, vulnerable traditional communities and the occurrence of isolated indigenous people in the project's area of influence and avoid these areas to settle petroleum activities. The occurrence of vulnerable traditional communities (subject to conflicts due to lack of land ownership and other rights) must be reported to INCRA.

- IPAAM is recommended to guide the entrepreneur to inform this agency and Funai of any eventual encounter with isolated indigenous people or vestiges.

- IPAAM is recommended to demand that the oil and gas company consult FUNAI, ICMBio, indigenous organizations on the existence of indigenous peoples and traditional communities. It is recommended to highlight the indigenous lands not acknowledged by Governmentand the vulnerable communities that exist in the area of interest for exploration and production and to deliver this survey to IPAAM.

- IPAAM is recommended to forward the survey to the intervening bodies (FUNAI, IPHAN, ICMBio etc.), indigenous associations and other representations of the communities involved and to promote collective discussion with these stakeholders, to

guide both the preparation of studies on indigenous and traditional peoples and the LPI Consultation.

- Establish a partnership between the Municipal Government and the oil company operating in the municipality so that the company can promote more effective dissemination actions, in the channels and places of greater reach to the population, also considering the logistical difficulties and the need to adapt communication to the reality of countryside communities (indigenous, traditional, riparian etc.).

- Develop a communication plan for activities with local communities (on the surroundings of the activity and in the support base).

- Identify conflicts related to use of land or natural resources, especially logging and fishing, in the area of influence of the project.

- Support socioeconomic development projects, promoting mechanisms that facilitate and reduce bureaucracy to include community-based associations. For that purpose, it is recommended to promote the structuring, regularization and training of associations.

- Encourage the implementation of mechanisms of good practices in human rights in projects that are in the process of licensing installation and/or operation (according to references of international good practices).

- Base studies and reports on environmental impact in bibliographic reviews on endemic, threatened and potentially sensitive species to the activity and collection of primary data (see list of species provided in the contribution to the public consultation - Annex IX of EAAS Solimões).

- Avoid, mitigate, and compensate impacts on endemic, threatened and potentially sensitive species to oil and gas activity.

- Monitor the periodic maintenance of supply and product logistics vessels, in order to minimize fuel leaks.

- Monitor the training of workers involved in the transportation of supplies, regarding the proper procedure in the treatment of indigenous and riparian residents, in case of encountering.

- The impact assessment should consider the circulation of vessels to transport supplies, labor and products associated with the activity, to enable the proposal of mitigating measures.

2.7.2 Recommendations applicable to Seismic Survey

- Minimize the need for new acquisition of seismic data, using subsurface computational modeling, integrating aerial electromagnetic data with seismic and drilled wells' data.

- The suppression of vegetation must follow basic guidelines such as, for example, avoiding areas with large and noble trees, limiting logging for trees up to 16 cm in diameter, not obstructing water courses and respecting minimum distances from water bodies such as springs or lakes. Recommendations applicable to Exploratory Drilling

- Take advantage of pre-existing roads and infrastructure, minimizing the removal of vegetation and the creation of new accesses.

- Restrict drilling in bodies of water, flooded areas, *várzeas* and riverbanks.

- Prioritize the use of rigs that have technology to perform directional drilling. In this way, from the same point, more than one objective can be reached, reducing the need for suppression of vegetation. In addition, using this technology it is possible to reach a potential reservoir located below bodies of water, flooded areas, *várzeas* and riverbanks, without causing impacts on these places.

- Adopt technologies that allow the reduction and reuse of drilling fluid.

- Ensure adequate storage and disposal of the drilling fluid, avoiding its release into the environment.

- Establish a program to control erosive processes generated by the implantation of well pads.

2.7.3 Recommendations applicable to Production

- Take advantage of pre-existing roads and infrastructure, minimizing the removal of vegetation and the creation of new accesses.

- For the development of Production, prepare a map of oil sensitivity around the well drilling sites and an oil dispersion modeling.

