STRATEGIC PLAN

FOR AMBERGRIS CAYE SUSTAINABLE DEVELOPMENT - BELIZE

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GENERAL CONTENT

The following components of the Strategic Plan are summarized in this document:

- Introduction
- Executive Summary
- Multisectoral diagnosis
    - Urban Growth
    - Vulnerability to Natural Risks
    - GHG Inventory and Mitigation Roadmap
    - Tourism Analysis
    - Current Carrying Capacity
- Development scenarios
- Future carrying capacity
- Vision, Action and Financial Plan
- A zoom-in to the North

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Content

Introduction

In 2022, the Prime Minister of Belize, Hon. John Briceño, appointed a "Task Force" to foster Ambergris Caye's development. Members include Ministers, San Pedro's Mayor, and representatives from the private sector. The Task Force asked for IDB's support to elaborate a sustainable development strategy for North Ambergris Caye, considering challenges across the Island. The IDB supported this effort by committing technical and financial resources to develop several studies. This document outlines the comprehensive outcome of this cooperation: a **Sustainable Strategic Plan for Ambergris Caye.**

Key components of the Strategic Plan include urban growth analysis, assessing natural risk vulnerabilities, and estimating current and future carrying capacity of the territory. Emphasizing sustainable urban development and climate change mitigation, the plan aims to identify projects enhancing the island's carrying capacity amidst urban growth and tourism demands. The consultancy aims to provide recommendations for efficient urban development, prioritizing the well-being of Ambergris Caye's residents with a special view to the northern area of the island.

The recommendations are aimed at defining a realistic growth scenario, including plans and projects for land-use planning and necessary infrastructure investments, with the identification of possible sources of financing, proposed investment schedules, and interinstitutional coordination, including public and private stakeholders.

Given its status as a tourist destination, the Plan incorporates a carrying capacity model and tourism diagnosis, crucial for sustainable future development.

This document includes the following sections:

- **Executive summary**
- **Multisectoral diagnosis**
    - Urban diagnosis
    - Vulnerability to natural risks
    - GHG Inventory and mitigation roadmap
    - Tourism analysis
    - Current carrying capacity.
- **Development scenarios**
- **Future carrying capacity**
- **Vision, Action Plan and Financial Plan**
- **A Zoom-in to the North**

The **multisectoral diagnosis** provides a detailed analysis of the existing conditions in Ambergris Caye, examining the territory comprehensively through five main components:

- **Urban diagnosis**, which analyzes the national, regional, and local context of the island, the urban development processes in recent years and growth dynamics, especially in terms of current growth vectors and demographic changes. This section also studies the general territorial systems (mobility, public spaces, urban facilities, public services, etc.), as well as the regulatory framework and previous planning processes developed for Ambergris Caye. As part of the multisectoral analysis, numerical results are integrated, as a quantification of the observed territorial reality, using the methodology of the Emerging and Sustainable Cities Program, wish includes some indicators, on which the necessary adaptations for Ambergris Caye are made.

- **Vulnerability to natural risks**, which examines the natural hazards to which Ambergris Caye is exposed, focusing on hurricane-related events such as storm surge flooding and strong winds. Coastal erosion was also studied as a phenomenon that particularly affects the beach areas on the eas coast of the island.
- **GHG Inventory and mitigation roadmap**, which analyzes the different sources of greenhouse gas (GHG) emissions, as well as the absorption capacity of these emissions by local ecosystems (mangroves, native forests, among others), in order to propose a roadmap aimed at defining mitigation strategies.
- **Tourism analysis**, which includes the description of the current panorama of tourism development in Ambergris Caye, analyzing visitor statistics and projections, as well as the components of the tourism value chain (accommodations, tours, tourism-related services, among others), in order to generate recommendations for the integral and sustainable development of this activity on the island.
- **Current carrying capacity,** where an evaluation model is used to study the level of coverage, deficit and saturation level of the current provision of public services on the island (piped water, sewage, solid waste), as well as housing needs and educational facilities.

Considering the results and findings of the diagnosis, the study generated three development scenarios for the island, which propose potential outlooks according to demographic and tourism projections, environmental constraints, growth dynamics and the implementation of identified trigger projects. Two of these scenarios are theoretical and were analyzed in order to understand the cost differences in the provision of urban services implied by not guiding the growth of the urban footprint in a sustainable and intelligent way.

The scenarios are as follows:

- **Business as Usual (BAU),** which projects a growth model that follows organic urban growth trends and where no planning tools are implemented and enforced to guide the island's development.
- **Optimal,** which proposes an ideal and theoretical growth model for Ambergris Caye, where development processes are fully aligned with planning tools and there is a full enforcement of the standards.
- **Intermediate**, which proposes a viable and feasible scenario for the island, taking into account the development objectives for the territory, as well as the dynamics of tourism growth.

Subsequently, considering the intermediate scenario and previous outcomes, the study develops the **Future Carrying Capacity model**, which determines the requirements for potable water, sewage, waste collection, housing, and educational facilities, taking into account a development time horizon of 2045.

Considering the inputs and variables analyzed above, the study proposes the **Vision 2045 for Ambergris Caye**, which also draws on the determinants generated by parallel studies developed on the island, such as communications strategies by Pacifico and investment climate and business environment, developed by the Investment Climate Reform (ICR). Afterwards, the **Action Plan** is described, which details the specific steps to achieve Vision 2045 and is structured into Thematic Axes and Strategic Lines, from which investment plans and projects are established. For the execution of the different plans and projects, a **Financial Plan** was developed. The main purpose of this section is to propose how to finance the monetary and resource needs of the identified projects to be implemented in Ambergris Caye.

In addition, the document includes a specific section focused on the **development of the northern area of Ambergris Caye**, which, based on the identified growth vectors and tourism projections, is the area where the major urban development dynamics will take place, stimulated also by the future implementation of high impact projects such as the new cargo port and new airport, as well as related "high-end" tourism complexes that will drive the economic development of the island, together with the development of new housing projects and social facilities.

Finally, all of the above sections are briefly explained in the Executive Summary, which is included at the beginning of this document along with a list of acronyms for the terms used throughout the report.

List of Acronyms

AAGR – Average Annual Growth Rate

BAU - Business "As Usual"

BBRRS – Belize Barrier Reef Reserve System

BCMR - Bacalar Chico National Park and Marine Reserve

BTB – Belize Tourism Board

BWSL – Belize Water Services Ltd

CBA – Central Building Authority

CBG – Concessional Resources/Blended Finance/ Green Finance

CBWS – Corozal Bay Wildlife Sanctuary

CHPA – Central Housing Planning Authority

CZMAI – Coastal Zone Management Authority and Institute

DAAGR – Decrease Average Annual Growth Rate

Dw/acre – Dwelling per Acre

Dw/ha – Dwelling per Hectare

ECLAC – Economic Commission for Latin America and the Caribbean

E- Execution

F – Formulation

GDP – Gross Domestic Product

GFA – Gross Floor Area

GHG – Greenhouse Gas

GSTC – Global Sustainable Tourism Council

Ha – Hectares

HCMR – Hol Chan Marine Reserve

I – Implementation

IDB – Inter-American Development Bank

Inh. /mi2 – Inhabitants per Square Mile

MBRS – Mesoamerican Barrier Reef System

mi2 – Square Miles

NEMO – National Emergency Management Organization

OSM – Open Street Map

PPC – Public-Private Collaboration

QBAU - Qualify Business As Usual

REDATAM – Retrieval of Data for Small Areas by Microcomputer

SDA – Special Development Areas

SIB – Statistical Institute of Belize

Sqft – Square Feet

TDZU – Touristic Development Zoning Units

TP – Traditional Public Works

TC – Technical Cooperation

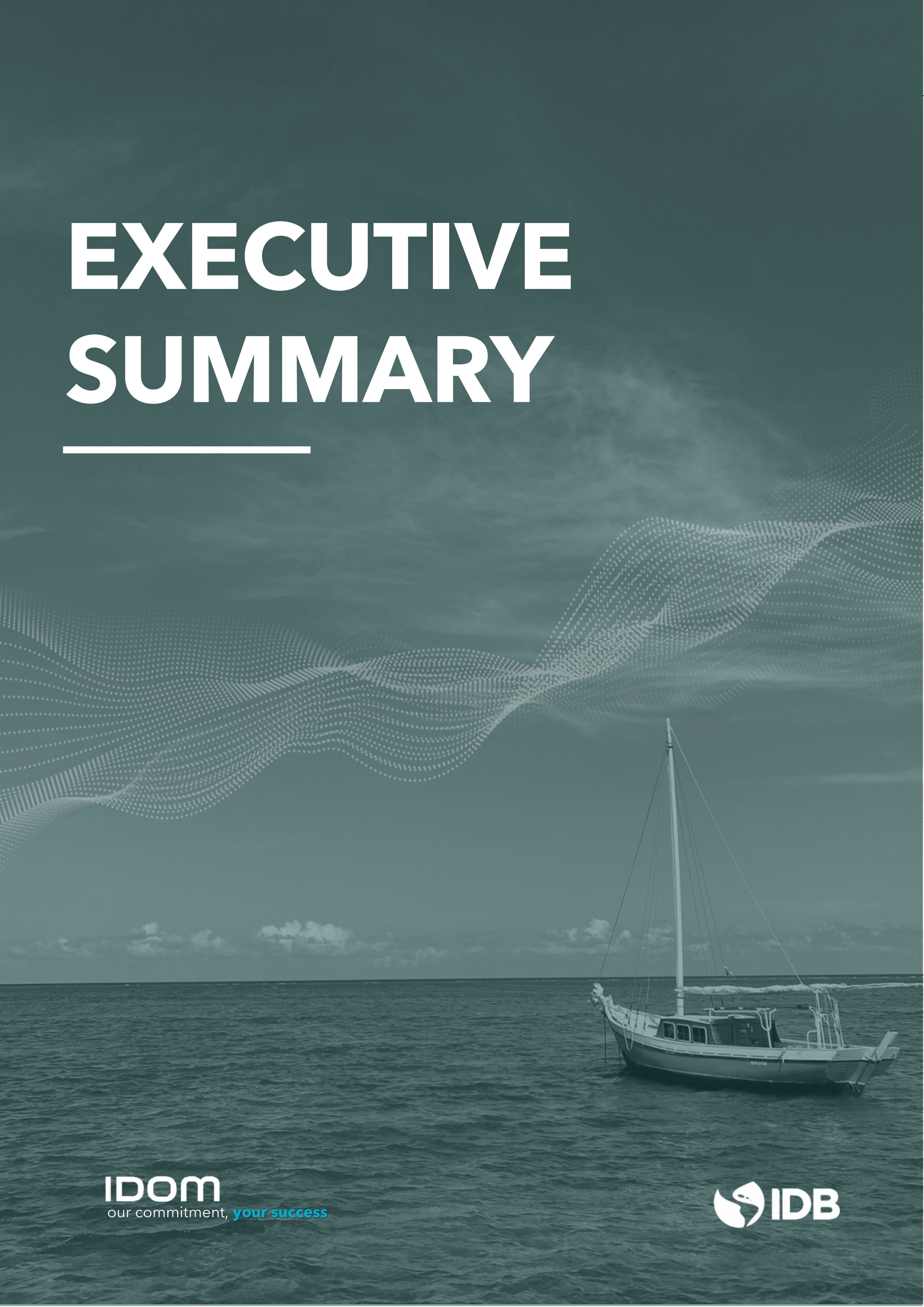
UNDP – United Nations Development Program

UNESCO – United Nations Educational, Scientific and Cultural Organization

UZU – Urban Zoning Units

WHO - World Health Organization

EXECUTIVE SUMMARY



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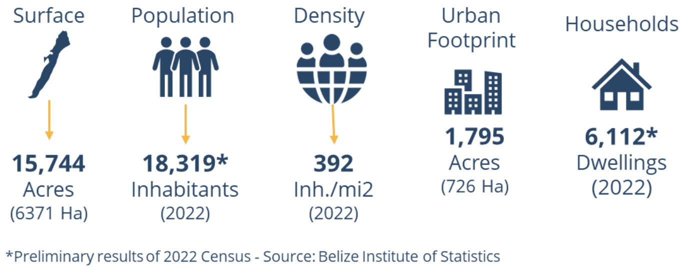
1. Executive Summary

This summary is intended to provide an overview of all the components of the **Strategic Plan.** It introduces the main results of the multi-sectoral diagnosis, the growth scenarios, the current and future carrying capacity, the action and financial plan, and finally the zoom to the proposals that will allow the **optimal and sustainable development of North Ambergris.**

1.1. Diagnostic outcomes

The consultancy considers the complete territory of Ambergris Caye as scope for the study. This Island is located on the eastern coast of Belize in the Caribbean Sea, with an area of approximately 25 square miles (65 square kilometres), with about 18,319 inhabitants on the island according to 2022 population estimate (SIB, 2022).

Figure 1 - Key Data Island Scale

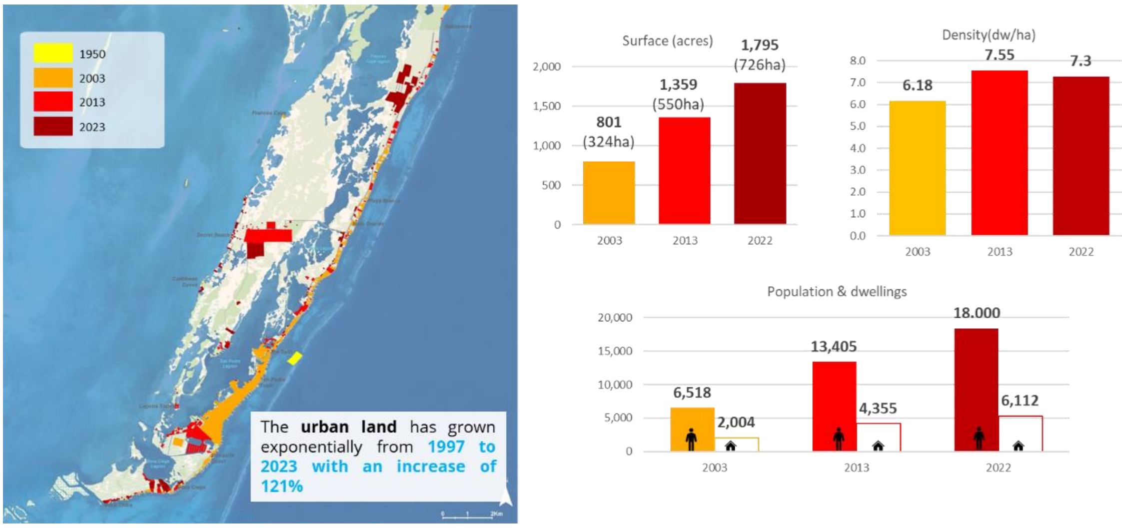


Source: Estimated projections by the Statistical Institute of Belize

1.1.1. Current and historical urban footprint

The growth of the urban footprint of San Pedro, reflects the interplay between natural resources, socio-economic factors, and tourism development. From its modest beginnings as a fishing village, San Pedro has experienced remarkable urban expansion driven by tourism and infrastructural development. Important milestones, such as the establishment of marine reserves, the construction of key infrastructure, and the declaration as a town, have shaped its growth trajectory. Today, San Pedro stands as a natural and desirable destination, balancing its rich cultural heritage with modern urban amenities.

Figure 2 – Historical growth of urban footprint in Ambergris Caye between 1950 and 2013



Source: IDOM, 2023

The most representative changes occur in the following poriods: 2023 with a occupied footprint of 801 acres (324 ha), 69% of which was urban, with 6,518 inhabitants. And 2013, the population doubled about 13,951 inhabitants with a footprint occupied in 1.359 acres (550 ha).

1.1.2. Territorial systems

The analysis of the territorial systems provides an overview of the existing conditions of infrastructure and functionality on the island. In this sense, it is evident that urban development in Ambergris Caye has been disjointed, generating a fragmented and inequitable territory in terms of accessibility and coverage of public spaces, urban facilities and public services. Some of the relevant conclusions are:

Table 1 – Conclusions by territorial systems

Territory System	Conclusion
Environmental System and Protected Areas	• 46% the ambergris caye area is classified as a protected area • 64% of the Caye surface area is made up of mangroves and lagoons • 51% of the mangroves and coastal lagoons are outside the natural reserves • 7% of mangrove were remove between 1980 and 2023. • Degradation affects 3% of Ambergris Caye Coral
Mobility System	• The mobility system presents deficiencies in terms of accessibility, multimodality of transportation modes and quality of infrastructure. • Only 8% of the road network is paved or cemented • The system also lacks road lighting, drainage system and signs • Regulation on parking areas is nedeed • There is not a massive public transportation system • Most of the roads do not have adequate areas for the bicycle system • Lack of safe sidewalks and crosswalks for pedestrians
Public Space System	• The public space system in Ambergris Caye is highly concentrated in the center of San Pedro • The Caye has 3.3 acres of qualified green areas. • The public space indicator is 8.6 square feet per inhabitant (0.8 square meters). According to the (WHO), the optimal indicator should be between 107 sqft and 161 sqft of green areas per inhabitant.
Urban Facilities System	• Most of the facilities are concentrated in san pedro town. North and south area require some planning and management • 84% of the population can reach the different facilities offered by the island by walking less than ten minutes
Public Services System	• Public services system is Sewage Pond System; Desalination Plant; Electrical substation; Solid waste transfer station; Gas station; Sewage Management and Water Distribution Network • Capacity evaluation (with the inputs received), and infrastructure upgrades are crucial to accommodate population growth.

Source: IDOM, 2023

1.1.3. Demographic projections

The urban footprint model and land uses are strongly determined by the quantity of population and its behavior in the territory. In its quantitative aspect, population dynamics significantly conditions urban growth. The sources used for this analysis are the following:

- **Statistical Institute of Belize (SIB)**, national entity in charge of the collection, analysis, and dissemination of demographic statistics in Belize.
- **REDATAM**, site with complete and updated information from the 1991, 2000 and 2010 censuses.
- **Belize Tourism Board (BTB)**, entity with tourist arrival projections for the 2030 horizon.

According to the analysis, it is expected that Ambergris Caye will continue to experience population growth over the next few years, reaching 30,877 inhabitants by the year 2045. It is also expected that the ratio of inhabitants per dwelling will continue to decrease, reaching 2.52 Inh/dw.

On the other hand, it is estimated that the number of dwellings in the 2045 horizon will be 12,241, representing 6,129 new dwellings between 2023 and 2045. This means approximately double the number of existing dwellings according to the count estimated by the Statistical Institute of Belize, posing an important challenge in terms of carrying capacity and sustainable development in the territory.

Table 2 – Estimation of Dwellings and Rate of Inhabitants Per Dwelling in San Pedro

YEAR	TOWN POPULATION	DWELLINGS	RATE OF INHABITANTS PER DWELLING
2010	11,767	3,784	3.11
2022	18,319	6,112	3.00
2025	**19,957**	**6,875**	**2.90**
2030	**22,687**	**8,104**	**2.80**
2035	**25,417**	**9,396**	**2.71**
2040	**28,147**	**10,770**	**2.61**
2045	**30,877**	**12,241**	**2.52**

Source: IDOM, with information from the Statistical Institute of Belize, 2023

1.1.4. Natural Risks Conclusions

In terms of natural hazards for Ambergris Caye, three were prioritized and analyzed, Coastal Erosion, Hurricane Winds and Flooding. These threats were identified and worked on from the stakeholder meetings that were held at the beginning of this consultancy.

Table 3 - Natural Risks Conclusions

Topic	Principal conclusions
Storm Surge Flooding	• Within the study area relevant to this research, the data available on the IPCC platform indicate a projected sea-level rise of 1.38 feet by 2050, based on the SSP5-8.5 scenario. • The northern area of the island requires special attention due to it identify vulnerability. The buildings in this region demonstrate notable resilience, largely attributed to the implementation of concrete walls and elevated designs aimed at mitigating the impact of flooding, therefore is necessary that the future

Topic	Principal conclusions
	construction take this modification into account in orden to maintain the vulnerability to this natural risk low.
Strong Winds	• Roofs made of aluminum metal sheets and those with thatched roofs are the most affected areas. While concrete roofs entail higher replacement costs, they are less likely to sustain severe damage.
Coastal Erosion	• Mangroves are a natural protection against land erosion and play a crucial role in maintaining sea levels and preventing the erosion in certain areas of the island. • The erosion and sedimentation processes are not always evident as they fluctuate in response to extreme climatological events. • Protective seawalls have a pronounced impact on subsequent sections, accelerating the erosion of the coastline.

Source: IDOM, 2023

1.1.5. GHG Inventory Conclusions

For the inventory of greenhouse gases present in Ambergris Caye, the BASIC scope methodology was considered for the inventory accounting and its respective mitigation route. It is important to highlight that currently Ambergris Caye absorbs more GHG than it produces; however, depending on the growth and how it is regulated, it will lose more or less of its absorption capacity.

Table 4 - GHG Inventory Conclusions

Topic	Principal Conclusions
GHG inventory	• According to the results of the 2022 GHG emissions inventory, Ambergris Caye emitted 38,856.88 t CO2e during that year regarding a BASIC scope • In the BASIC+ scope, Ambergris Caye is a net carbon sink with a negative balance of 43,524.86 t CO2e.
Mitigation Roadmap	• In the energy sector, competencies regarding energy production are limited as most of the power used in the Caye is mostly supplied by a general energy company within the country. • Conservation efforts, in conjunction with potential ECB restoration could reduce an additional 84100 TCO2e per year by 2030. • Mangrove protection and/or restoration offer significant carbon-related benefits as a cost-effective and scalable natural climate solution. This is because the price of a blue carbon credit increases with the area of conserved and protected ecosystems.

Source: IDOM, 2023

1.1.6. Tourism Conclusions

Tourism is one of the most important economic sectors in Ambergris Caye, so the main resources, the value chain and the main trends were analyzed.

Table 5 - Tourism Conclusions

Topic	Principal Conclusions
Tourism Resources	According to BTB: • The Barrier Reef was the most visited tourism site in 2019. • The most popular activities were snorkeling (87%) and diving (13%). • Tourism contributes over 15% of GDP and represents the 12% of Belize's workforce. • The highest number of overnight tourism arrivals was in 2019, with 503,167 arrivals
Tourism Value Chain	• The tourism value chain comprises Destination Management Organizations, Transportation and Accommodation Providers, Tour Operators, Attractions and Activities. • The synergy between all the elements of the value chain is crucial to creating a favorable environment for tourism development and fostering sustainable practices. • The value chain generates employment opportunities and a steady income for the island
Competence & Trends	Highest data related to registered and licensed are: • Hotels: 196 hotels in 2019 • Rooms: 2,412 rooms in 2019 • Beds: 3,981 beds in 2019 • In terms of projections, it is expected 216,202 arrivals in 2030, an accommodation capacity of 2,638 beds, with an occupancy of 63.5%

Source: IDOM, 2023

1.2. Current Carrying Capacity

As a basis for this consultancy and decision making in the sustainable development plan, the current and future carrying capacity was analyzed.