- Establish rules for navigation and water use to avoid degradation of aquatic environments and water quality. For this purpose, establish limits of size and flow of vessels based on the width and depth of the rivers, to minimize indirect impacts on biota and *terras caídas* (a natural phenomenon of landslide on the riverbank that may be aggravated by passage of vessels).

- Maintain the current production system (*inland off-shore*), in which the transportation of people, equipment, supplies and products occurs preferably by river or air, not roads.

- Prioritize technological alternatives that minimize the width/extension of the right of way for the outflow pipelines.

- Establish safe distances between water collection points to supply human populations in the area of influence and production equipment and facilities, such as producing wells, processing units, among others.

- Establish a program to control erosive processes generated by the implantation of wells, outflow pipelines and processing units.

- For the development of shale gas production (Coari fit sub-area), adopt specific measures: obtain a water use license to hydraulic fracturing, “green completion”, ensure the integrity of the well, perform modeling and monitoring of seisms, prioritize reuse of flowback water, prioritize the adoption of techniques that minimize the number of vertical wells (such as the multi-well model).

2.7.4 Recommendations applicable to Transport

- Prioritize river transportation, to minimize the opening of roads, with suppression of vegetation, in the fit sub-areas of Jutaí, Juruá and Uarini.

- Prioritize the use of the existing pipeline infrastructure, for the fit sub-areas of Tefé and Coari.

- The transmission pipelines must have a reduced right of way, technically defined according to the environment where the pipeline is installed, with the introduction of bridges for the passage of fauna (*canopy bridge*).

- Establish a program to control erosive processes generated by the implantation of pipelines and port facilities.

2.7.5 Recommendations applicable to Decommissioning

- Present a decommissioning project, including at least: budgeting for decommissioning, destination of equipment and infrastructure, the recovery of areas, removal of pollutants and remediation, if necessary, of contaminated aquatic and ground environments.

2.8 Action Plans for Monitoring

Three types of Action Plans have been developed (Table 2.6), according to their purposes:

a) Regional Environmental Programs, as subsidies for the Environmental Licensing of future activities;

b) Actions for the areas in moratorium, that allow to minimize the conflicts identified in these areas; and

c) Actions to improve the region's socioenvironmental management, addressing the gaps and conflicts identified in the study, but which are not directly linked to oil activities.

Table 2.6 - Action Plans

Type	Purpose	Actions
Regional Environmental Programs	Expansion of knowledge and improvement of the environmental management of the study area, as a subsidy to the environmental licensing processes of future activities	Identify areas of occurrence of isolated indigenous people and develop public policies for territorial protection
		Promote land regularization
		Promote the articulation of oil and gas operators to share logistics infrastructure and resources
		Improve the infrastructure for monitoring oil and gas activities
		Constitute and maintain updated socioenvironmental database associated with oil and gas activities
		Promote integration between public bodies and society to strengthen the governance system
Action for Areas in Moratorium	Cease the uncertainty associated with the indigenous lands lacking legal protection and minimize conflicts in the region	Identify and Homologate TIs
		Establish the Sustainable Use Conservation Unit indicated by APCB
Actions to improve socioenvironmental management in the region	Contribute to fill knowledge gaps and mediation/conflict resolution	Minimize conflicts among users of natural resources, aiming to reduce social vulnerability
		Expand knowledge about biodiversity and water resources in the Amazon
		Minimize conflicts between traditional communities and indigenous groups
		Stimulate the region's development with sustainability.
		Promote the development and implementation of UC management plans
		Constitute and maintain updated municipal socioeconomic database
		Improve municipal management

3. Conclusions

Public institutions at the federal, state and municipal levels, and civil society organizations with local, regional, national, and international activities acts in the region governance. Among governmental institutions that formulate public policies, MMA and MME interact to establish general guidelines for the development of the oil and gas industry, to make it compatible with environmental conservation at the federal level. Other institutions operate at the local level at the interface with petroleum activities: regulatory agencies (ANP and National Water and Basic Sanitation Agency - ANA); the bodies responsible for the environment (ICMBio, Secretary of State for the Environment - SEMA and IPAAM); agency responsible for land management (INCRA); FUNAI, which works to protect the rights of indigenous peoples; municipal governments; and non-governmental associations and organizations. In addition, the State and Federal Public Ministries are present.