The Model for The Carrying Capacity was composed of multiple individual results for the 8 variables considered. Three categories are proposed to classify the level of deficit that each variable obtained, which facilitates the results obtained for the current carrying capacity.

- **GREEN: ACCEPTABLE DEFICIT** The deficit identified in the variable is less than 15%.
- **YELLOW: WARNING CONDITION** The deficit identified in the variable is between 15% and 35%.
- **RED: CRITICAL DEFICIT** The deficit identified in the variable is more than 35%.

The percentages shown below evaluate the results obtained by this consultancy with the information available, through the classification and the parameters mentioned above.

There are 4 variables in a critical state: Production Capacity of Fresh Water, Wastewater Treatment, Sewage coverage and Recycled Solid Waste. These are directly related to the quality of life and environmental impact on Ambergris ecosystems; Just recycling capacity could be solve by management than new infrastructure, others require important investments.

Table 6 Summary Table Current Carrying Capacity

	Deficit on install capacity obtained for 2022
Production Capacity of Fresh Water	27%
Wastewater Treatment	80%
Wastewater (Sewage coverage)	80%
Solid Waste Transfer Station Capacity	0%
Recycled Solid Waste	100%
Housing *	1%
Preschool and Elementary Education *	0%
High schools Education *	0%

Source: IDOM 2023

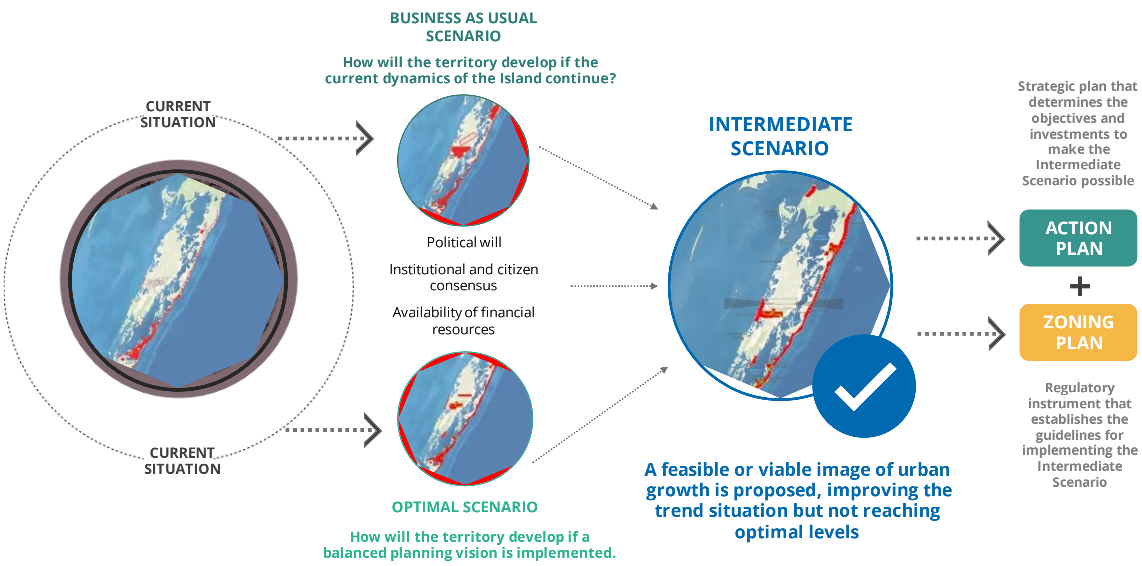
* Were determined from secondary information available from various public sources.

**the data incorporated in this initial Carrying Capacity model require revision with more precise data. In some cases, the variables can be updated with data from the 2022 Census, but in other cases they require data from other local or national sources. **

1.3. Urban growth scenarios

The study considers two theorical scenarios with a time horizon of 2045, with the objective of identifying recommendations for a sustainable growth model that will improve the island's position with respect to natural risk mitigation and prevention, and adaptation to climate change. This will increase the local and regional competitiveness of the territory.

Figure 3 - Urban Growth Scenario Diagram



Source: IDOM, 2023

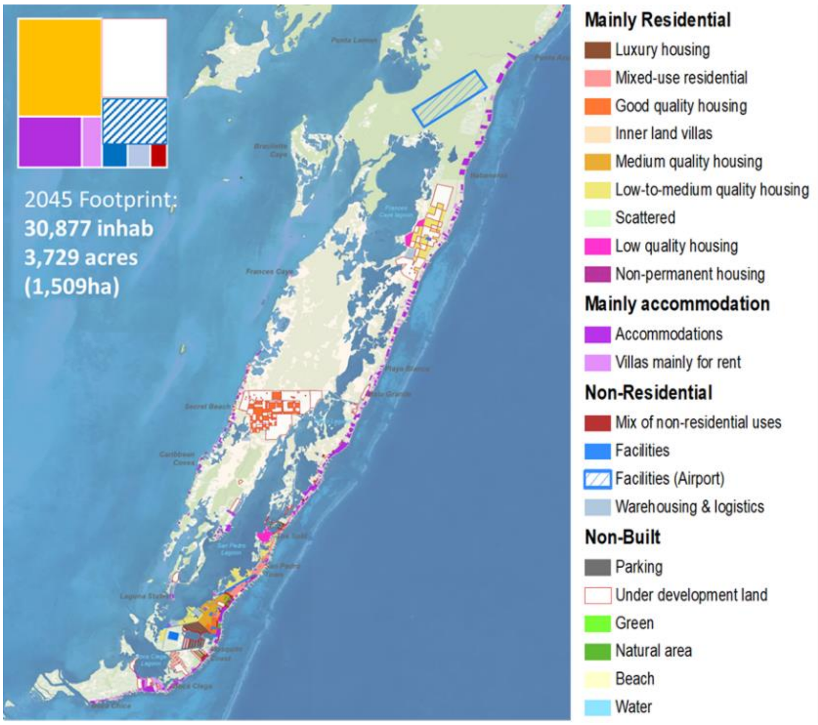
1.3.1. Urban Growth "As Usual" Scenario

The design of this scenario considers two main criteria: the analysis of current trends and decision making according to the variables that define the scenario. Considering these analyses, characterization of the demand for land between 2022 and 2045, is quantified at 2,157 acres. That is, multiplying the footprint by 2.2 over the next 20 years.

This theoretical land demand is distributed on the island according to the vectors analyzed, considering both dynamics within the current footprint, either by the development of Land Under Development, or the growth in vacant land.

The following figures show the result of the comparison between the current model and the baseline scenario graphically and quantitatively.

Figure 4 - Urban Growth "As Usual"



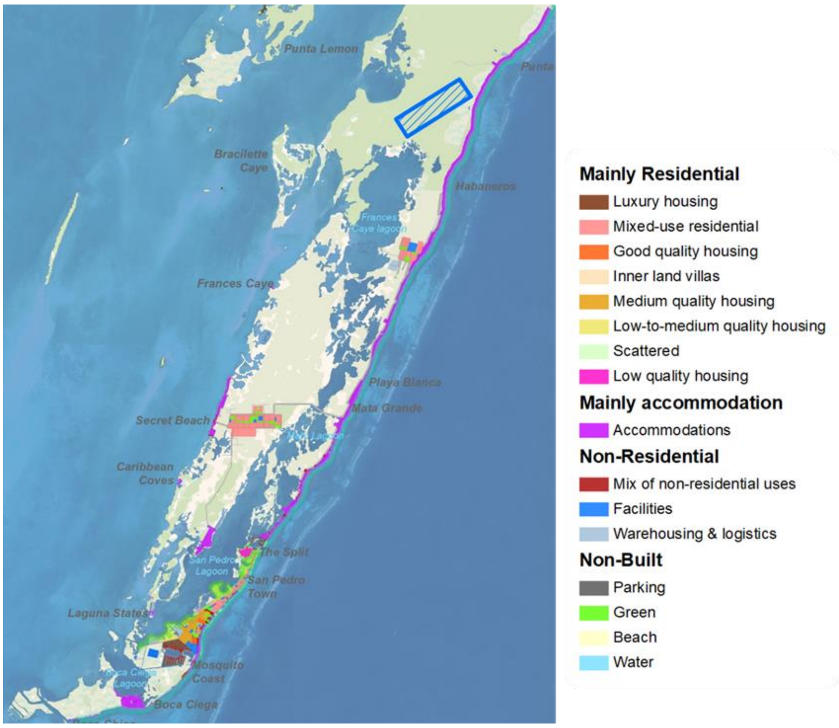
Source: IDOM, 2023

1.3.2. Optimal scenario

This scenario is consistent with the ideal vision of urban growth for a given area, allowing the sustainability perspective to be used to determine the maximum level of permitted future development. The basic requirements for its definition are focused on improving the quality of life for the population through the best use of natural resources, taking into account growth constraints, natural hazards, climate change adaptation measures, and a use of the territory that combines efficiency and equity, ensuring a high level of social cohesion.

The design of this scenario considers two main criteria: the analysis of current trends and decision making according to the variables that define the scenario. The optimal scenario offers an efficient and sustainable territorial system, halting the consumption of new land on the island by keeping the urban footprint below 20 acres. Concentrating residential development in 3 independent and interconnected hubs reduces dependency on the center, improving the quality of life and reducing commuting times.

Figure 5 - Optimal Scenario

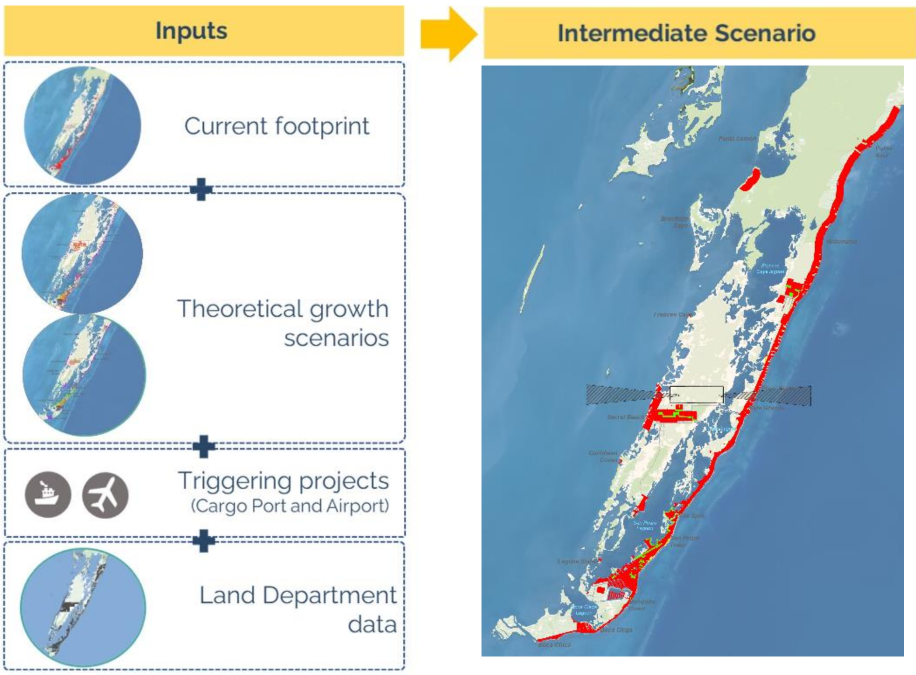


Source: IDOM, 2023

1.3.3. Intermediate scenario

Considering the theoretical scenarios, the Vision 2045, and the General Objective for the territorial development of Ambergris Caye, the study tailored the Intermediate Scenario upon which the Action Plan, Financial Plan, and Zoning Plan will be based.

Figure 6 – Construction of Intermediate Scenario

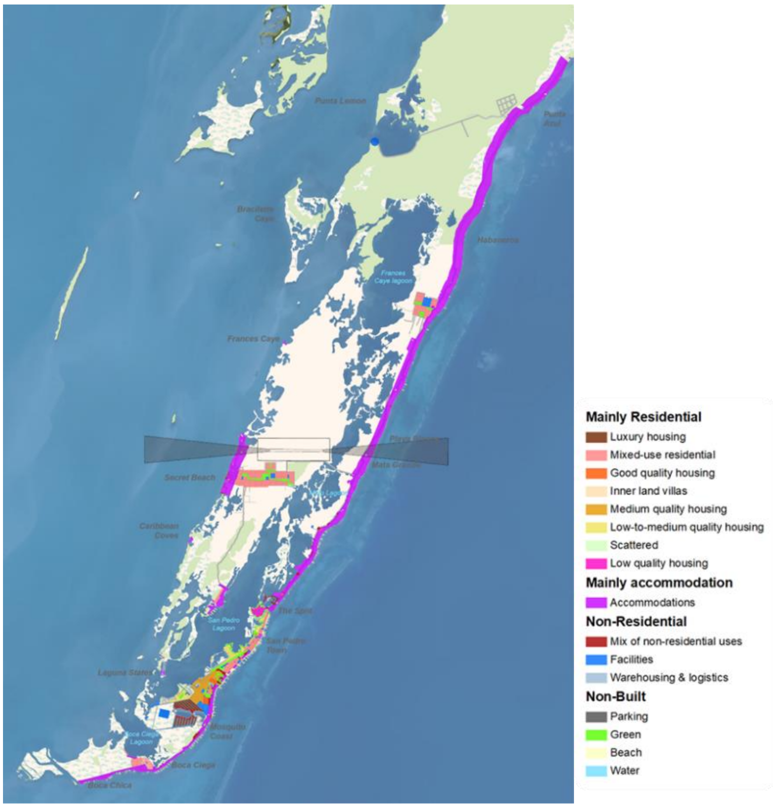


Source: IDOM, 2023

This scenario maintains the same guiding concepts outlined in the definition of the Optimal Scenario, while also introducing new considerations that the territory with the development expectations projected in the present:

- Residential development pressure in the nodes of Grand Belizean Estates and Cayo Frances.
- Construction of a new Cargo Port in the north of the island.
- Construction of a new airport in in the projected new development in the north just below Bacalar Chico

Figure 7 - Intermediate Scenario



Source: IDOM, 2023

The Intermediate Scenario integrates the needs of economic development and conservation of the island, balancing the impact of tourist and residential activities with the recovery and enhancement of its ecological systems. It provides a connected, functional, and enjoyable island for both its visitors and residents. Some of the indicators are:

Figure 8 - Intermediate Scenario Indicators

Main data	Population	30,877	Dwelling	12,241
	Acres	3,829	Ha	1,549
Natural areas and public space	Protected area affected (acres)			47
	Mangrove affected (acres)			420
	Green area (sqm/inhab)			23
	Public Space (sqm/inhab)			23
	% Population at less than ten minutes walking distance Public Space (total footprint)			60%
	Net density			34.4
	Gross density			7.9

Residential Growth	Number of precarious dwellings	0
Accommodation Growth	Reserved Land (acres)	1,450
Urban Facilities	% Population at less than ten minutes walking distance Facilities (education & health)	85%
Public Services	% Population with sewerage	98%
	% Population with water	98%

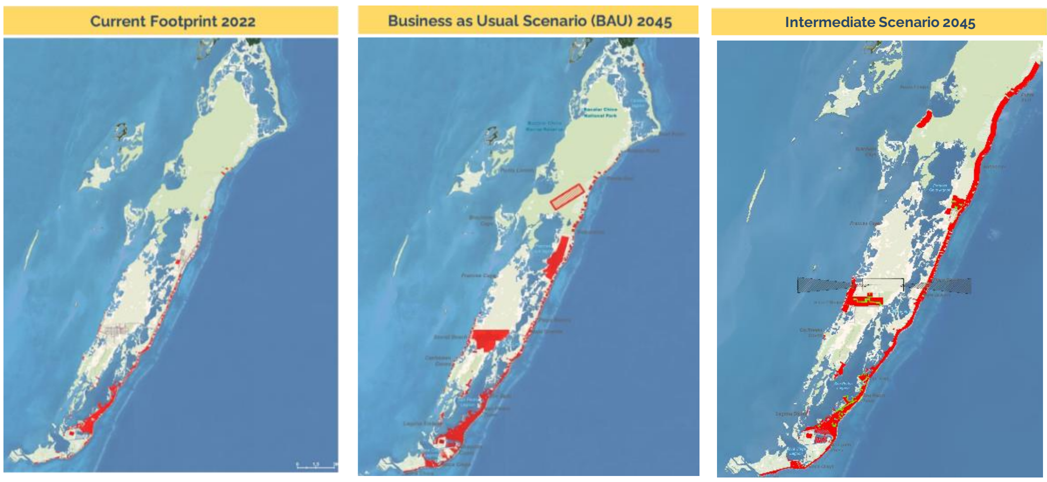
Source: IDOM, 2023

1.3.4. Comparison of growth urban scenarios

Following the design of the scenarios, a comparison is made between the indicators obtained in each of them and the corresponding data in the current model to quantitatively assess the impact of the actions in the scenarios.

The next figures show the result of the comparison between the current model and the scenarios graphically and quantitatively. Note that the Optimal and Intermediate scenarios have the same data for most of the indicators due to similar criteria used to define them.

Figure 9 - Comparison of the 2022 Current footprint with the Scenarios 2045



Source: IDOM, 2023

The "Urban Growth As Usual" scenario has a much greater impact on the natural environment, affecting protected areas 1.5 times greater than in the current or Intermediate Scenario. Something similar happens with the deforested mangrove area that is multiplied by 1.8 in the trend with respect to the intermediate. Regarding the provision of green areas and public space, in both cases the indicators of the optimal/Intermediate scenario are the only ones that reaches the WHO recommendation of 10sqm/inhab.

1.4. Future Carrying Capacity

This model has been developed based on the inputs from the Diagnostic and the agreements reached with stakeholders. The following sections will detail the definitions and basic data identified for the 6 variables of the proposed model. A matrix has been generated to summarize the variables analyzed, based on a "traffic light" system with 3 categories associated with the estimated deficit:

- **GREEN: ACCEPTABLE DEFICIT** The deficit identified in the variable is less than 15%.
- **YELLOW: WARNING CONDITION** The deficit identified in the variable is between 15% and 35%.
- **RED: CRITICAL DEFICIT** The deficit identified in the variable is more than 35%.

Table 7 Current and Future Carrying Capacity Results for Ambergris Caye: Estimated deficit for each variable.

	2022	2030	2035	2040	2045
Production Capacity of Fresh Water	27%	45%	52%	58%	63%
Wastewater Treatment	83%	87%	88%	89%	90%
Wastewater (Sewage coverage)	75%	81%	84%	86%	87%
Solid Waste Transfer Station Capacity	0%	36%	49%	60%	69%
Recycled Solid Waste	100%	100%	100%	100%	100%
Housing	1%	26%	36%	44%	51%
Preschool and Elementary Education	0%	19%	28%	35%	41%
High schools Education	0%	0%	0%	0%	41%

Source: IDOM, 2023

Based on this categorization, it can be clearly visualized that there are enormous challenges for the coming years in Ambergris related to carrying capacity, which will be essential to generate an investment program that will anticipate and finance the needs showed before.

In relation to the projected carrying capacity for the economic and social future of the Caye, it was found that currently, for fresh water there is a deficit of 27%, a deficit of 80% for wastewater treatment and 75% for sewage coverage. Therefore, these three variables become the most important variables that required a quick action to ensure optimal population growth.

the data incorporated in this initial Carrying Capacity model require revision with more precise data. In some cases, the variables can be updated with data from the 2022 Census, but in other cases they require data from other local or national sources.

1.5. Action & Financial Plan

1.5.1. Action Plan

The construction of a Vision and Action Plan is a key process for the sustainable and integral development of the Ambergris Caye territory. The Vision 2045 takes as a starting point the results found in the previous phases of the Consultancy, as well as the conclusions of the participatory process and the contrast with the findings of the consultancy being developed by the firm Pacifico and the Investment Climate Reform. The following figure shows the relationship between each of the elements and the proposed action plan, which contains plans and projects necessary to achieve the development of the Caye and its future carrying capacity.

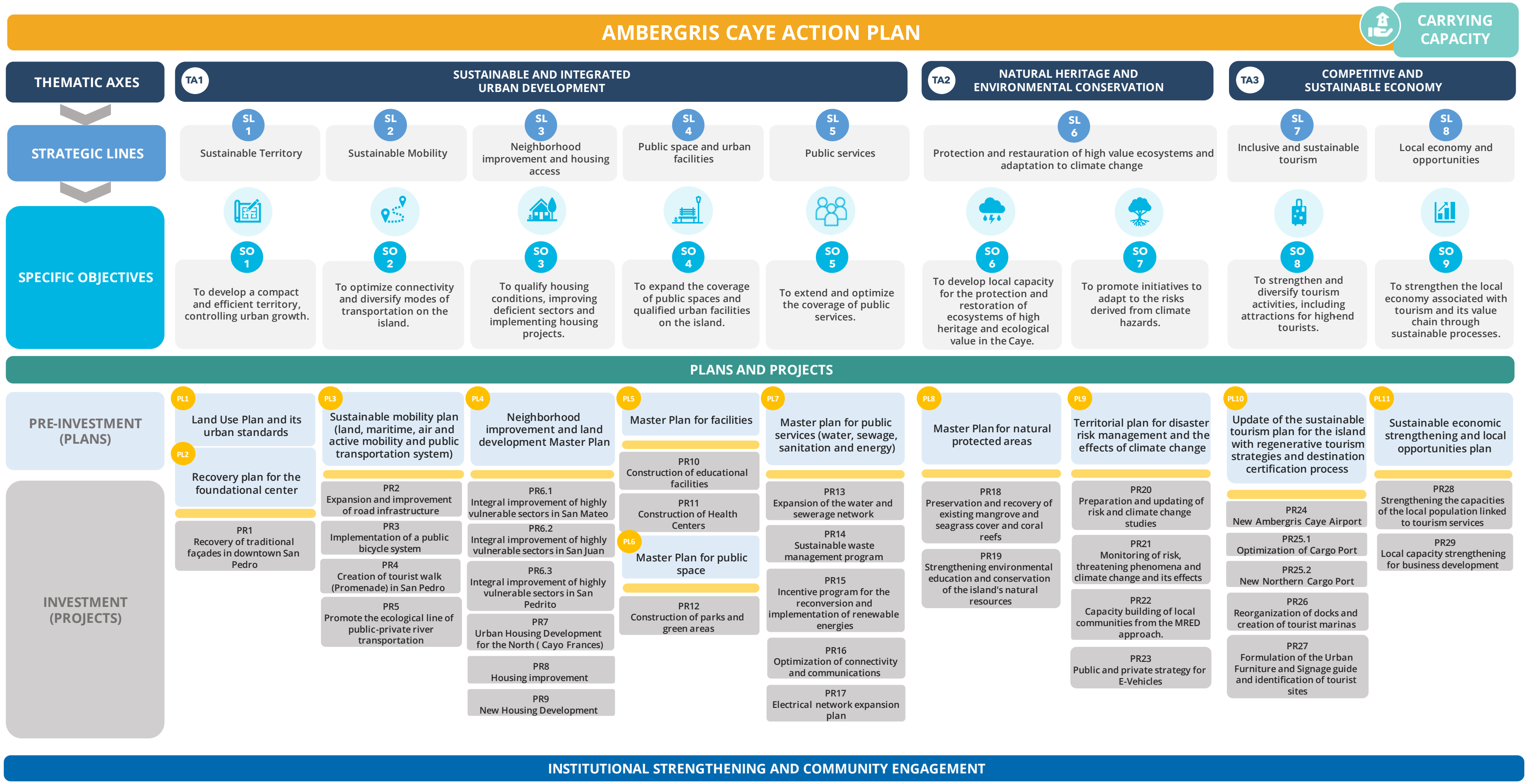
Figure 10 – Vision and action plan Structure for Ambergris Caye 2045

Source: IDOM, 2023

Vision	By 2045, Ambergris Caye will be a sustainable territory, by building resilient-natural sensitive infrastructure, and the generation of economic opportunities, promoting cultural identity in a productive, inclusive, and equitable environment.
General Objective	To implement strategies in Ambergris Caye that promote an integrated territorial development, based on harmonious relations with the natural heritage, the improvement of education, the qualification of urban spaces, the adaptation to climate risks, and the strengthening of the tourism sector; that reduce current inequality gaps, generating an attractive, resilient, sustainable territory with a high quality of life.