The Policies, Plans and Programs (PPPs) surveyed are mostly national (68%), in contrast to those at the state, regional and municipal levels. Among these PPPs, 30% aimed oil and gas activities, 42% the population in general, 15% indigenous peoples and 13% are dedicated to the environment.

EAAS Solimões participatory process was developed in six phases: individual interviews, context and strategic focus workshop, participatory mapping meetings, workshop to compare strategic options, informative meetings and public consultation (in person and via internet). Five groups of stakeholders were identified in the region, invited to participate in the process: researchers and university professors (Academia); federal, state and municipal civil servants, preferably working in the environmental area (Public Administration); oil and gas professionals (Companies in the sector); professionals from different areas of activity linked to NGOs (Civil Society); and leaders of indigenous groups and traditional communities. In addition to promoting communication with the different stakeholders, this process was relevant to understand conflicts and demands from local communities, highlighting the mapping of lands traditionally occupied by indigenous peoples lacking legal protection. The collected information fed the Regional Social and Environmental Baseline and, consequently, the later stages of the study.

The Regional Social and Environmental Baseline made it possible to understand the sensitivities of the Solimões sedimentary basin and showed a region of rich diversity, in

social, cultural and environmental terms, but also of several conflicts related to land and use of natural resources (especially fishing and forest resources), in addition to the presence of isolated indigenous peoples.

Exploration and production (E&P) activities for oil and gas have been established in the region since the 1950s and are located in areas of low deforestation. The model adopted in the seven fields currently in production, all operated by Petrobras, comprises the interconnection of smaller fields in a central processing hub located close to the larger fields (Arara Pole), known as the Petroleum Province of Urucu. This production model and other exploratory activities minimize the opening of clearings and roads, prioritizing the transport of equipment and supplies by air and river.

Most of the municipal portion of royalties and special participation (payments to the Public Administration) associated with production goes to the municipality of Coari. This municipality showed rapid demographic growth between 1991 and 2010, which was probably associated with E&P activities. In Carauari, due to the proximity to the Arara Pole, direct jobs were created associated with oil production. Seismic surveys are characterized by the generation of temporary jobs with a predominance of workers hired in the municipalities of the region.

According to the trend analysis prepared in the Study, there will be a significant drop in financial stakes due to the decline in production from existing fields. This reduces the generation of economic benefits, especially for the municipal budget of Coari (reflected in investments in health and sanitation infrastructure) and the level of employment in the region.

Regarding the development scenarios, based on the production model currently practiced, the analysis of strategic impacts of the medium and high activity scenarios for conventional resources indicates a greater sensitivity of socio-cultural indicators, compared to environmental indicators. Indeed, it was observed that the petroleum activities existing in the region are able to coexist with biodiversity, provided the best practices are applied, reinforced in the Recommendations for Environmental Licensing. On the other hand, the complex regional socio-cultural dynamics is so unique that it demands greater attention.

In relation to scenarios with shale gas production, the negative impacts of its exploration increase in disproportion to the positive impacts, especially when comparing the medium

intensity scenarios for conventional resources, with and without shale gas. This is confirmed by the parameters of the scenarios, which demonstrate that there is a significant number of production wells associated solely with the exploitation of shale gas. Despite requiring greater demand for jobs and services, there is a poor increase in production volume, and, consequently, a low upgrade on the positive impacts of generation of financial stakes. It is worth mentioning that shale gas exploration and production was modeled, in the present study, only for the Province of Urucu.

Therefore, the comparison of the four development scenarios revealed that the Scenario of high activity for conventional resources presented the best relationship between opportunities versus risks.

When comparing the strategic options, a step carried out with social stakeholders in the region, it was revealed that the Coari option would be subject to less negative impacts from the E&P activities of conventional resources than the others: Jutaí, Juruá, Tefé and Tapauá. However, in scenarios that included shale gas, Coari, the only region where this exploration was considered, would be subject to the greatest negative impacts.