The Action Plan is the organized set of specific steps intended to outline a realistic path or strategy for the achievement of the Vision 2045.

Figure 11 – Ambergris Caye Action Plan



Source: IDOM, 2023

1.5.1.1. Investment plan for a general framework of Plans and Projects

This section outlines the Investment Plan for implementing the proposed projects over a 20-year timeframe, spanning from 2025 to 2045.

In general, the total expected budget of the projects over the 20 years is USD$ 270 million, of which 3% corresponds to the pre-investment phase and 97% to the investment phase. Divided by execution periods, periods 1 and 2 represent the largest amounts, requiring a total budget of USD$ 109 million and USD$ 85 million, respectively.

Table 8 –Investment timeline per period.

Phase	2025-2029	2030-2034	2035-2039	2040-2045	Total
Pre-Investment	$ 12,109,000	$200,000	$ 64,000	$ 56,000	$ 12,429,000
Investment	$ 147,498,000	$ 74,790,000	$ 59,359,000	$ 21,422,000	$ 303,069,000
Total*	$ 159,607,000	$ 74,990,000	$ 59,423,000	$ 21,478,0000	$ 315,498,000

*Housing value is taken out of the total investment due to the distortion it generates for the integral improvement of the island.

Source: IDOM, 2023

1.5.2. Project Prioritization

1.5.2.1. Pre-investment plans prioritization

In order to prioritize the pre-investment plans, the present study proposes to consider as analysis variables the existence of consultancies or studies previously developed on the topics addressed in the plans, as well as the execution costs formulated in the Action Plan.

In this regard, the following tables detail these variables for the respective pre-investment plans:

Table 9 – Pre-investment plans prioritization

	Axe	Plan	Detail of plans	Previous Studies	It has previous studies	Estimated costs (USD)
1	TA 1	PL1	Land Use Plan and its urban standards	Zoning Plan (2023)** Land Use Plan (2013) Revised Master Plan (2009)	YES	$150,000
2	TA 1	PL2	Recovery Plan for the Foundational Center	N/A	NO	$200,000
3	TA 1	PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility, and public transportation system)	National Transportation Master Plan (2018)	YES	$250,000
4	TA 1	PL4	Neighborhood improvement Master Plan	San Mateo Integral Improvement (2023)**	YES	$150,000
5	TA 1	PL5	Master plan for facilities	N/A	NO	$110,000
6	TA 1	PL6	Master plan for public space	N/A	NO	$90,000
7	TA 1	PL7	Master plan for public services (water, waste, sewage, sanitation, and energy)	North Ambergris Caye Expansion (water & wastewater); Caye Caulker South and	YES	$1,500,000

	Axe	Plan	Detail of plans	Previous Studies	It has previous studies	Estimated costs (USD)
				Placencia Peninsula WWTP and collection System (2022) *		
8	TA 2	PL8	Master Plan for natural protected areas	Coastal Zone Management Guidelines (2016	YES	$350,000
9	TA 2	PL9	Territorial plan for disaster risk management and the effects of climate change	Coastal Zone Management Guidelines (2016)	YES	$250.000
10	TA 3	PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process	Research Analysis and Update of the National Sustainable Tourism Master Plan for Belize (2022) * National Sustainable Tourism Masterplan for Belize 2030 (2011)	YES	$180.000
11	TA 3	PL11	Sustainable economic strengthening and local opportunities plan	Research Analysis and Update of the National Sustainable Tourism Master Plan for Belize (2022) * National Sustainable Tourism Masterplan for Belize 2030 (2011)	YES	$250.000

Source: IDOM, 2023

*Ongoing study.
**As part of the present consultancy "Support for Ambergris Caye Sustainable Development".

1.5.2.2. Investment Projects Prioritization

To identify the prioritization of projects for the Caye, the consultancy proposes three criteria, according to the identified needs and alignment with the study:

- Prioritization of Infrastructure of National Interest

Infrastructure projects considered of High Interest by the National Government are prioritized due to their importance for the economic and tourism development of Ambergris Caye. These projects are listed in the following table:

Table 10 – Project prioritization according to Infrastructure of National Interest

Axe	Project	Detail project
TA 3	PR24	New Ambergris Caye Airport
TA 1	PR02	Expansion and improvement of road infrastructure
TA 1	PR13	Expansion of the water and sewerage network
TA 1	PR15	Incentive program for the reconversion and implementation of renewable energies
TA 3	PR25.1	Optimization of Cargo Port
TA 3	PR25.2	New Northern Cargo Port
TA 1	PR07	Urban Housing Development for the North (Cayo Fránces)
TA 1	PR05	Promote the ecological line of public private water transportation

Source: IDOM, 2023

- Timing and carrying capacity.

This criteria includes projects directly related to current and future carrying capacity variables. Projects PR13 and PR9 will be developed in stages, according to the deficit indicators and conditions established in the model. These projects are listed in the following table:

Table 11 – Project prioritization according to timing and carrying capacity.

Axe	Project	Detail project
TA 1	PR6.1	Integral improvement of highly vulnerable sectors San Mateo
TA 1	PR6.2	Integral improvement of highly vulnerable sectors San Juan
TA 1	PR6.3	Integral improvement of highly vulnerable sectors and San Pedrito
TA 1	PR13	Expansion of the water and sewerage network
TA 1	PR10	Construction of educational facilities

Source: IDOM, 2023

- Local sustainable development

This prioritization is based on weighted parameters, which were used to evaluate the final impact of the projects on sustainable development of the Caye. A linear mathematical process was established based on four weighted parameters, which were used to evaluate the final impact of the project on the urban and sustainable development of the Caye.

Thus, and aligning the development priorities identified in the diagnostics carried out, 4 fundamental axes were selected from which this impact evaluation will be carried out. These axes are:

Quality of Life / Carrying capacity: In this fundamental axis, were considered parameters that could transversally evaluate the impact of the project.

Therefore, among the quality-of-life issue it was considered whether the project to be evaluated improves:

- Access to public services
- The relationship and indexes of public facilities and spaces.
- Mobility.
- And as an additional parameter, it was considered whether the project includes sustainable or climate change adaptation actions.

Legal and Governance: In this fundamental axis, it was considered whether it required:

- If there are necessary planning instruments
- The number of entities proposed to be coordinated.
- If the project could be implemented immediately.

Economy and Opportunity: In this fundamental axis, it was considered:

- If the projects could count on sustainable financing,
- The amount required for their execution and
- If it is favored the local economy and tourism.

Timing of project execution: In this thematic axis, it was considered:

- If it could be executed in the short, medium, or long term.
- If it strengthened the carrying capacity
- If it's required immediate action.

Thus, each parameter was assigned scores that quantitatively classify the relationship of each parameter with its fundamental axis, so that each fundamental axis had a maximum score of 5 points and a minimum of 0 points.

Likewise, each fundamental axis was weighted according to an interdisciplinary meeting within the IDOM team, where it was identified that the most important fundamental axis for sustainable urban development in the Caye was to improve the quality of life, followed by temporality, economy and opportunity and the legal scope. Thus, the following is the order of the projects with their final score obtained.

Table 12 – Project prioritization

Axe	Project	Detail project	General Evaluation
TA 1	PR15	Incentive program for the reconversion and implementation of renewable energies	4.4
TA 1	PR8	Housing improvement	4.4
TA 1	PR11	Construction of Health Centers	3.5
TA 1	PR12	Construction of parks and green areas	3.4
TA 3	PR26	Reorganization of docks and creation of tourist marinas	3.3
TA 1	PR14	Sustainable waste management program	3.3
TA 1	PR17	Electrical network expansion plan	3.3
TA 2	PR19	Strengthening environmental education and conservation of the island's natural resources	3.2
TA 1	PR04	Creation of tourist walk (Promenade) in San Pedro	3.1
TA 2	PR20	Preparation and updating of risk and climate change studies	2.9
TA 2	PR21	Monitoring of risk, threatening phenomena and climate change and its effects.	2.9
TA 1	PR03	Implementation of a public bicycle system, including bike lines	2.8
TA 3	PR28	Strengthening the capacities of the local population linked to tourism services	2.8
TA 3	PR29	Local capacity strengthening for business development	2.8
TA 2	PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	2.7
TA 1	PR05	Promote the ecological line of public-private water transportation	2.6
TA 1	PR16	Optimization of connectivity and communications	2.5
TA 1	PR01	Recovery of traditional façades in downtown San Pedro	2.5
TA 2	PR22	Capacity building of local communities from the MRED approach	2.3
TA3	PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	2.3

Source: IDOM, 2023

The action plan is directly aligned with the 2045 vision, general objectives, the specific SMART objectives, as well as with the conditions such as the future carrying capacity and population and tourism growth of the Caye.

The action plan is structured in 3 thematic areas (sustainable development, environment and competitiveness and sustainability); and in 8 strategic lines, from which the specific SMART objectives are derived and; as well as plans and projects.

Plans and projects are prioritized according to their contribution to the quality of life, the regulatory and governance framework, economic level and opportunity, level of importance, and time of execution. This prioritization responds directly to the needs identified in the future carrying capacity and development of the island.

1.6. Financial Plan

This chapter analyzes the possible sources of financing to carry out the different projects proposed in the Action Plan. The financing sources for projects comes from two main sources: public and private. Public financing uses state resources, international contributions, and strategies like taxes or debt. Organizations like the EBRD, IDB, and World Bank provide grants or loans. Private financing includes Public-private collaboration, where the public and private sectors collaborate for funding and maintenance. Governments also play a crucial role in project funding, using their budgets to support sustainable development effectively.

Subsequently, the type of financing source is analyzed depending on the type of project, analyzing different alternatives:

- Seven projects can be developed through Public-private collaboration. This alternative involves the private participation in the provision of public infrastructure in a cost-effective manner.
- Thirteen projects can be implemented by reimbursable or non-reimbursable Technical Cooperation.
- Seven projects could be developed through Concessional resources, non-reimbursable technical cooperation or green/blended financing. In the specific case of the construction of the health center in Ambergris Caye, it could be implemented through the facilities provided by the Government of Taiwan, thanks to the good bilateral relationship.
- Last, nine projects can be developed through a TP. For most of the projects, this procurement alternative is the most feasible option given the trajectory and the amount.

1.7. A zoom-in to the north

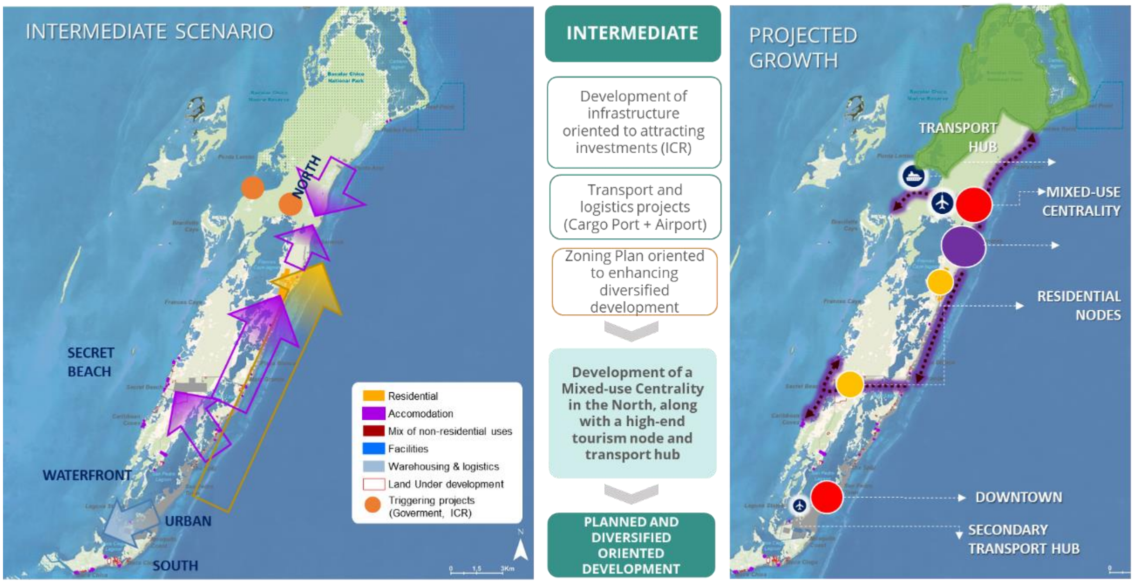
One of the main objectives of this **Strategic Plan** is to consolidate the sustainable growth of **Northern Ambergris**, through the execution of key projects directed to close the gaps in private investment and allow development to take place in a planned way. In this order, the analysis identified the main **triggering projects prioritized by the Task Force**, which were decisive assets that modified the growth vectors, as will be explained later in this chapter.

1.7.1. Growth vectors

In Ambergris Caye, through a multi-sector analysis, it was identified that the major organic growth trends are pointing towards the northern area, through predominantly linear developments along the coastline, mainly consisting of resorts and tourist housing. These dynamics will be significantly impacted by the execution of strategic projects of national interest, such as the new cargo port in Laguna Santa Cruz and the construction of a new International Airport in the surrounding area of Cayo Francés. This will represent a significant attractor factor for new developments, both for accommodations and residential and mixed-use developments to support these new infrastructures.

Taking the above into account, the consultancy has considered Northern Ambergris as an area of special focus in Ambergris Caye, for which, considering these triggering national investments and the infrastructure gaps identified by ICR, specific projects have been proposed in order to generate integral urban areas around the new tourist and logistical developments.

Figure 12 - Development Vectors



Source: IDOM, 2023

1.7.2. Tourism Growth Benchmark Analysis

Considering that Ambergris Caye is the most touristic destination in Belize, it is evident that the island has a growing number of visitors and tourism developments in its territory. Likewise, different investment gaps in the private sector were identified. Therefore, it is necessary to plan a high-level tourism development located in the developable areas of the north of the Caye that not only covers the different needs and activities of visitors, but also functions as a comparison between different types of investments that can be developed. In this way, a benchmarking of good tourism practices in destinations with similar characteristics to those of the Caye was carried out, in order to find the lessons learned from different places that have managed to promote tourism in a planned manner.

The following is the analysis carried out to compare cities such as Cancun and Punta Cana with Ambergris Caye as a high-level tourist destination.

As can be seen in the image below, the total surface of hotel infrastructure in Cancun reaches 1,241 acres. In this area, there are 1,129 large-scale hotels and an estimated beach extension of 110.90 acres. In Punta Cana, on the other hand, the total area of hotel infrastructure reaches 2,442 acres with a coastline distance of 8.6 miles. In this area, there are more than 700 large-scale hotels and a beach extension of 172.64 acres.

Considering the above, the proposal for Ambergris Caye sets an area of 1,372 acres for hotel infrastructure. Out of this designated area, a total of 1,163 acres are available for the development of a tourist corridor on the east coast, which is equivalent to 84.7% of the total area. This leads us to understand that a hotel infrastructure the size of Cancun or Punta Cana could perfectly adapt to the area designated in the east coast of the Caye.

Figure 13 - Scale analysis and comparison.

Source: IDOM, 2023

Once the scales of the analyzed cities were compared with Ambergris Caye. A detailed investigation was carried out on the different urban components necessary to cover an adequate high-level tourism development.

1.7.3. Triggering projects and actions to develop the north of the Caye.

Once defined and analyzed the minimum characteristics that must be considered to achieve a high-end tourist destination. A comparative matrix was developed that describes and demonstrates the different components that the Caye has or should have. The matrix is shown below.

Figure 14 - Comparative matrix between tourist destination

	Task	Cancun	Punta Cana	Ambergris Caye	ICR Needs	Northern Proposal
INFRASTRUCTURE REQUIREMENTS	International Airport	✓	✓	Local Airport	✓	✓
	Main Roads	✓	✓	Infrastructure	✓	✓
	Cargo Port	✓	✓	Size Improvement	✓	✓
FACILITIES	Hospitals & Health Centers	✓	✓	✗	✓	✓
PUBLIC SERVICES	Water & Sanitation	✓	✓	✗	✓	✓
	Public Transportation	✓	✓	✗	✓	✓
HOUSING	Employee's Residence Zone	✓	✓	Housing Improve	✗	✓

✓ Existent ✗ Non-Existent Need of Improvement

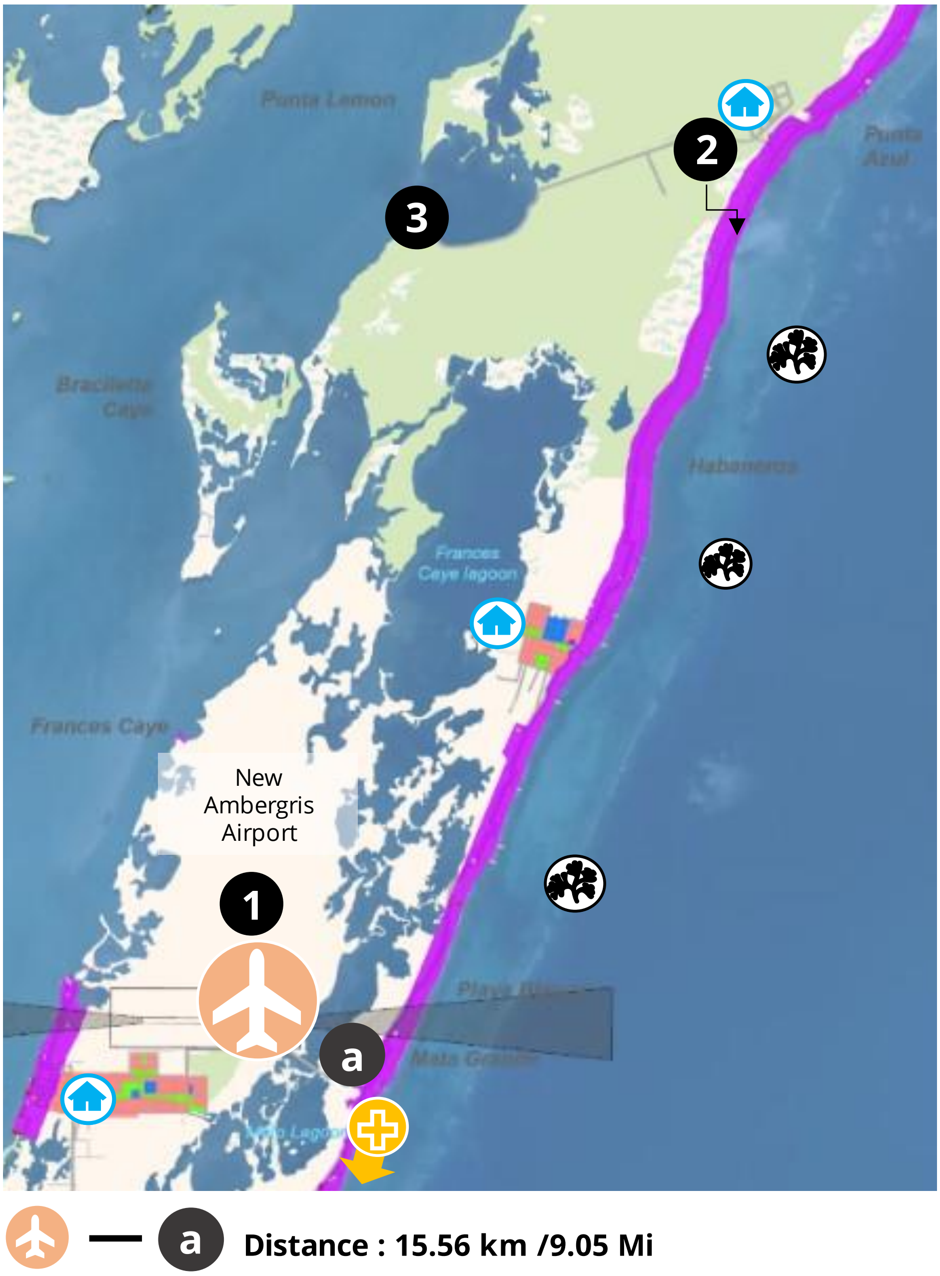
Source: IDOM,2023

As can be seen in the matrix, the Caye has great potential to become a high-end tourist destination. However, it is evident that major infrastructure improvements must be developed to cover the basic needs of tourists visiting the island. Considering the cities compared and analyzing the missing elements for Ambergris Caye to become a responsible and sustainable tourism destination, the analysis of the consultancy was further developed.

To redefine the growth vectors and promote north development in a sustainable way, inputs were considered:

- Identification of **triggering projects that will change the vectors of growth** in the Caye, through key infrastructure (Investment Climate Reform -ICR.) and projects prioritized by the government.
- Identification of main **barriers to investment**
- Analysis of **best practices for the development of high-end tourism**, in conditions similar to those of the Caye.
- Evaluation of **potential airport locations**.

Figure 15 – Key factors to redefine the growth vectors and promote north development.



Source: IDOM, 2023

Key factors:

- Build new roads to link south - north side of the Caye.
- Develop new international airport infrastructure.
- Strengthen the transportation hub including the cargo port in the north of the cay.
- Construction of health facilities with high service standards.
- Extension of the tourist development corridor on the east coast- Approximately 1150 feet (350 meters deep).
- Develop housing nodes in the north of the island that offer services to the tourist industry.
- Develop facilities in the developed areas that guarantee quality of life for the local population and tourists.

A roadmap for the execution of the key factors identifies the timing and costs, according to pre-investment and investment relevant to the develop the north part of the island.

These are an integral part of the overall plans and projects, shown on the previous chapter, involving the south of the Caye.

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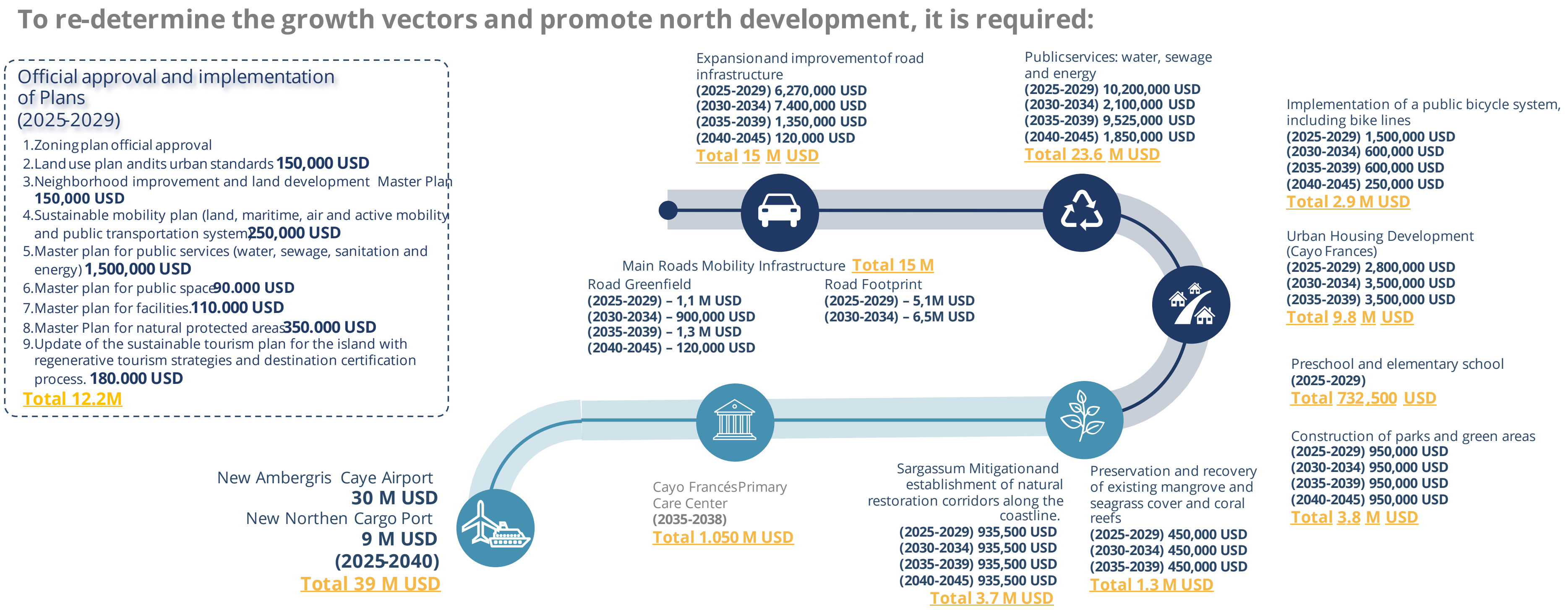
Figure 16 – General Roadmap to re-determinate the growth vectors and promote north development



Period	2025 -2029	2030 -2034	2035 -2049	2040 -2045	Total
Pre-investment	$12,370,000	$ 60,000	$ 57,000	$ 3,000	**$12,490,000**
Investment	$50,540,500	$31,535,500	$36,660,500	$15,405,500	**$134,142,000**
Total	**$62,910,500**	**$31,595,500**	**$36,717,500**	**$15,408,500**	**$146,632,000**

Note 1: All prices and execution dates include studies, design and construction phases.
Note 2: The roadmap and costs must be adjusted according to the pre-investment plans.

Source: IDOM, 2023

Table 13 Roadmap and Investment Plan for the Northern Zone

	Specific Activities (Plans and Projects)	Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution — 2025 2026 2027 2028 2029	2030 2031 2032 2033 2034	2035 2036 2037 2038 2039	2040 2041 2042 2043 2044 2045
TA1 - SUSTAINABLE AND INTEGRATED URBAN DEVELOPMENT							
SL1 - SUSTAINABLE TERRITORY							
PL1	Land Use Plan and its urban standards	$ 150,000	N/A	F; $ 150,000		I	
SL2 - SUSTAINABLE MOBILITY							
PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility and public transportation system)	$ 250,000	N/A	F; $ 250,000		I	
PR2	Expansion and improvement of road infrastructure	$ 180,000	$ 15,140,000	F		E	
PR2 F1	Expansion and improvement of road infrastructure greenfield north zone	$ 30,000	$ 3,490,000	$ 20,000; $ 1,120,000	$10,000; $ 900,000	$ 1,350,000	$ 120,000
PR2 F2	Expansion and improvement of road infrastructure footprint north zone	$ 150,000	$ 11,650,000	$ 110,000; $ 5,150,000	$40,000; $ 6,500,000		
PR3	Implementation of a public bicycle system, including bike lines	$ 30,000	$2,950,000	F; E	F; E	F; E	F; E
PR3 F1	Implementation of a public bicycle system, including bike lines in the north	$ 30,000	$ 2,950,000	$10,000; $ 1,500,000	$ 10,000; $ 600,000	$7,000; $ 600,000	$ 3,000; $ 250,000
SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS							
PL4	Neighborhood improvement and land development Master Plan	$ 150,000	N/A	F; $ 150,000	I		
PR7	Urban Housing Development for the North (Cayo Francés)	$ 150,000	$ 9,800,000	F; $ 150,000; $ 2,800,000	E; $ 3,500,000	$ 3,500,000	
PR9	New Housing Development	$ 2,500,000	$ 32,900,000	F		E	
PR9 F1	Construction of new urban housing (Cayo Francés)	$ 2,500,000	$ 32,900,000	$ 2,500,000			
PR9 F1A	*New affordable housing (Cayo Francés)*	N/A	$ 10,500,000	$ 2,200,000	$ 2,100,000	$ 2,600,000	$ 3,600,000
PR9 F1B	*New workers housing (Cayo Francés)*	N/A	$ 22,400,000	$ 4,500,000	$ 4,500,000	$ 5,700,000	$ 7,700,000
SL4 - PUBLIC SPACE AND URBAN FACILITIES							
PL5	Master plan for facilities	$ 110,000	N/A	F; $ 110,000		I	
PR10	Construction of educational facilities	N/A	$ 735,000	F		E	
PR10 F1	Preschool and elementary school North	N/A	$ 735,000	$ 735,000			
PR11	Construction of Health Centers	$ 50,000	$ 1,050,000	F; E			
PR11 F2	Cayo Francés Primary Care Center	$ 50,000	$ 1,050,000			F; E; $ 50,000; $ 1,050,000	
PL6	Master plan for public space	$ 90,000	N/A	F; $ 90,000		I	
PR12	Construction of parks and green areas	N/A	$ 3,800,000	F		E	
PR12 F1	Construction of parks and green areas north zone	N/A	$ 3,800,000	$ 950,000	$ 950,000	$ 950,000	$ 950,000
SL5 - PUBLIC SERVICES							
PL7	Master plan for public services (water, waste, sewage, sanitation, and energy)	$ 1,500,000	N/A	F; $ 1,500,000		I	
PR13	Expansion of the water and sewerage network	N/A	$ 20,075,000	F		E	
PR13 F1	Main Water & Sewage lines (North)	N/A	$ 800,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000
PR13 F3	Expansion of freshwater & Sewage network (North)	N/A	$ 2,350,000	$ 750,000	$ 700,000	$ 450,000	$ 450,000
PR13 F5	Expansion of wastewater treatment plant	N/A	$ 6,800,000	$ 5,200,000		$ 1,600,000	
PR13 F6	Expansion of Desalinization treatment plant	N/A	$ 10,125,000	$ 4,050,000		$ 6,075,000	
PR17	Electrical network expansion plan	$ 300,000	$ 3,600,000	F		E	
PR17 - F4	North power grid construction (High Voltage)	$ 300,000	$ 3,600,000	$ 300,000	$ 1,200,000	$ 1,200,000	$ 1,200,000
TA2 - NATURAL HERITAGE AND ENVIRONMENTAL CONSERVATION							
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE							
PL8	Master Plan for natural protected areas	$ 350,000	N/A	F; $ 350,000		I	
PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	N/A	$ 5,092,000	F	E		
PR18 F1	Preservation and recovery of existing mangrove and seagrass cover and coral reefs (Located in the north zone)	N/A	$ 1,350,000	$ 450,000	$ 450,000	$ 450,000	
PR18 F2	Sargassum collection in the northern zone	N/A	$ 3,742,000	$ 935,500	$ 935,500	$ 935,500	$ 935,500
TA3- COMPETITIVE AND SUSTAINABLE ECONOMY							
SL7 - INCLUSIVE, COMPETITIVE AND SUSTAINABLE TOURISM							
PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$ 180,000	N/A	F; $ 180,000		I	
PR24	New Ambergris Caye Airport	$ 5,000,000	$ 30,000,000	F; E; $ 5,000,000; $ 20,000,000		E; $ 10,000,000	E
PR25.2	New Northern Cargo Port*	$ 1,500,000	$ 9,000,000	F; $ 1,500,000	E; $ 9,000,000		

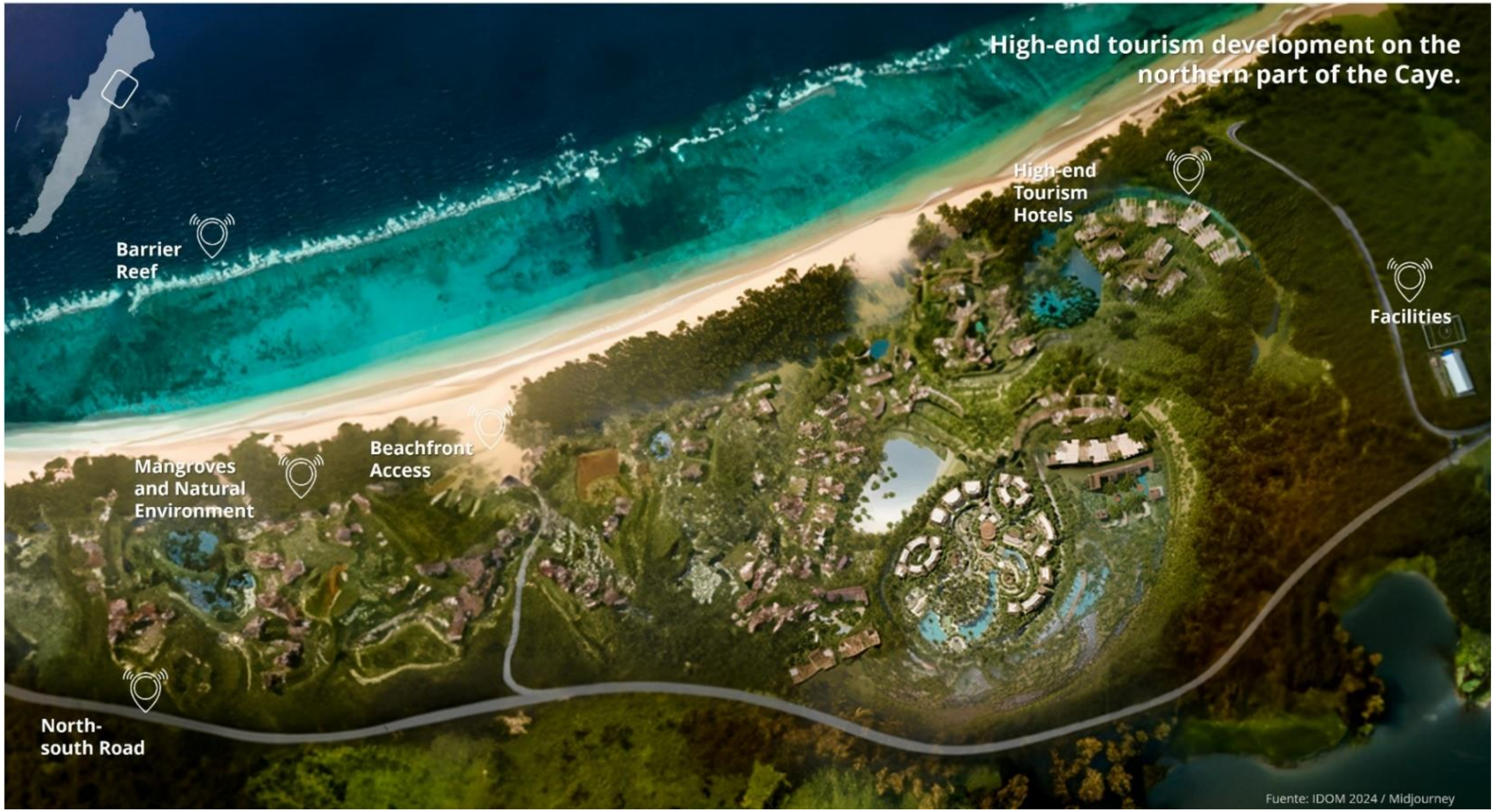
* It is important to notice that the investment in new housing (apart for social and workers) is not being considered in the total of the Action Plan/ the final price will depend in the approval of the power network project

Source: IDOM, 2024

1.7.4. Tentative renderings of the development in the north

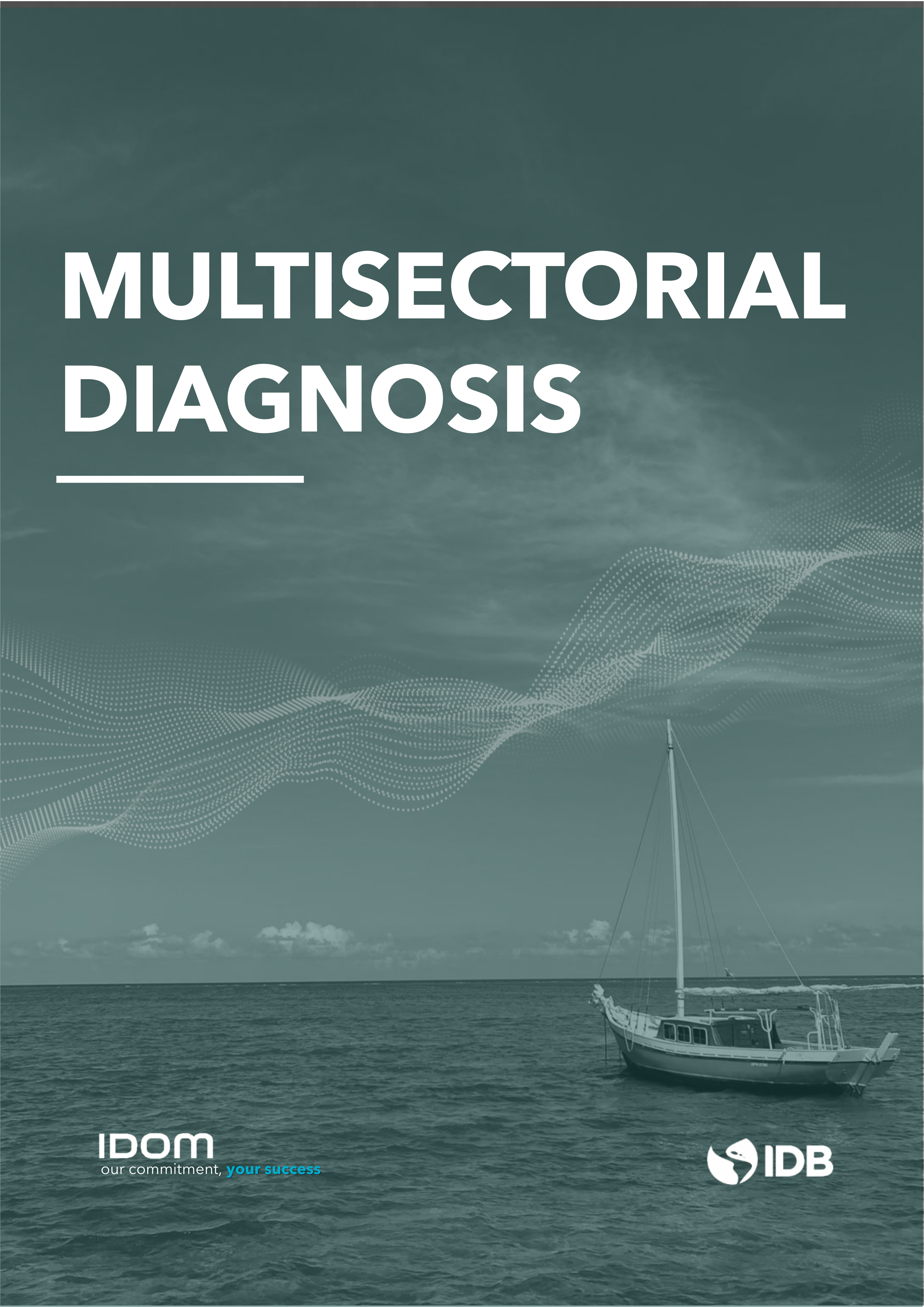
Some tentative images of the coastal area in the north of the island were made. The proposed hotel complexes and the different infrastructures and facilities that will be proposed for this sector can be seen.

Figure 17- Tentative renderings of the intermediate scenario



Source: IDOM, 2023

MULTISECTORIAL DIAGNOSIS



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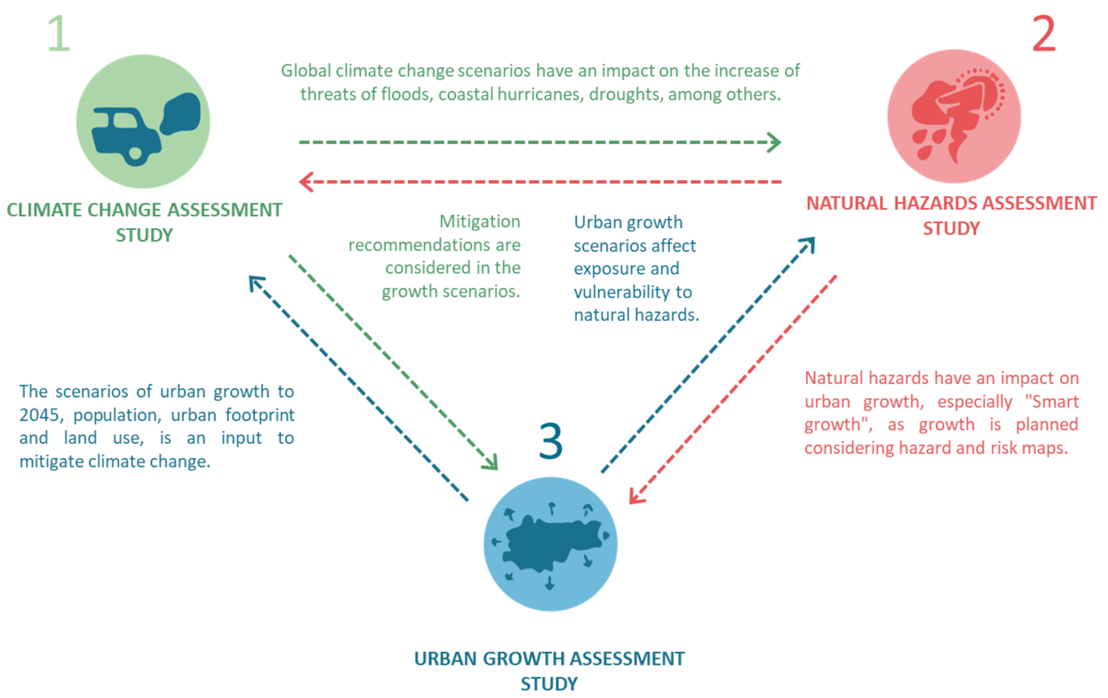
2. Multisectorial Diagnosis

One of the objectives of the multisectoral diagnosis, is to understand the different dynamics that have occurred in the growth process of Ambergris Caye, identifying the strengths and weaknesses of the territory in terms of its future development.

The complex relationships that exist between territory, climate, environment, tourism, economy, society, among others, are demanding new ways of facing challenges and proposing new solutions. The challenges are common: the effects of climate change, strong population growth, rural-urban migration, poverty, low urban density, natural risks, environmental degradation, socio-spatial segregation, and difficulty in providing urban services, among others. These studies provide general guidelines for a sustainable territorial planning, according to the scale of intervention.

In addition, in order to project the sustainable development of the study area, three interrelated analyses are developed within the diagnosis: the Urban Growth study, the Vulnerability to Natural Risks study, and the climate change and GHG inventory. The main relationships between these three components are:

Figure 18 - Relationship diagram between components



Source: IDOM, 2023

With those inputs and the analysis of determinants and limitations to urban development, the consultancy should be able to build a perspective analysis of urban development and carrying capacity in three scenarios "urban growth as usual", "optimal" and,"intermediate" Scenario, considering higher population density, green areas conservation, triggering projectsand limitation of urban footprint expansion.

URBAN DIAGNOSIS

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2.1. Urban diagnosis

In the following chapters a multi-scale approach to the territory will be developed in order to make a correct diagnosis of Ambergris Caye., consider factors such as territorial framework, analysis of the growth of the urban footprint, determination of homogeneous units, demographic analysis, the different territorial systems, the studies, and planning processes executed and in process, the real estate offer and the determinants and limiting factors of growth.

2.1.1. Territorial Framework

To support Ambergris Caye for a sustainable development, it is important to approach the territory on different scales, according to the relevant elements: Urban growth, Natural hazards and GHG emissions analysis. This general approach is made from the national level to the municipal level. Thus, understanding the relationships and physical-geographical determinants that give reason for the urban and territorial configuration of the island.

To better understand the territorial framework of Ambergris Caye, this section focuses on three distinct scales that provide in-depth information about its environment, connections, size, population, and other key elements.

2.1.1.1. National Scale

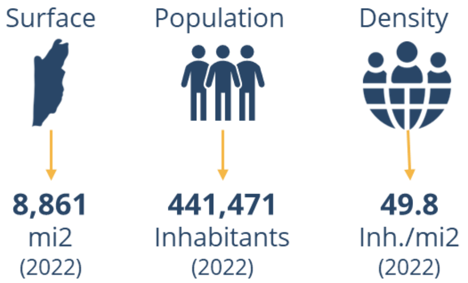
Figure 19 - National Scale Map

Source: IDOM, 2023

Belize, situated on the north-eastern coast of Central America, with an approximate area of 8,861 square miles (22,966 square kilometres), the country encompasses a rich variety of ecosystems, including lush rainforests, pristine coastlines, and the magnificent Belize Barrier Reef, a UNESCO World Heritage site.