The suitability classification sought to indicate areas favorable or not to new petroleum activities. In addition to the legal restrictions assumed as premises for the suitability classification, the main Risks identified and evaluated were used as indicators of unsuitability, to reduce uncertainties in the Environmental Licensing of E&P activities. Risks were related to the most striking characteristics of the region: its regime of floods and droughts, which determine biological patterns and human occupation, with its socio-cultural and economic activities, in addition to the typical cultural characteristics. These aspects were represented by the indicators Rivers, lakes and *várzeas*, Lands traditionally occupied by indigenous peoples and Conservation Units for sustainable use. Avoiding E&P activities in the areas where such characteristics are most clearly expressed prevents eventual conflicts and more forceful impacts. Therefore, 58% of the effective Basin area was considered unfit for E&P activities, while 28% was considered fit, which represents more than twice the areas already granted.

Indicators of areas in moratorium represent demands for protection of territory, indicating existing or potential conflict sites. It comprises the immediate surroundings of the Lands traditionally occupied by indigenous peoples and the only APCB with priority action to create a conservation unit of sustainable use, resulting in 3% of the effective Basin.

Based on the results found, Strategic Guidelines, Recommendations for Environmental Licensing and Action Plans were prepared, with a view to contributing to: i) maximizing Opportunities and minimizing residual risks; ii) optimization of the governance of oil and gas activities; iii) optimization of socioenvironmental management in the region; iv) filling information gaps about oil activities; and v) filling knowledge gaps about biodiversity and socio-cultural complexity. It is noteworthy that, throughout the study, some opportunities were identified across the indicators analyzed in the Baseline, i.e., issues that demand improvements so that the reflexes of oil and gas activities in the region can generate benefits for local socioeconomic development. These transversal Opportunities were addressed in the Guidelines and Action Plans and are related to public management, knowledge expansion, communication and public-private partnerships.

The present study allowed to indicate areas of the sedimentary basin more favorable to the development of new E&P activities and areas of the sedimentary basin that should be avoided by operators. Investment in new E&P activities in unfit areas has high risk of arising territorial conflicts in the region. In addition, guidelines, recommendations for environmental licensing and action plans for sustainable development in the region were proposed.

It is noteworthy that in addition to areas with legal restrictions, extensive *várzea* areas, the National Forest of Tefé and indigenous lands with claims for recognition were also considered. On the other hand, areas fit for E&P activities at the regional level were observed, in addition to those under concession, demonstrating that there is a possibility of expansion of the industry, provided that the best practices are adopted, and the Environmental Licensing process is respected. In addition, through the participatory process, the study could be discussed and built from the interaction with representatives of the main local social stakeholders.

It is proposed that the present study be revised in 10 years, since the socioeconomic and environmental patterns observed are dynamic and, from the analysis of new conditions, it is possible to realize the need to reconsider the conclusions obtained. To define the temporal validity of the conclusions of this study, the following aspects were observed: (i) cycle of E&P activities; (ii) existing policies, plans and programs in the region; and (iii) nature of the primary and secondary data collected. It is noteworthy that there are other relevant aspects, such as international oil prices, political conditions,

climate changes, among others, which, due to the high uncertainty, were not considered, but can influence the context of oil activities and socioenvironmental characteristics.

Finally, the present study will serve as a subsidy to the Conclusive Report that will be prepared by CTA and forwarded to the Interministerial Commission yet to be designated, according to Interministerial Ordinance 198/2012. It is worth mentioning that the responsibility to offer exploratory blocks in the Solimões Sedimentary Basin relies on ANP, based on Decree No. 9.641, dated December 27, 2018, which "delegates competence to the National Oil, Natural Gas and Biofuels Agency - ANP for defining blocks in onshore basins to be the object of bidding, under the concession regime, in the Permanent Offer system", in line with the National Energy Policy. Such delegation was reiterated by Resolution CNPE 03/2020.

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