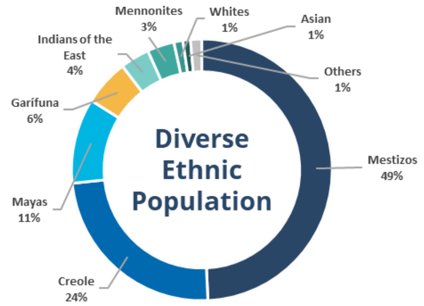
Belize´s current population is about 441,471 people (According to the projections of the Statistical Institute of Belize), offering a vibrant cultural tapestry influenced by Mayan, Creole, Garifuna, and Mestizo traditions. The country's demographic makeup reflects its multicultural heritage, fostering a rich blend of languages, cuisines, and customs.

Figure 20 - Key Data National Scale



Source: Spanish Diplomatic Information Office (April 2023) – Census 2010

Figure 21 - Diverse Ethnic Population Chart



Source: Spanish Diplomatic Information Office (April 2023) – Census 2010

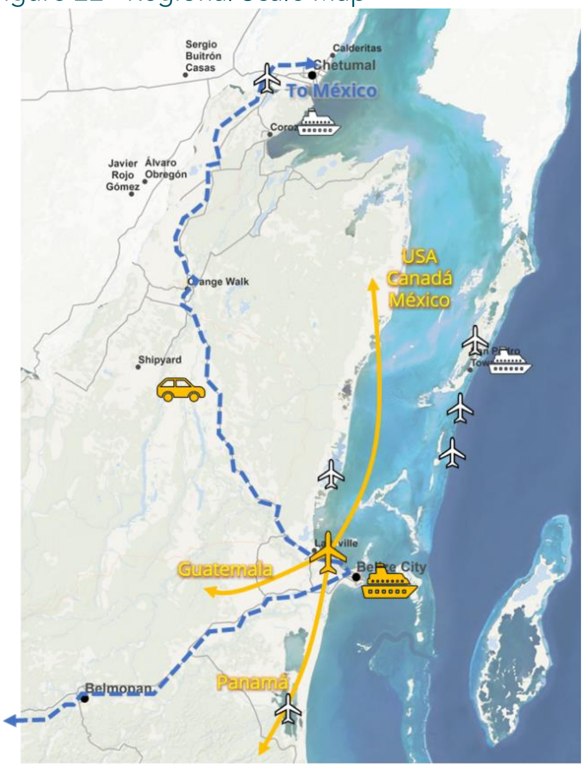
In terms of connectivity, the country's eastern coastline is flanked by the Caribbean Sea, providing opportunities for trade, tourism, and marine activities. About some infrastructure:

- Road network: is extensive and connect several regions.
- The Philip S. W. Goldson International Airport, located in Belize City, serves as the primary gateway for international air travel, facilitating connections with major cities in North America and beyond.
- Domestic airports, seaports and docks enhance internal mobility and trade within the country.

2.1.1.2. Regional Scale

At the regional level, Belize has an inland and an island section. This connection is strong within the mobility system and is given in 3 main modes, terrestrial, maritime and air. At the regional level, Ambergris Caye is an important source of tourism for the region and the country.

Figure 22 - Regional Scale Map



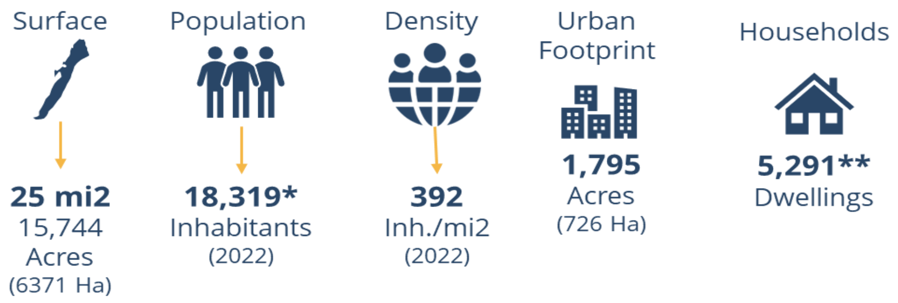
Source: IDOM, 2023

- Ground Connection: Belize has several primary roads that allow not only a national but also an international flow to reach neighbouring countries such as Mexico and Guatemala.
- Aerial Connection: The International Airport in Belize City is served by 2 airlines to 8 cities within the region. Also, the country has domestic airport service to: Caye Caulker, Caye Chapel, Corozal, Placencia, Punta Gorda, San Ignacio, and San Pedro.
- Maritime Connection: Belize City´s Port is one of the largest in the country. It has other ports of great relevance such as the Big Creek Port in the Stann Creek District or in towns such as Punta Gorda, Corozal and San Pedro, where several docking facilities can be found. Also, it is possible to travel to Chetumal, Mexico from the San Pedro Town.

2.1.1.3. Island Scale

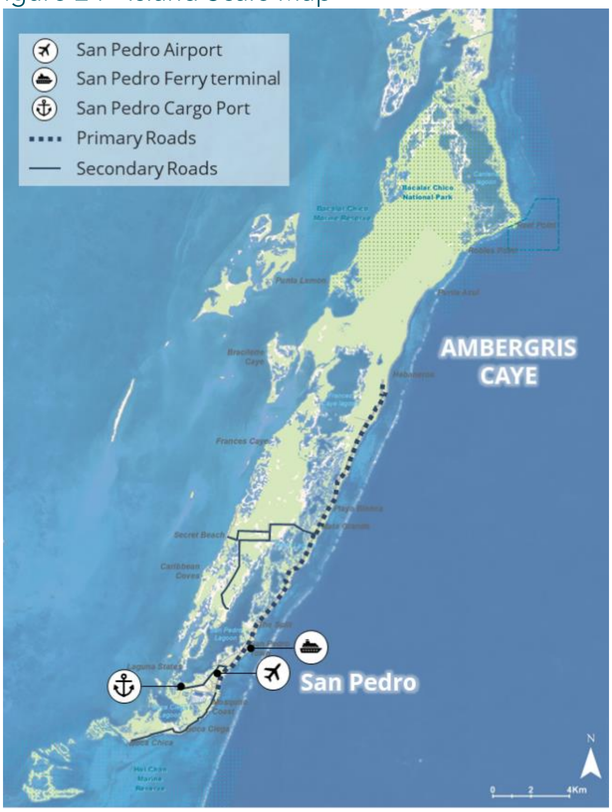
Ambergris Caye, is located on the eastern coast of Belize in the Caribbean Sea, with an area of approximately 25 square miles (65 square kilometres), with about 18,319 inhabitants on the island according to 2022 population estimate (SIB, 2022). This captivating island showcases a blend of natural beauty and vibrant communities.

Figure 23 - Key Data Island Scale



Source: Estimated projections by the Statistical Institute of Belize

Figure 24 - Island Scale Map



Source: IDOM, 2023

The island's population has continued to grow, driven by its appeal as a popular tourist destination and workplace for many locals. The island's communities reflect a diverse mix of locals and expatriates, contributing to a rich cultural tapestry.

In terms of connectivity, the island is accessible via boat or plane. Thanks to regular ferry services and domestic flights connecting it to mainland Belize.

The island's infrastructure comprises a network of secondary roads, although the primary mode of transportation within Ambergris Caye is golf carts and bicycles. The absence of cars and the relaxed atmosphere contribute to the island's charm and enhance the overall experience of exploring its attractions.

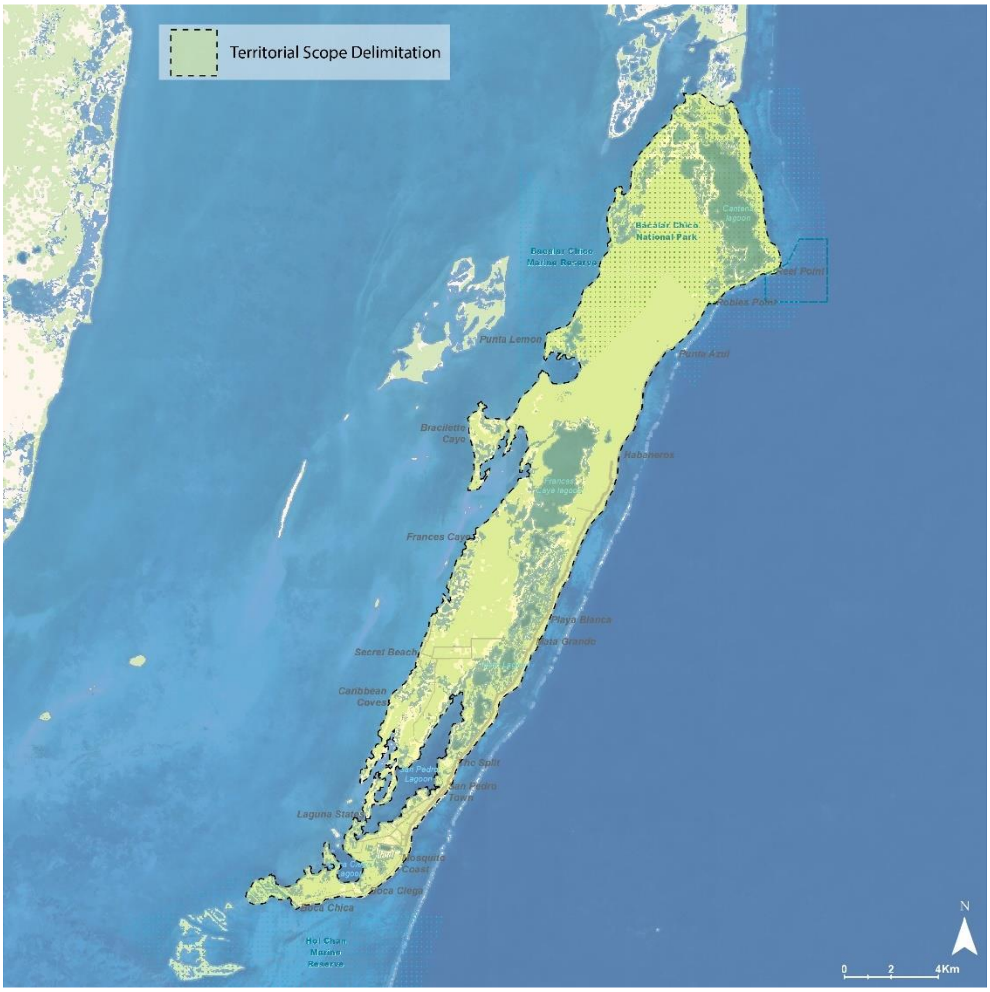
2.1.1.4. Definition of the study area

The Emerging and Sustainable Cities Methodology focuses on the urban areas of intermediate cities. In this sense, Ambergris Caye is going to be studied to its full extent, including San Pedro town, which is to the most densely populated and urbanized sector.

It is important to mention that, although the study area corresponds to the entire Caye, the dynamics and relationships with the town of San Pedro are considered to understand the dynamics of growth of the urban footprint of Ambergris Caye and to be able to project the urban growth scenarios (trend and smart) in the time horizon to 2045.

The map below includes the delimitation of the territorial scope to be analysed in this consultancy.

Figure 25 - Territorial scope of the Consultancy



Source: IDOM, 2023

Likewise, the document will handle different scales of maps to analyse in detail some issues that require closer scales, which is why an intermediate scale was also made, ranging from the area of Secret Beach to the southern tip of the island and an urban scale where the town of San Pedro can be shown in more detail, from the Barry Bowen Bridge in the north to Mahogany Bay in the south.

In conclusion, considering the spatial characteristics and territorial dynamics analyzed in this section, the entire geographical area of Ambergris Caye has been considered as a study area for the Climate Change Mitigation Studies, Urban Growth Analysis and Disaster Risk Assessment components.

2.1.2. Analysis of the growth of the urban footprint

This section is an analysis of the growth of Ambergris Caye's urban footprint over time. This study is developed to understand the urban dynamics of the area and the different extensions that have been developed since the date of its foundation. Additionally, this analysis allows us to provide different ideas of where new urban developments will be located and under what guidelines they will be settled.

2.1.2.1. Current and Historical Urban Footprint

The historical growth of the urban footprint of San Pedro, reflects the development and transformation of the Caye over time. From its humble beginnings as a fishing village, San Pedro has evolved into a vibrant town attracting tourists from around the world. This chapter aims to explore the key milestones and significant dates in the town's foundation and subsequent urban expansion. By examining these historical events, we can gain insight into the factors that shaped San Pedro's urban growth and understand its present-day urban footprint.

- **Period Between 1848 – 1950**

Figure 26 - Ambergris Caye 1950 Map

Source: IDOM, 2023

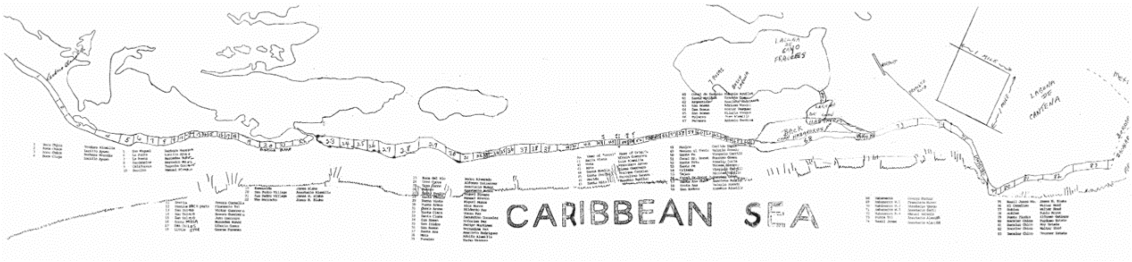
The first settlements and founding of San Pedro took place in 1848.

The Town's history dates to the mid-19th century when it was settled by Mestizo refugees from the Yucatan Peninsula fleeing the Caste War. These settlers relied primarily on fishing and agriculture for their livelihoods.

The founding of San Pedro is generally attributed to the establishment of a fishing cooperative in 1848. However, it remained a small, isolated community with minimal urban development during this period.

The lands of Ambergris Caye belonged to wealthy families who oversaw production of different businesses through agriculture such as "Palo Campeche", coconut, chicozapote, among others. This is how this families decided to migrate to the island and gave large pieces of land to other refugees from the Caste War.

Figure 27 - Property Distribution on Ambergris Caye "in the beginning"

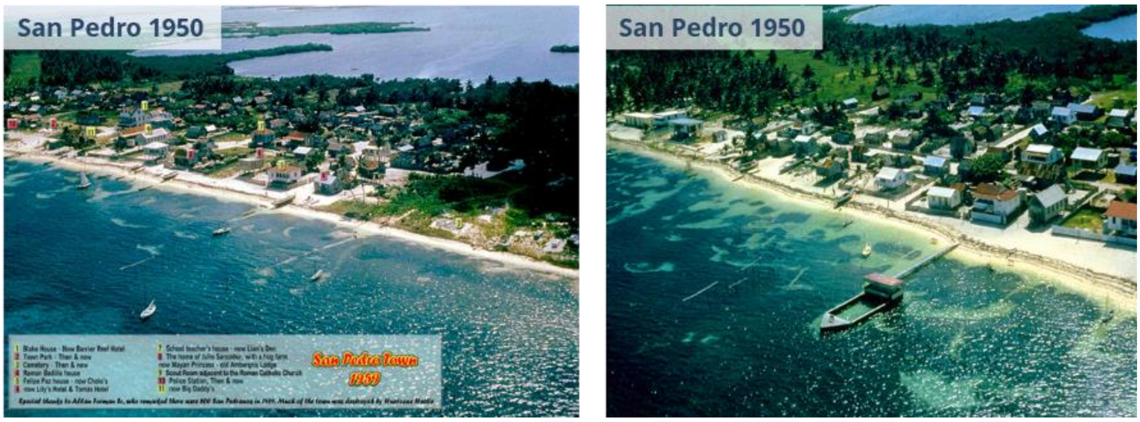


Source: Ambergris.com, Ambergris Caye, Belize History by George Parham J.P.

Around 1920, the island began to change its economic character, as fishing became the main business and income for the settlement. Likewise, coconut farms began to develop around the island and the sale of coconuts became an extremely important element of the island's economy. By 1935, coconut and fishing were the main source of income for the entire island.

In November 1942 a hurricane destroyed 90% of the buildings in San Pedro, including the coconut farms. This devastating natural event stalled the development that the island had been generating, as it left the island with only seven buildings standing and very few resources to move forward. In 1960 the coconut farms were abandoned as the land was more valuable for real estate than for agriculture and fishing became the island's main source of income.

Photo 1 - San Pedro Village in 1950



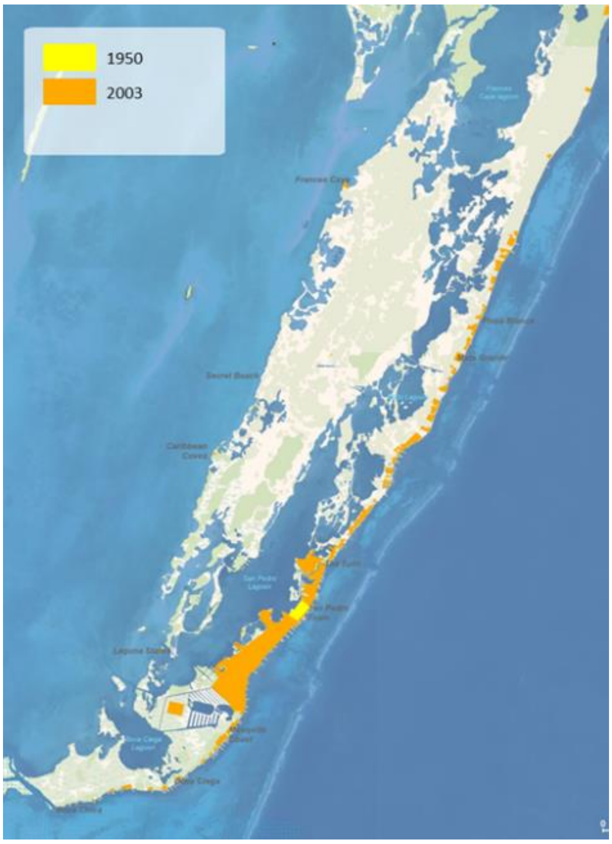
Source: Ambergris.com, Ambergris Caye, Belize History, A Necklace Draped Alongside a Beach (1999)

Urban growth for this period started in the centre of San Pedro and began to spread along the beaches between the south and the north in small scales where the fishing piers and coconut farms were located on the extreme sides.

- **Period Between 1960 – 2006**

San Pedro continued to grow and began to recover from the hurricane in the right way. Having an economy so closely tied to the fishing of snapper, mullet, bonefish, and especially lobster. In 1964 the Caribbean Queen Company cooperative agreed to buy and export lobsters under the cooperative's quota.

Figure 28 - Ambergris Caye 1950-2003 Map



Source: IDOM, 2023

The 1970s marked a turning point for San Pedro, as tourism emerged as a major industry in Belize. The region's pristine beaches, crystal-clear waters, and the nearby barrier reef attracted travellers seeking a tranquil getaway. The rapid growth of the tourism sector triggered a significant increase in infrastructure development, leading to the expansion of San Pedro's urban footprint.

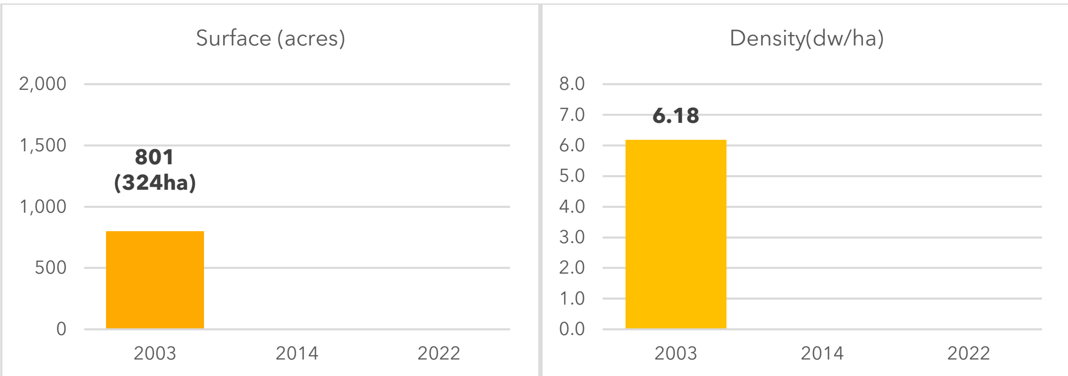
San Pedro experienced significant growth and development following Belize's independence from British colonial rule in 1981. In 1984, the fishing business was providing great income to the island, selling around 184,000 pounds per year. However, in 1993 production dropped to only 18,000 pounds per year due to seasonal shortages.

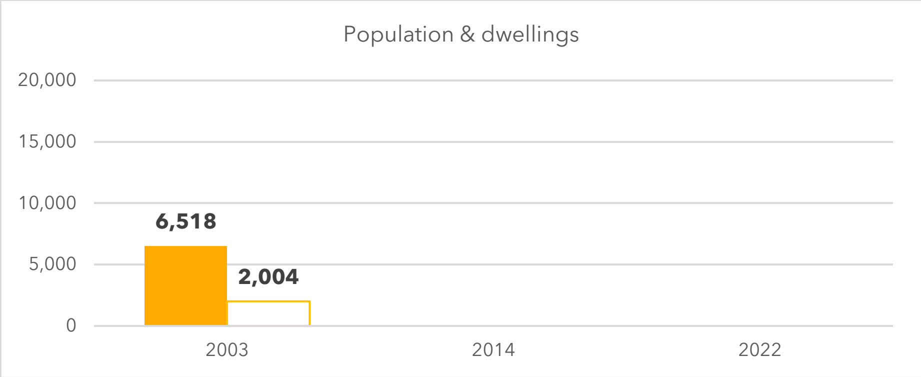
During the 1990s, what was once a simple airstrip, was taking on more and more infrastructure and an increasing flow of tourists looking for diving and leisure plans on the beach.

It was since 1993 that tourism began to have the priority importance of the economy throughout the Caye. Fishermen began to provide diving services and the first hotels and stores began to set up in the centre, such as the Holiday, the Coral Beach Hotel, the Paradise, among others.

In 2003, the footprint occupied 801 acres (324 ha), **69% of which was urban**, and linear developments were concentrated over a **length of nearly 6 miles**.

Figure 29 – Historical urban footprint Ambergris Caye 2003

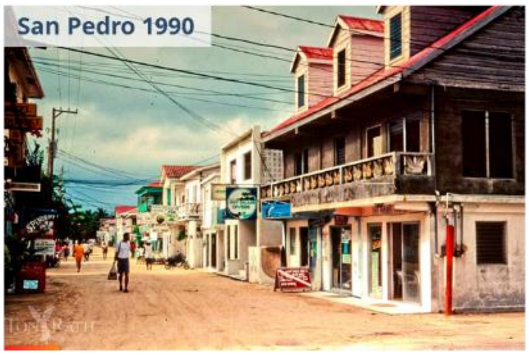




Source: IDOM, 2023

Beginning the 2000s, San Pedro was completely consolidated towards tourists, with diving services, beaches, gastronomy, great hotels among other services. It was in that period that the Barry Bowen Bridge was built, connecting the downtown area with the northern part of the island.

Photo 2 - San Pedro in 1990 and 1999

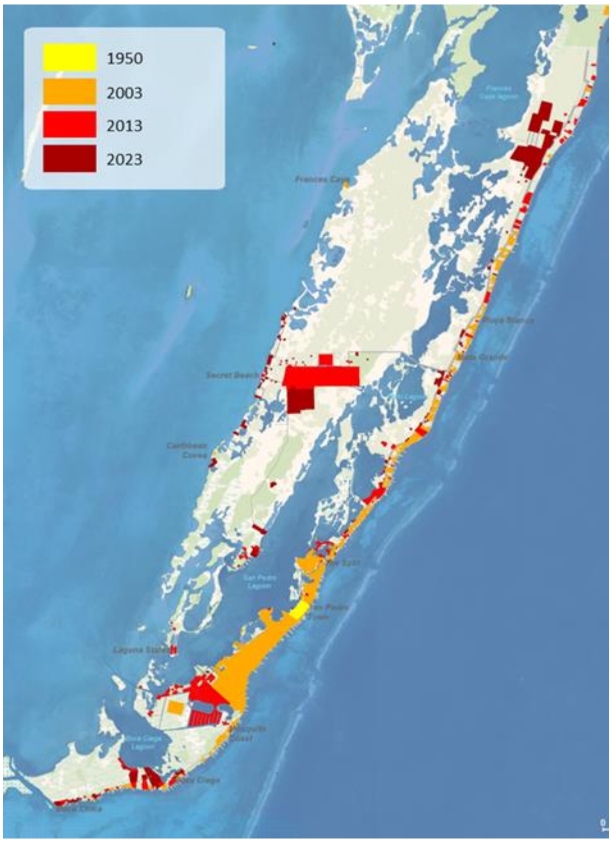


Source: Ambergris.com, Ambergris Caye, Belize History, A Necklace Draped Alongside a Beach (1999)

During this period, tourism fostered the growth of the urban footprint. The development of different hotels on the edges of the beach and commerce in the center, allowed more people to develop beach houses or rooms for rent on the south side of the island, while on the north side they had the connection to the new bridge but were only allowed to travel on foot or with a golf cart.

- **Period Between 2006 – 2023**

Figure 30 - Ambergris Caye 1950 - 2023 Map



Source: IDOM, 2023

The period between 2006 and 2023 witnessed significant growth and development in the urban footprint of San Pedro, Belize. This era was marked by various important dates and milestones that shaped the town's transformation into a bustling tourist destination. Currently, the island's prosperity depends on tourism. Countless job opportunities have been generated from related activities that have attracted many visitors from the Americas.

In 2008, the construction of the new San Pedro Town Hall commenced, signalling a commitment to enhancing the town's administrative and civic services. The Town Hall provided a central hub for local governance and showcased the growing importance of San Pedro as a regional economic and administrative center.

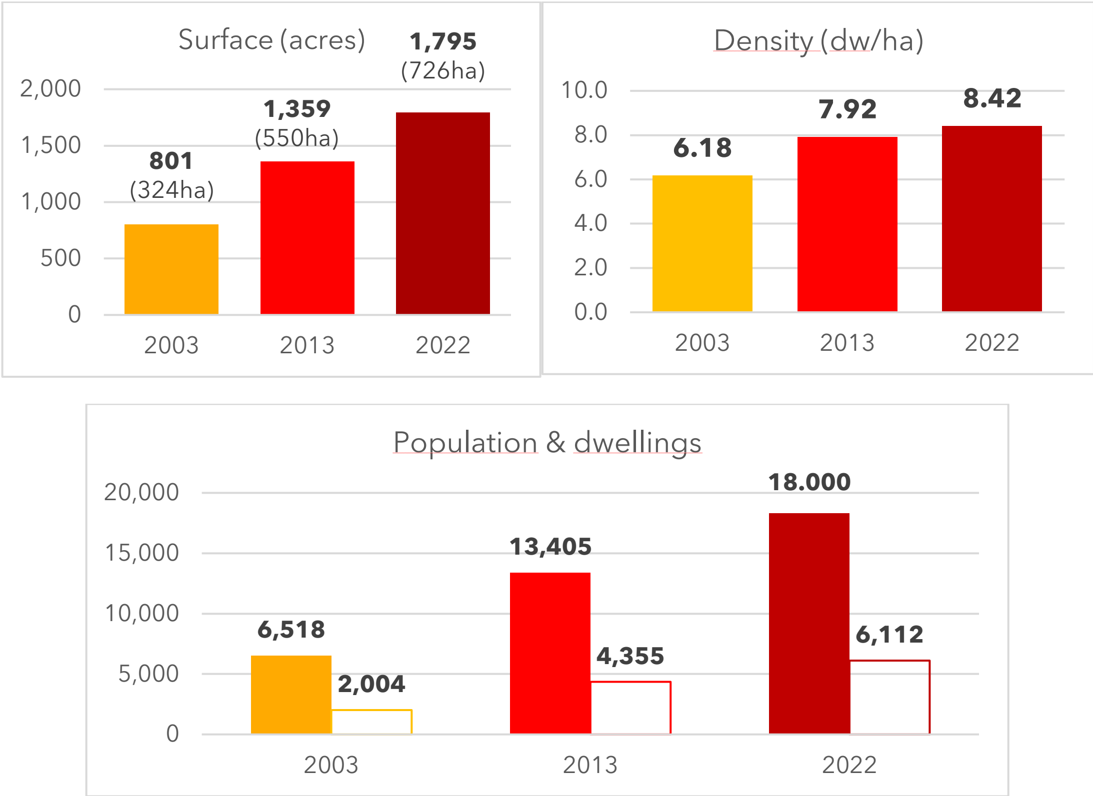
The following year, in 2009, San Pedro celebrated the opening of the San Pedro High School.

This expansion of the educational facilities helped accommodate the growing population, providing improved access to education for the town's youth.

By this time, San Pedro already had a solid educational infrastructure, a television station, and a large satellite-linked telephone exchange. It also has a gigantic network of hotels and resorts of different scales.

In 2013, the population doubled, and the density increased slightly, 8,27 dw/ha. **Urban land now represents only 47%** due to the increase of peri-urban developments, which already reach a **distance of 8 miles.** About footprint occupied in 2013 is was about 1.359 acres (550 ha)

Figure 31 – Historical urban footprint Ambergris Caye 2003 - 2023



Source: IDOM, 2023

In 2021, the Barry Bowen Bridge was reconstructed, allowing traffic of large vehicles. This made it possible to transport materials, food, and other products more easily to the north side of the island. Likewise, the construction of this bridge was able to unite the foundational centre of San Pedro with the northern sector of the Caye, thus allowing a flow of people and a great initiative of growth to the north side of the island. Today, the north side is the area that is generating the most development since it is an area of significant size that presents different attractions such as beaches, natural areas, lagoons, among many others.

Photo 3 - San Pedro in 2017 and the New Barry Bowen Bridge in 2021

Source: San Pedro Town Council, 2022

Due to the reconstruction of the bridge and the tourist impulse of the area during this period, it is evident that the north side of the island begins its expansion with new infrastructure developments to support tourism such as restaurants, hotels, resorts, commerce, among others. This period presents the greatest amount of growth towards the northern vector of the island.

In summary, the growth of the urban footprint of San Pedro, reflects the interplay between natural resources, socio-economic factors, and tourism development. From its modest beginnings as a fishing village, San Pedro has experienced remarkable urban expansion driven by tourism and infrastructural development. Important milestones, such as the establishment of marine reserves, the construction of key infrastructure, and the declaration as a town, have shaped its growth trajectory. Today, San Pedro stands as a natural and desirable destination, balancing its rich cultural heritage with modern urban amenities.

The most representative changes occur in the following poriods: 2023 with a occupied footprint of 801 acres (324 ha), 69% of which was urban, with 6,518 inhabitants. And 2013, the population doubled about 13,951 inhabitants with a footprint occupied in 1.359 acres (550 ha).

2.1.2.2. Analysis of Recent Changes (2014 – 2022)

As mentioned in the previous chapter, during the last decade Ambergris Caye has experienced a considerable growth of the urban footprint, located especially on the northern and southern end of the Island, as well as on the coastal edge of Secret Beach.

Considering this situation, it is important to analyze the types of developments that are generating changes in the footprint, in order to identify the main trends in land occupation and their potential impact on the territory.

For the purposes of this analysis, the recent changes were characterized by the following categories:

- C1 – Landfills on lagoons and land reclaimed from the sea.
- C2 – New inland plots.
- C3 – Accommodation and tourism developments.
- C4 – New housing and mixed-use developments.
- C5 – Consolidation of residential and mixed-use areas.
- C6 – New logistics and industrial uses.
- C7 – New roads.

The map below illustrates the location of changes in Ambergris Caye's urban footprint during the 2014 - 2022 timeframe. The map also displays the percentage distribution of changes by category, which are mentioned in the table below:

Table 14 – Surface and percentage distribution of recent changes

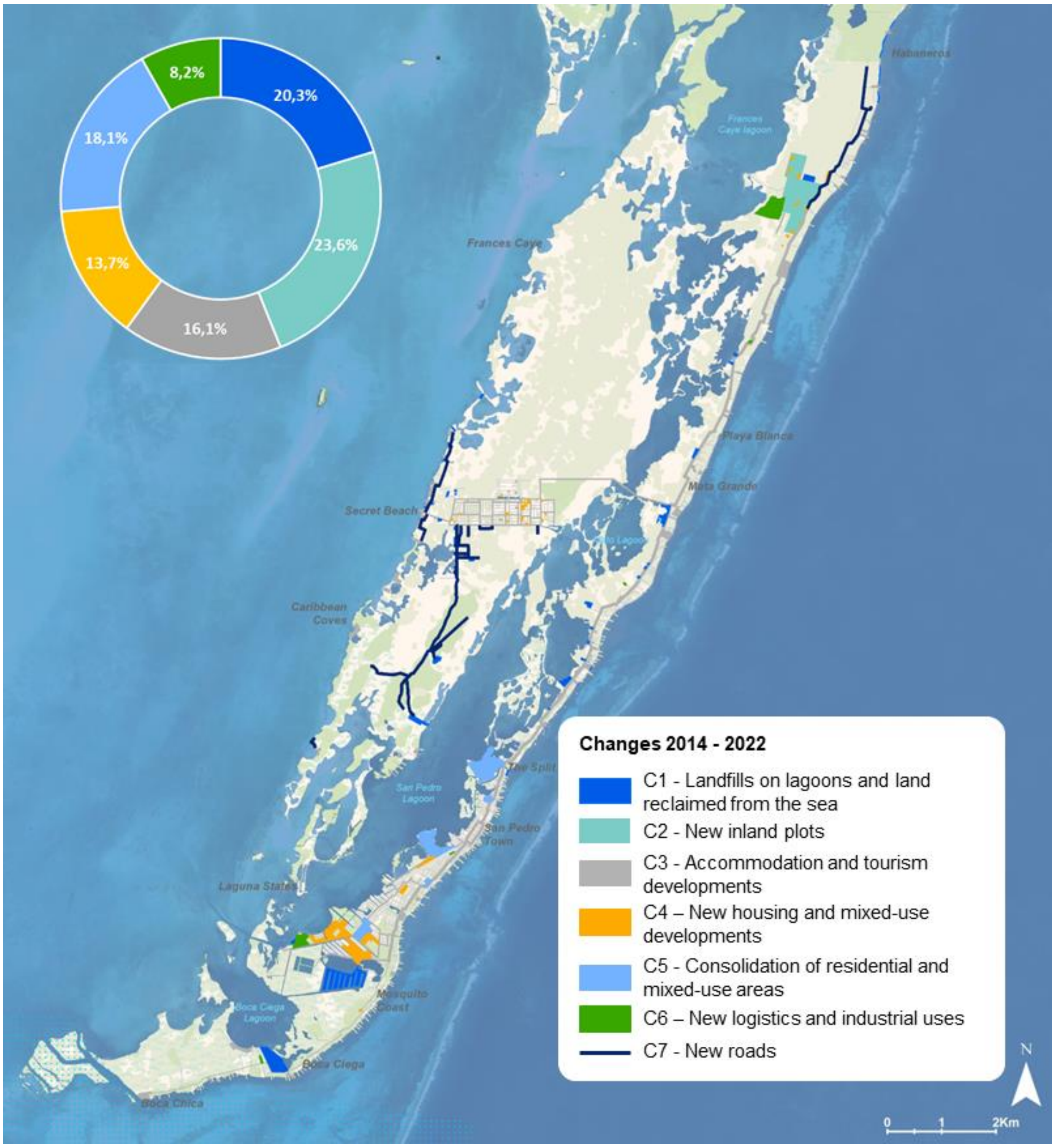
Type of recent change		Surface (acres)	Distribution of recent changes (%)
C1	**Landfills on lagoons and land reclaimed from the sea**	119.3	20.3%
C2	**New inland plots**	139.5	23.6%
C3	**Accommodation and tourism developments**	95.5	16.1%
C4	**New housing and mixed-use developments**	80.9	13.7%
C5	**Consolidation of residential and mixed-use areas**	107.1	18.1%
C6	**New logistics and industrial uses**	48.4	8.2%
	TOTAL	**590.7**	**100%**

Source: IDOM, 2023

According to the table above, the types of recent changes that had the greatest impact on the transformation and growth of the urban footprint have been the development of new inland plots (23.6%), landfills on lagoons and land reclaimed from the sea (20.3%), and consolidation of residential and mixed-use areas (18.1%).

On the other hand, the figure below shows in terms of new road infrastructure, 9.4 miles of new roads built between 2014 and 2022 were identified, representing an increase of 8.5% over those existing in the base year of analysis of recent changes (2014).

Figure 32 – Changes in the urban footprint between 2014 and 2022



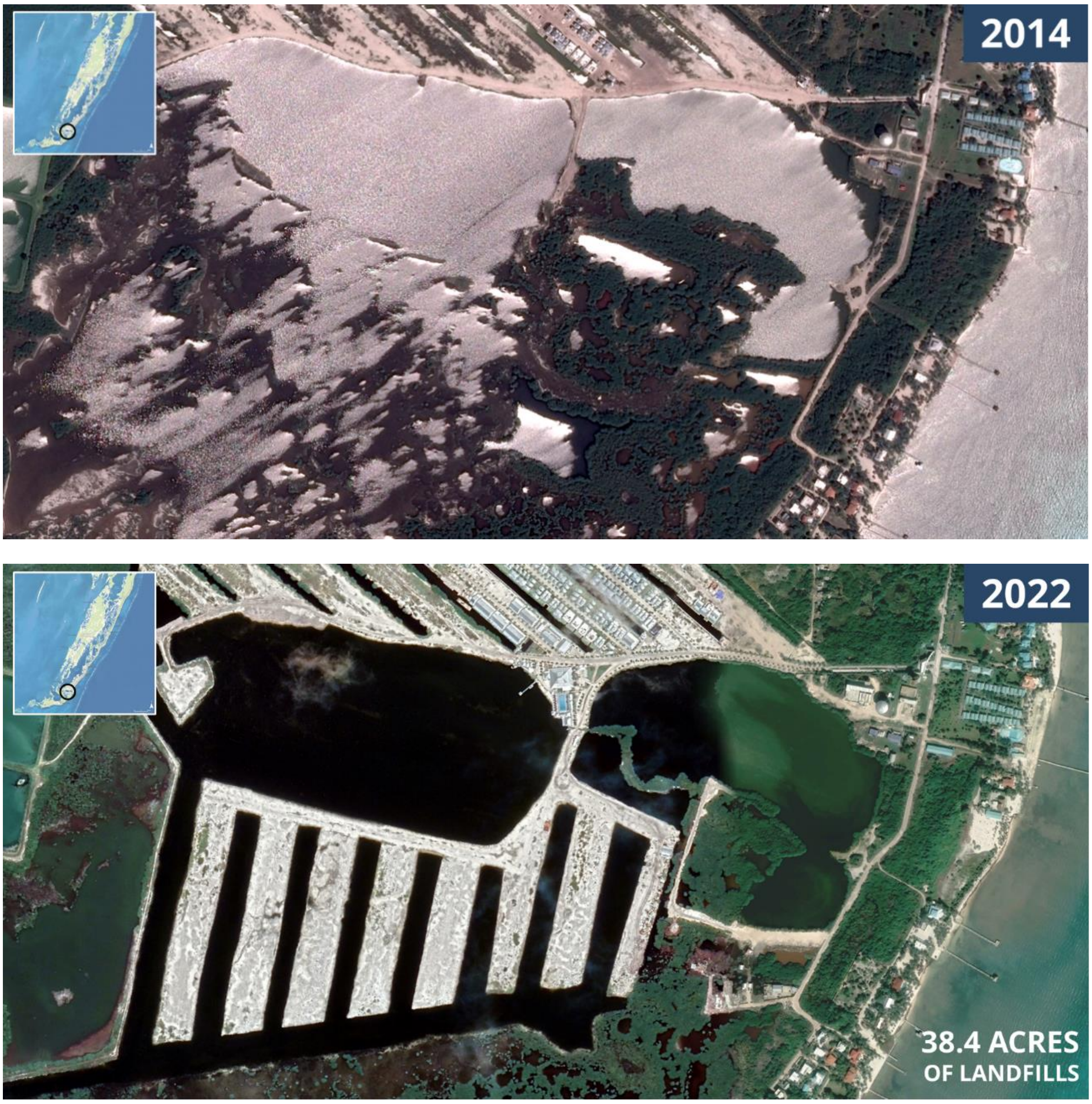
Source: IDOM, 2023

- **C1 – Landfills on lagoons and land reclaimed from the sea.**

One of the most notorious changes in the growth of the urban footprint has been the filling of the Caye's inland lagoons, mangrove areas and the coastal edge. Between 2014 and 2022, 119.3 acres located over water bodies and ecologically valuable areas were occupied by fill material, destined for future real estate development.

One of the most notable examples of this process is evident in Mahogany Bay, where more than 38 acres corresponding to lagoons and mangroves have been transformed into new land for future housing construction, radically changing the original natural landscape of the area.

Figure 33 – Fills on lagoons in Mahogany Bay



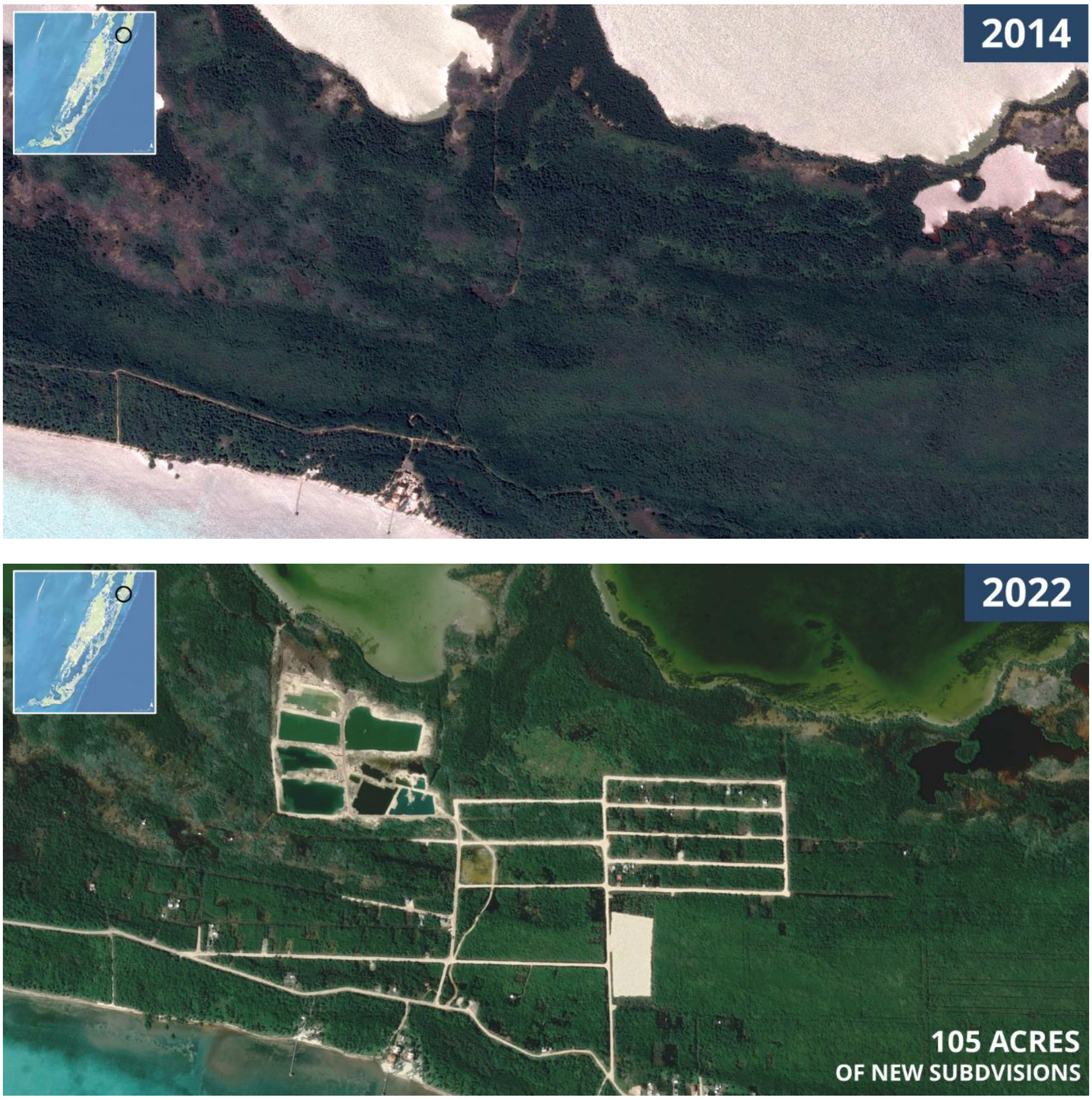
Source: IDOM with Google Earth images, 2023

- **C2 – New inland plots**

The development of new lots in inland areas of Ambergris Caye has been one of the most evident changes in the urban footprint. A total of 139.5 acres in the Island have been transformed into parcels in the period 2014 - 2022. Unlike the C1 category described above, these parcels are located on firm vegetated land.

One of the most notorious cases of this type of change in the footprint is the new parcellation that is being developed in the Northeast of the Island, next to Cayo Frances, in the area also known as "Promised Land". This subdivision comprises an area where which low-density housing is being developed, mainly for the homes of local people.

Figure 34 – New inland developments – Subdivisions in the Northeast (Cayo Frances)



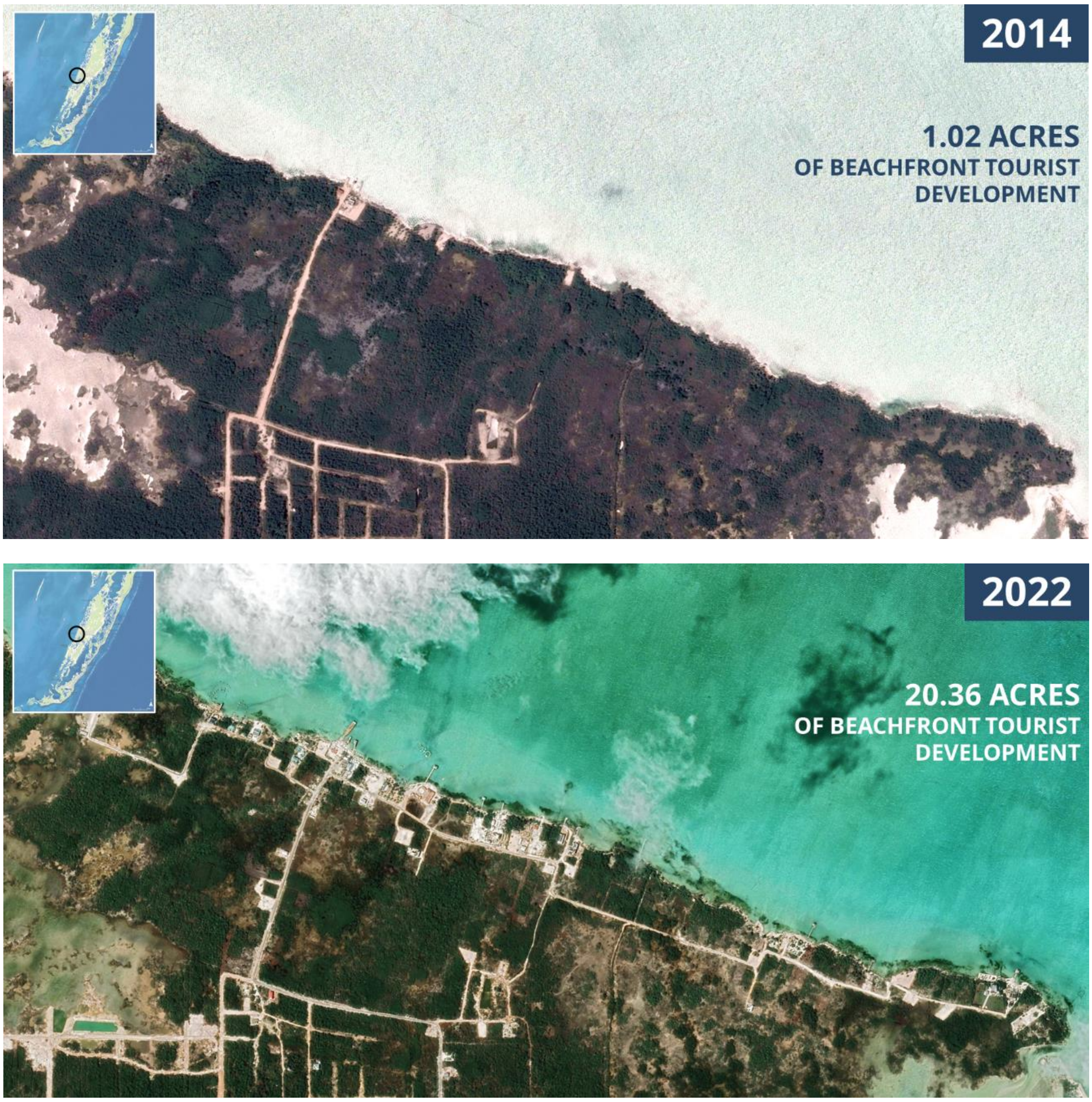
Source: IDOM with Google Earth images, 2023

- **C3 – Accommodation and tourism developments**

Tourism and its associated activities have been one of the main drivers of urban growth in Ambergris Caye during the recent years. The development of hotel complexes, resorts, and complementary uses such as restaurants, tour services and tourist piers have generated significant growth in the urban footprint, with a total area of 95.5 acres of new developments.

The images below show the comparative development of the Secret Beach waterfront between 2014 and 2022. This shows the accelerated growth of the urban footprint in this area of the Island, moving from 1.02 acres in 2014 to over 20.3 acres in 2022. This has contributed to accelerate the loss of vegetation cover, which in Ambergris Caye has decreased from 80% to 70% between 1997 and 2023.

Figure 35 – Beachfront tourist development in Secret Beach



Source: IDOM with Google Earth images, 2023

Some of the typologies identified on this category are:

Table 15 – C3 Typologies

Typology 1	Description	Photographic Records
# Floors	1 Floor	
Material	Mainly Wood	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 2	Description	Photographic Records
# Floors	2 Floors	
Material	Mainly Wood	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 3	Description	Photographic Records
# Floors	1 Floor	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 4	Description	Photographic Records
# Floors	2 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 5	Description	Photographic Records
# Floors	3 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 6	Description	Photographic Records
# Floors	More than 3 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

- **C4 – New housing and mixed-use developments**

New residential and mixed development has been identified, especially in the southern area of San Pedro. These mainly correspond to low-density housing, in lands that had been parceled since previous years. It is important to mention that these new developments correspond in most cases to single family constructions and not to general social housing or affordable housing programs.

The following comparison is the case of Ellis Subdivision, located in south San Pedro. As shown in the images, between 2014 and 2022 there has been a growth of 80.9 acres of new housing and mixed uses, the latter located mainly in proximity to the connecting road to cargo port.

Figure 36 – New housing and mixed uses in Ellis Subdivision

Source: IDOM with Google Earth images, 2023

Analyzing on this period the new housing and mixed uses along the island were 80.9 acres, including 37.84 acres on Ellis Subdivision.

Table 16 – New housing and mixed uses in Ambergris Caye 2014-2022

	Acres	Inhabitants	Dwellings
Total Footprint 2014	**1,359**	**13,951**	**4,550**
Total growth 2014-2022	**436**	**4,368**	**1,562**
New housing and mixed-use developments 2014-2022	80.9 (1,836 urban) (108 SB) (7.3 PL)	2,079 (1836 urban) (108 SB) (135 PL)	669 (590 urban) (35 SB) (44 PL)

Source: IDOM, 2023

Some of the typologies identified on this category are:

Table 17 – C4 Typologies

Typology 1	Description	Photographic Records
# Floors	1 and 2 Floors	
Material	Mainly Wood	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 2	Description	Photographic Records
# Floors	1 and 2 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

Typology 3	Description	Photographic Records
# Floors	3 and more Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolate	

Source: IDOM, 2023

- **C5 – Consolidation of residential and mixed-use areas**

There are sectors of San Pedro's urban area where consolidation processes have occurred over the last few years. This has been evident mainly in the areas of San Mateo and San Pedrito, where new housing and mixed-use constructions have been built in the urban voids present in 2014. It is important to note that the consolidation process in San Pedro has happened due to an increase in the number of constructions and has not represented an improvement in urban qualities (road infrastructure, public services, and urban facilities) in those sectors.

The images below display a comparison of the urban development in San Mateo between 2014 and 2022, where there is a significant growth in the number of constructions in the footprint occupied by this area:

Figure 37 – Consolidation of urban footprint in San Mateo

Source: IDOM with Google Earth images, 2023

Table 18 – Consolidation of residential and mixed-use areas 2014-2022

	Acres	Inhabitants	Dwellings
San Mateo 2014-2022 Total 2014 Total 2022	49.6	780	250 340 590
San Pedrito 2014-2022 Total 2014 Total 2022	33.6	250	80 230 350

Source: IDOM, 2023

Some of the typologies identified on this category are:

Table 19 – C5 Typologies

Typology 1	Description	Photographic Records
# Floors	1 Floor	
Material	Mainly Wood	
Material Condition	Non-Permanent Housing	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 2	Description	Photographic Records
# Floors	1 Floor	
Material	Mainly Wood	
Material Condition	Good Condition	

Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 3	Description	Photographic Records
# Floors	2 Floors	
Material	Mainly Wood	
Material Condition	Non-Permanent Housing	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 4	Description	Photographic Records
# Floors	2 Floors	
Material	Mainly Wood	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 5	Description	Photographic Records
# Floors	1 Floor	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 6	Description	Photographic Records
# Floors	2 Floors	
Material	Mainly Concrete	

Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 7	Description	Photographic Records
# Floors	3 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 8	Description	Photographic Records
# Floors	More than 3 Floors	
Material	Mainly Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 9	Description	Photographic Records
# Floors	1 Floor	
Material	Mixed / Wood & Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 10	Description	Photographic Records
# Floors	2 Floors	
Material	Mixed / Wood & Concrete	

Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 11	Description	Photographic Records
# Floors	3 Floors	
Material	Mixed / Wood & Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Isolated	

Source: IDOM, 2023

Typology 12	Description	Photographic Records
# Floors	2 Floors	
Material	Mixed / Wood & Concrete	
Material Condition	Good Condition	
Typology (isolated/continuous)	Continuous	

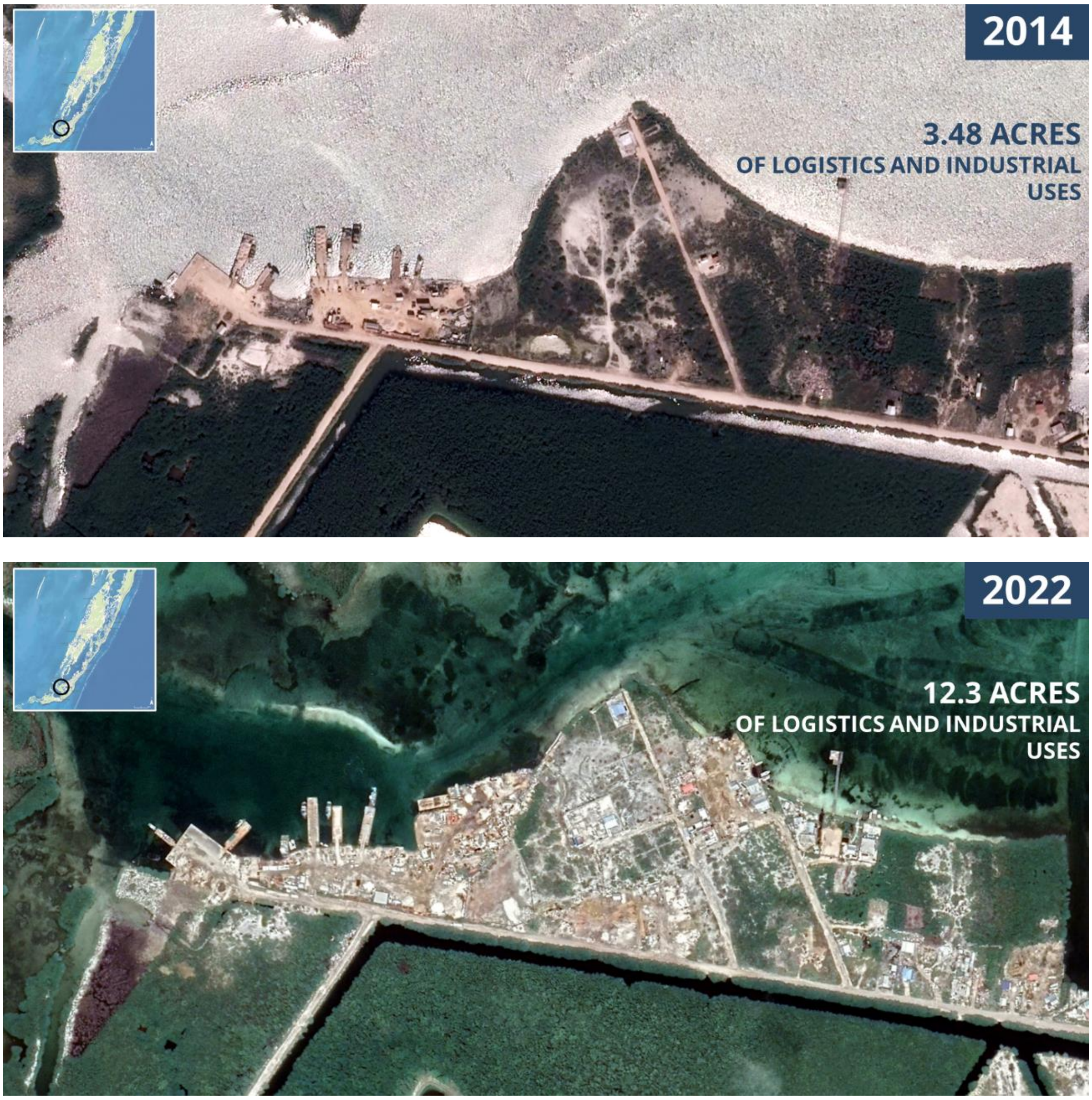
Source: IDOM, 2023

- ### C6 – New logistics and industrial uses

Another type of development identified within the recent changes in the urban footprint are new logistics and industrial uses. This type of growth has been particularly concentrated in the southern area of San Pedro, although new warehouses are also identified in the northern area, facing the main connecting highway. In total 48.4 acres of new uses under this category have been developed between 2014 and 2022.

As seen in the comparative images below, significant development of buildings for logistics uses has happened in the area adjacent to the San Pedro Cargo Port, increasing from 3.48 acres in 2014 to 12.3 acres in 2022, representing an increase of more than 3.5 times in footprint area occupied.

Figure 38 – New logistic and industrial uses close to the Port Area



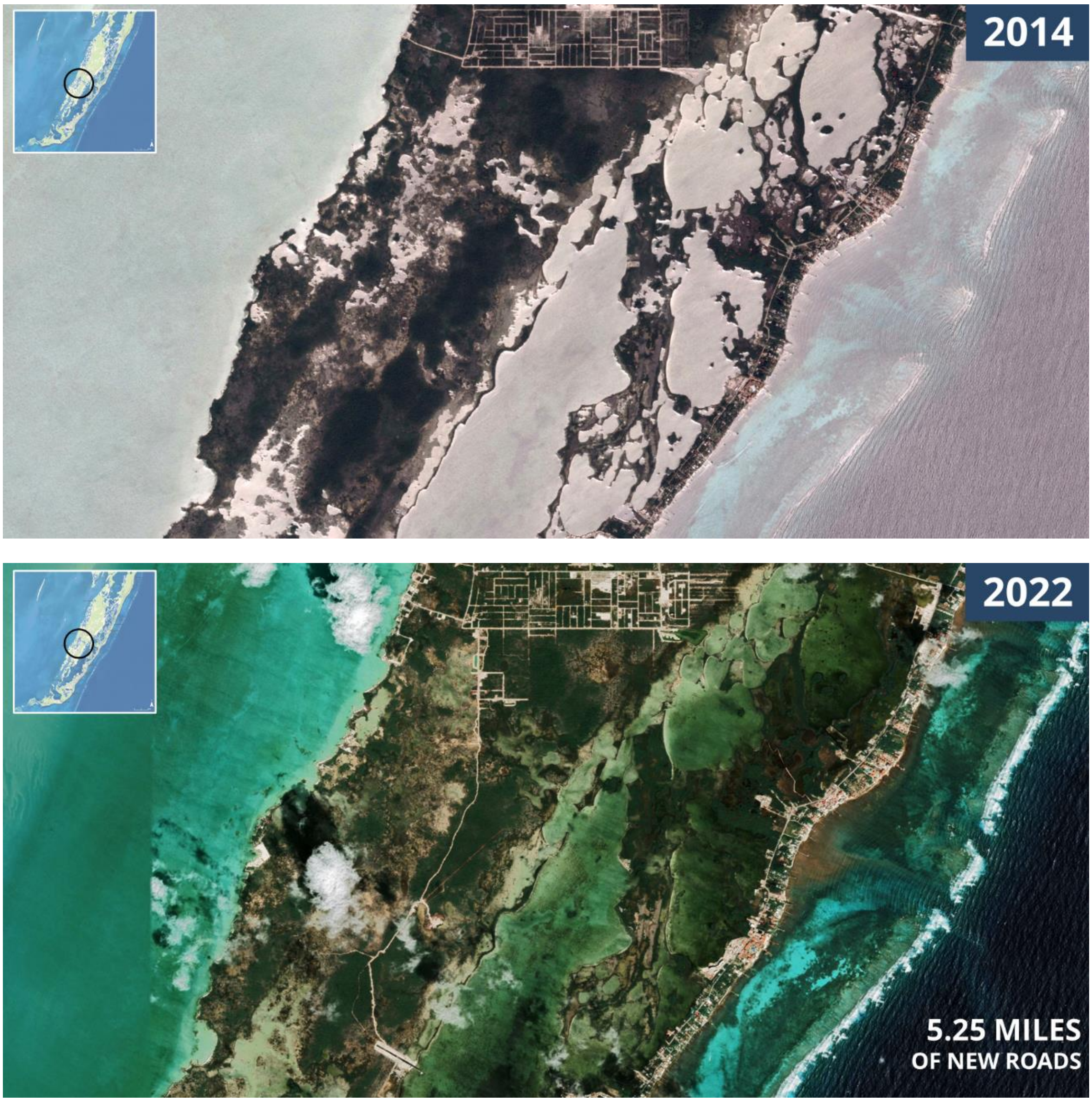
Source: IDOM with Google Earth images, 2023

- **C7 – New roads**

Finally, another element that has represented an important change in the growth of the urban footprint is the construction of new roads. Between 2014 and 2022, 9.3 miles of new roads have been built in Ambergris Caye, located especially in the Secret Beach sector, the northeastern end of the island (near Cayo Frances) and over the western side of San Pedro Lagoon.

These new roads have an irregular layout and are not paved. They currently serve the function of providing access to new real estate projects or are part of land parceled for future development. The images below show the layout of the new 5.2-mile road connecting Secret Beach to the Aruna Resort development area.

Figure 39 – New roads between Secret Beach and Aruna Resort



Source: IDOM with Google Earth images, 2023

Considering all the above, the analysis of recent changes in the footprint indicates that tourism developments and new subdivisions for real estate projects are the main drivers of urban growth on Ambergris Caye. In addition, the transformation of lands with ecological value for new subdivisions represents a serious problem that affects the native ecosystems, posing a constant threat to the preservation of natural areas.

Finally, the absence of effective planning instruments (master plans, zoning plans or specific urban norms) has contributed to generate an expansive and inequitable urban development, where areas of high ecological value have been threatened by the growth of the urban footprint. Therefore, as long as Ambergris Caye does not have regulations that establish defined urban limits, as well as clear guidelines for new road infrastructure, public services and facilities, the island's urban footprint will continue to grow in an increasingly unsustainable and unequal direction.

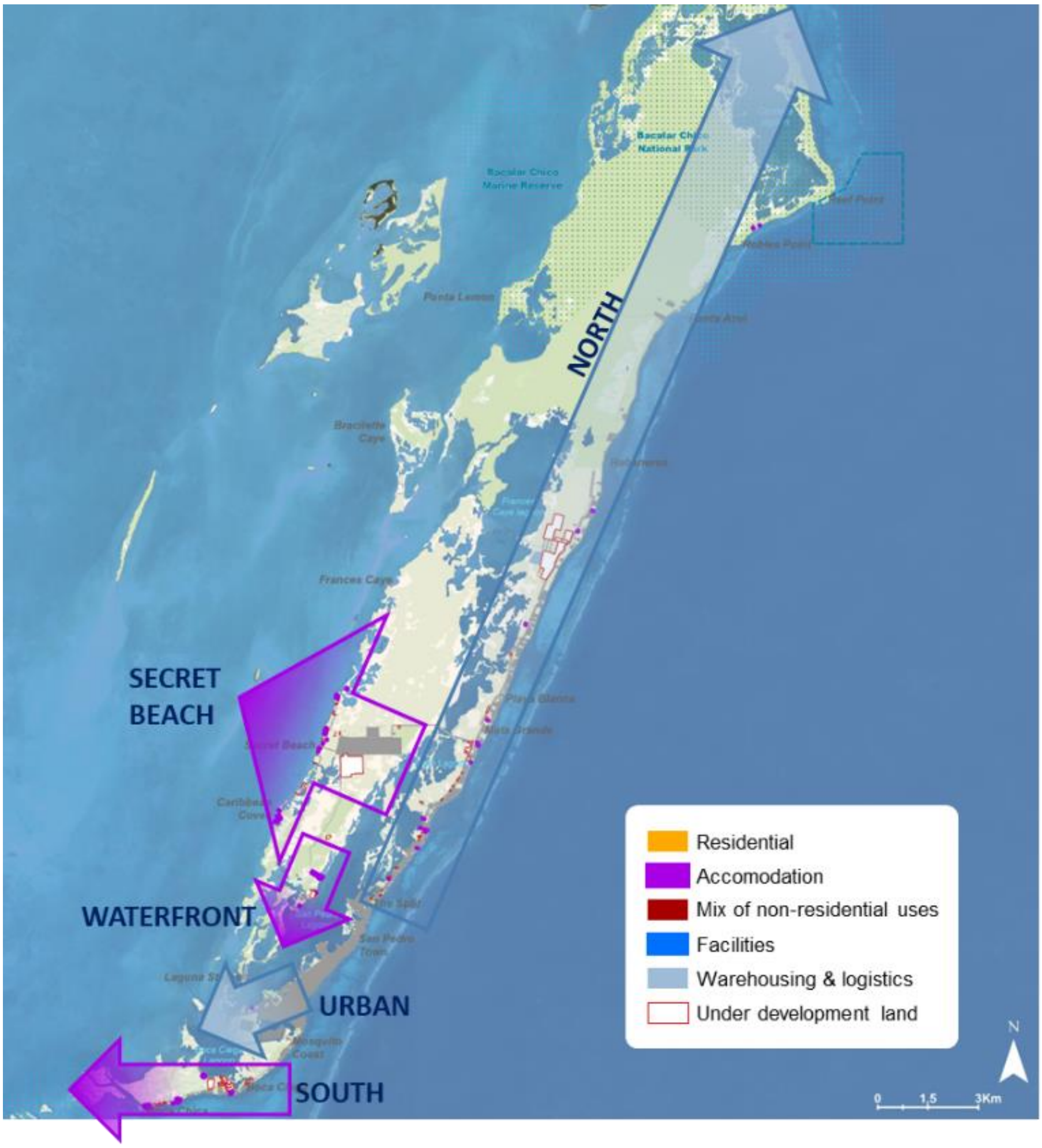
2.1.2.3. Growth Vectors

There are 5 possible natural growth vectors from San Pedro and their importance in the territory is analysed here to predict future trends. For this purpose, an analysis of the proportion of land consumed and the distribution of land uses, between 2014 and 2022, is measured.

The vectors considered were:

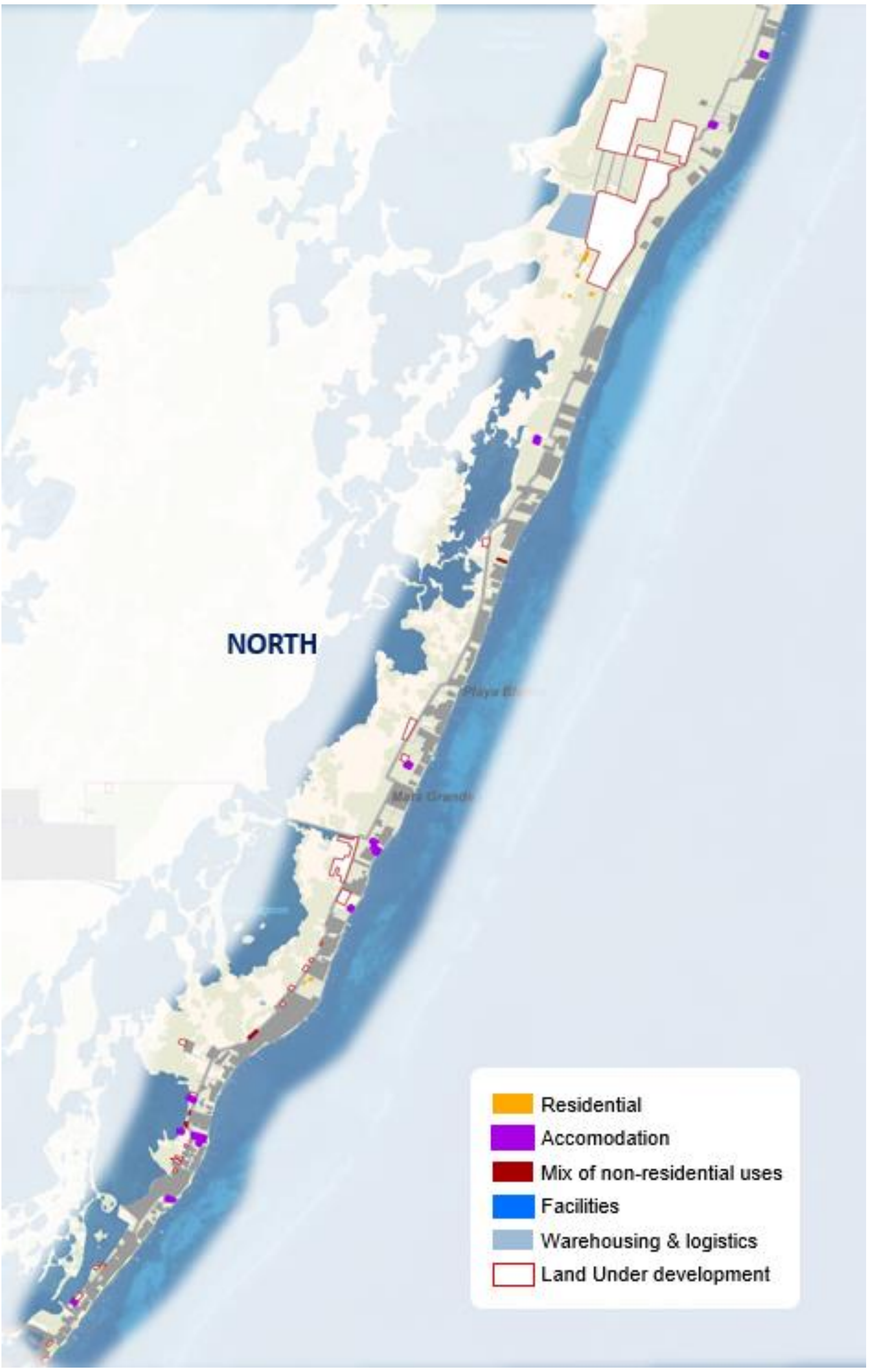
- **North**: Developments towards the north of the island along Honourable Heredia Jr. North Road
- **Secret Beach**: Includes all developments from Mato Lagoon to the west coast of the Caye.
- **Urban**: Expansion from San Pedro to Ellis Subdivision
- **South**: Growth on South Road from Mosquito Coast to Boca Chica
- **Other Waterfront**: Developments on the opposite shore of San Pedro Lagoon.

Figure 40 Growth vectors



Source: IDOM, 2023

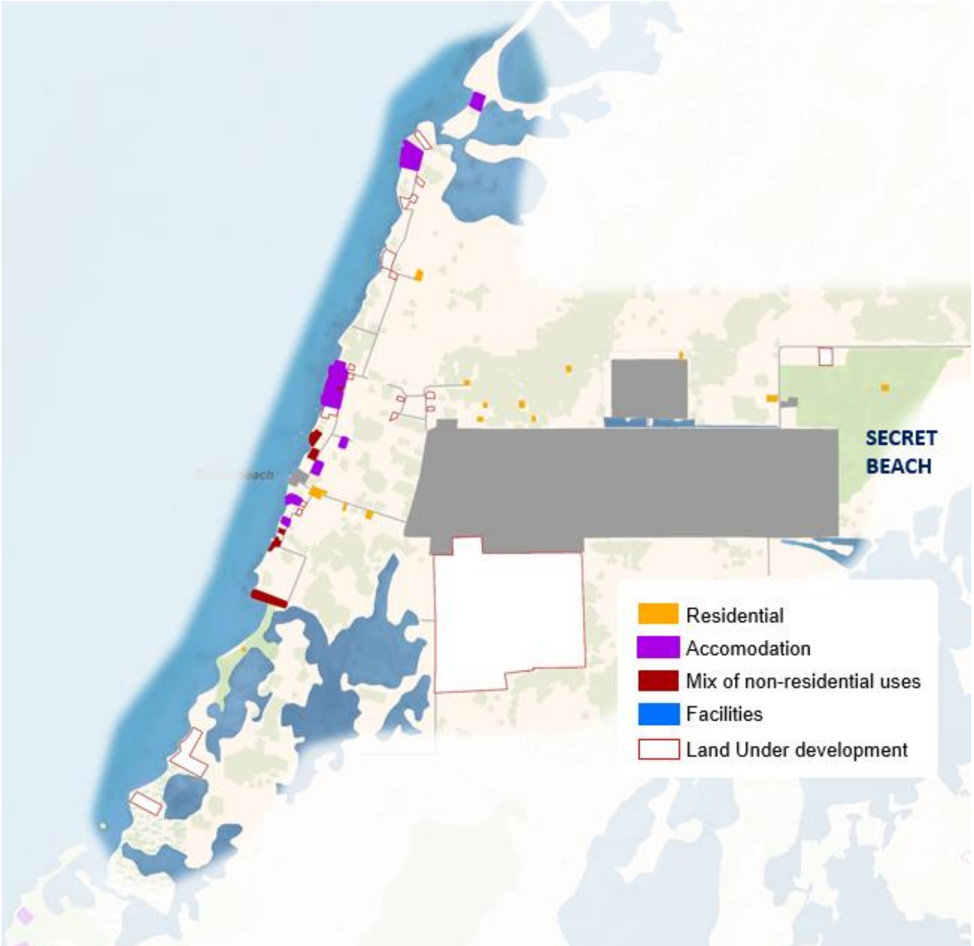
Figure 41 Growth vectors: North



Source: IDOM, 2023

In the northern vector, there are 234 acres of new land development, of which 81% corresponds to Land under development (190 acres), mainly due to the development near Frances Caye Lagoon. Additionally, 14% of the area consists of non-residential land, which includes Facilities, a mix of non-residential uses, and mainly warehousing. Moreover, 3% of the area is dedicated to accommodations (7.4 acres), comprising both hotels and vacation villas. Within this vector, 9% of the housing is intended for vacation purposes. However, only 2% of the area (3.7 acres) is residential, and it is predominantly of low quality.

Figure 42 Growth vectors: Secret Beach



Source: IDOM, 2023

In Secret Beach vector, there are 125 acres of new land development, of which 85% corresponds to Land under development (107 acres). Vacation accommodations along the coast account for 10% of the growth between 2014 and 2022 in this area, in the form of villas and hotels, with 32% of the housing developed in this vector dedicated to the vacation sector. Residential and mixed-use land only represent 3% of the growth (3.3 and 3.6 acres respectively).

Figure 43 Growth vectors: Waterfront

In the Waterfront vector, there are 18 acres of new land development, divided between new hotels and Land under Development, accounting for 41% and 59% of the land consumption in this vector (7 and 11 acres respectively).

Source: IDOM, 2023

Figure 44 Growth vectors: Urban

Source: IDOM, 2023

In the Urban vector, there is minimal development (1.6 acres) as this area is more affected by consolidation processes than expansion, and the consumption of new land is concentrated in the northern and southern vectors.

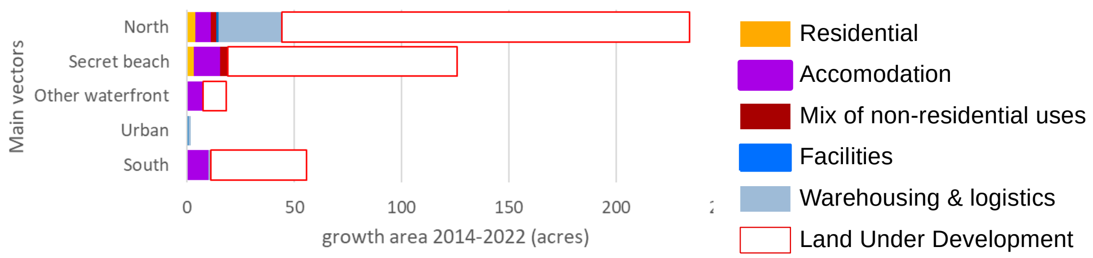
There are no residential developments observed, and the growth is limited to a new Gas Station (0.1 acres), new warehouses (1.1 acres), and some housing primarily for rental purposes (0.3 acres).

Figure 45 Growth vectors: South

Source: IDOM, 2023

In the southern vector, there are 56 acres of new land development, with 80% of it corresponding to Land under development (44 acres). Additionally, 18% of the area is designated for vacation purposes (10 acres), likely comprising Hotels and Villas mainly for rent. A small portion, 2% of the area, is allocated to warehousing (2.3 acres), indicating the presence of storage facilities or logistic operations. Notably, this vector does not show any growth in residential land, facilities, or mixed-use areas, suggesting that the focus of development in this region is primarily on new urban areas, vacation-related properties, and warehousing activities. The following figure shows the results in a graph, showing the acreage consumed in each vector between 2014 and 2022, as well as the main uses.

Figure 46 Growth surface (acres) and use 2014-2022



Source: IDOM, 2023

In summary, between 2014 and 2022, the foremost area growth is to the north (54%) followed by the vector to Secret Beach (30%). Residential growth is mainly to the north, especially in medium and low-quality housing where the vacation homes represent 10% of total housing in this vector. Secret beach, waterfront and south vectors are mostly Land Under Development, and secondarily accommodations, with no supply of facilities or mix of uses. 81% of the intervened surface between 2014 and 2022 still being Land Under Development. Finally, the urban vector is the least extensive, being mainly warehousing.

2.1.2.4. Multitemporal Land Cover Analysis (Landsat)

The analysis of the urban footprint based on satellite Landsat imagery allows to determine the changes of land uses and to quantify them on a semi-automatic way. The main aim of this analysis is to track the trends and dynamics occurring in the territory of Ambergris Caye, the urban footprint growth, the variations in forest area, wetlands, or mangroves. The results provide an important input for the Consulting Engagement 1: Climate change mitigation study.

The analysis has been performed using a Supervised Classification technique for classifying land, by which ground truth examples are taken to teach a model to differentiate between classes, in the Google Earth Engine programming interface. A Random Forest Machine Learning Workflow has been used to take a composition of cloud-free Landsat images of the dry months (January-April) for the years 1997 and 2023, and through the definition of training areas based on reliable information, a characterization of the land cover for the mentioned years is obtained.

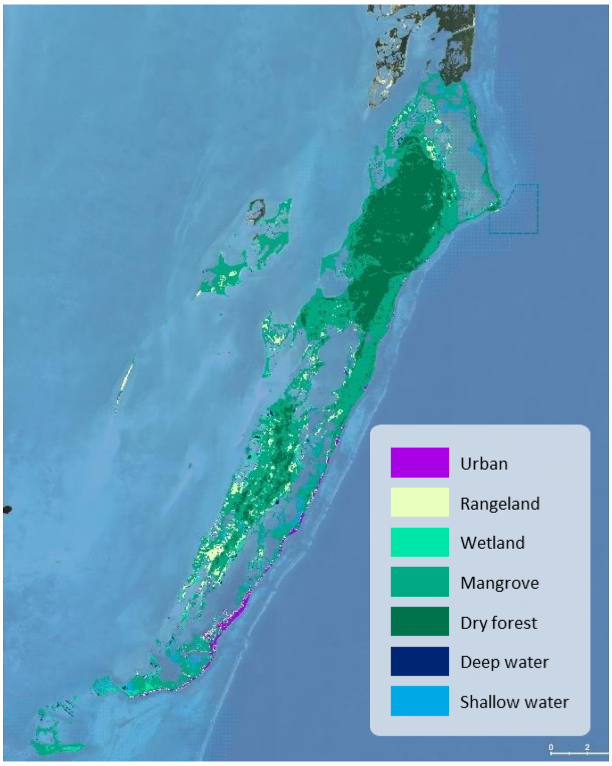
The Belize Ecosystem Map: "2017 version" classification was selected as information support for the analysis. It was developed by the Biodiversity and Environmental Resource Data System for Belize (Berds).

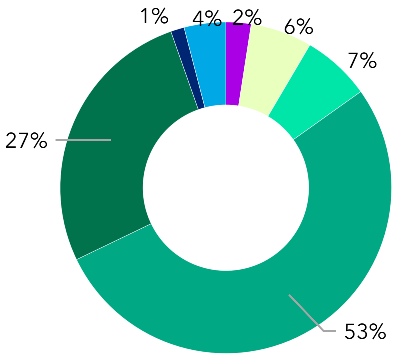
2.1.2.4.1. Analysis of results

Building on the classification made, area data were obtained. For the analysis of results, the limitations from the spatial resolution used will be considered; the classifications provide a general vision. Moreover, it is important to note that this Landsat analysis has a resolution of 30 meter of pixel size, so one pixel covers an extension of 900 sqm. This means that the landsat imagery may not be sensitive to the constructive characteristics of the Caye with low density occupation, but it is sensitive to changes in the majority use, which is what is intended with the analysis. Although there are other sensors with lower resolution, Landsat has been selected because it is the open license sensor that fits the temporal spacing requirements.

Figure 47 Landcover areas based on Landsat 1997

LANDSAT 1997





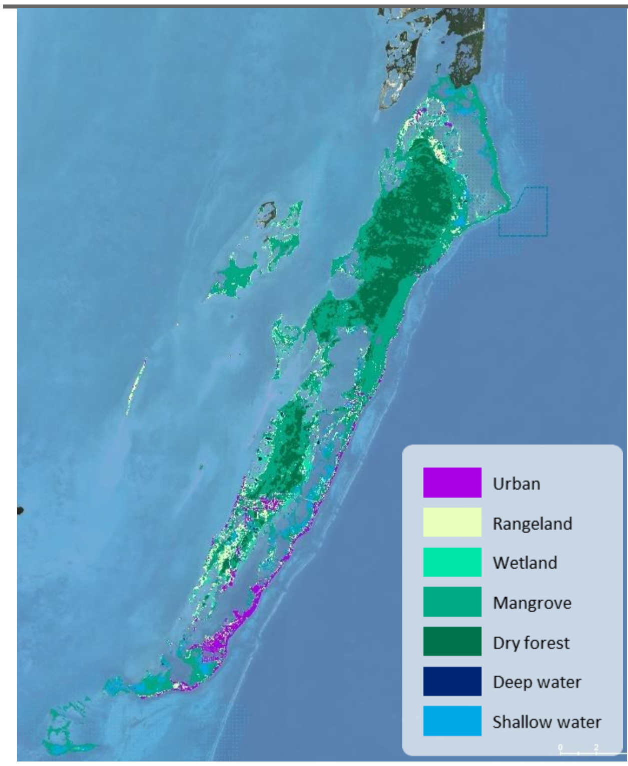
80% of the Caye is covered by vegetation, predominantly mangrove (53%) and dry forest (27%). There is also an important presence of areas partially covered by water or wetlands.

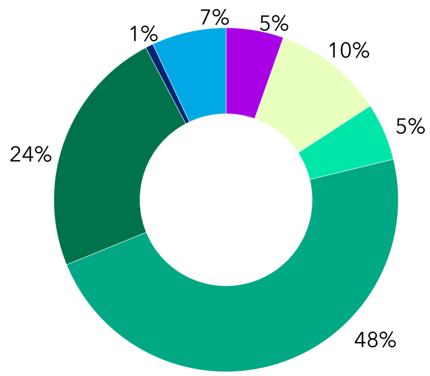
The urban area occupies 2% (734 acres) and the Range land occupies 65% of the surface.

Source: IDOM, 2023 based on satellite imagery

Figure 48 - Landcover areas based on Landsat 2023

LANDSAT 2023





Vegetation cover is 72%, where practically half is mangrove, and a quarter is dry forest. In terms of intervened areas, the anthropic soil exceeds 1,600 acres (Urban 5%). The soil without vegetation represents 10% with a coverage of more than 3,000 acres.

Source: IDOM, 2023based on satellite imagery

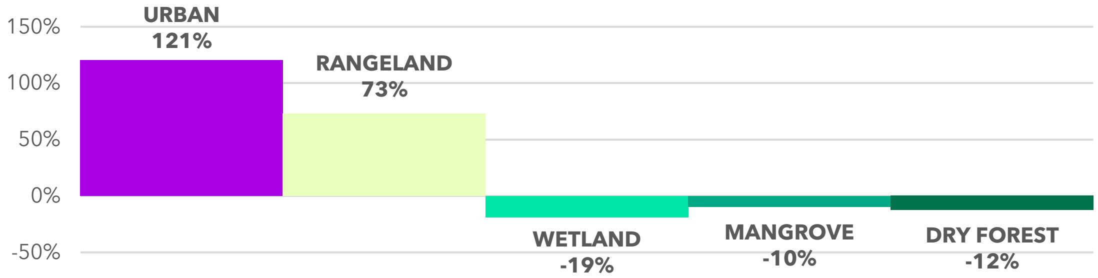
In view of the global data on land cover for both years, an analysis of the evolution of the main types of soil has been carried out, with the results shown in the following table.

Table 20 – Landcover areas based on Landsat.

	1997		2023		
	Area (acres)	%	Area (acres)	%	Cambio
Urban	734	2.5%	1,618	5.4%	121%
Rangeland	1,801	6.0%	3,111	10.4%	73%
Wetland	1,997	6.7%	1,618	5.4%	-19%
Mangrove	15,768	52.7%	14,245	47.6%	-10%
Dry forest	8,003	26.8%	7,009	23.4%	-12%
Deep water	394	1.3%	221	0.7%	-44%
Shallow water	1,215	4.1%	2,090	7.0%	72%

Source: IDOM, 2023 based on satellite imagery

Figure 49 - Landcover change.



Source: IDOM, 2023 based on satellite imagery

The analysis of change based on Landsat images shows a trend of vegetation loss throughout the Caye, because of the pressure of the urban footprint among others.Thus, vegetation cover has been reduced approximately 2,500 acres from 1997 to 2023, from a total cover of 80% to 70%. In addition, the urban land has grown exponentially from 1997 to 2023 with an increase of 121%, multiplying its surface by 2.2. There is also an increase in the area without vegetation or with scarce vegetation. Quantitatively, the rangeland has increased its surface area by 73% due to the removal of vegetation cover.

In conclusion, the analysis of the urban footprint growth identifies the development trends that Ambergris Caye has followed throughout its history and the factors that have triggered this growth. In this sense, the analysis of the historical evolution from 1950 to 2023 shows that the main increase in the analyzed periods occurred between 2003 and 2013, where the area occupied by the urban footprint went from 801 acres (324 ha) to 1,359 acres (550 ha).

On the other hand, according to the study of growth vectors, these developments have been taking place mainly towards the Secret Beach sector and the northeast of the island, bringing among their main consequences a loss of areas of high ecological value (wetlands, mangroves and dry forests). This is largely due to the lack of planning instruments that establish effective regulations to limit urban sprawl in the territory.

2.1.3. Homogeneous Units

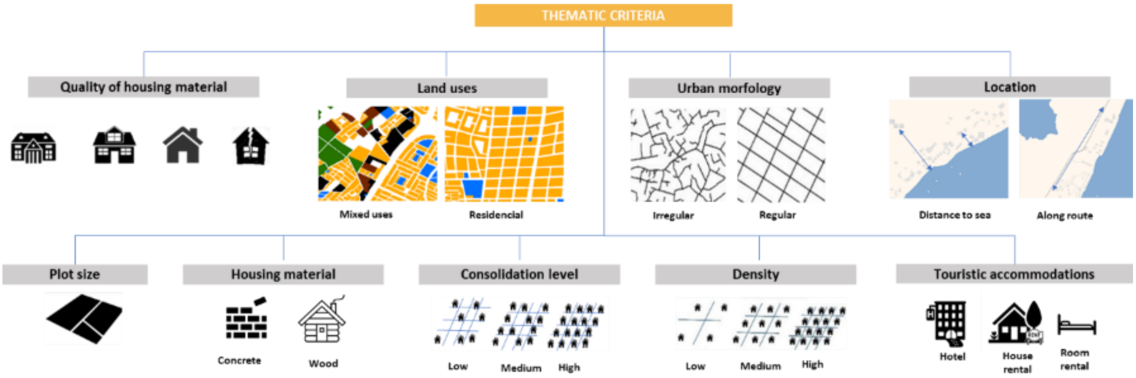
The Homogeneous Units for urban growth are defined as the division of the urban footprint into homogenous areas regarding the land uses, density, and edification typology, among other aspects. This exercise is essential since in many cases when urban planning has not been developed or does not match the physical reality.

This analysis of homogeneous sectors is used to characterize the town and is carried out under a socio- spatial approach, that is, identifying places where people live and under what conditions. The classes of analysis are a basic tool to design the urban growth scenarios.

2.1.3.1. Criteria for the Definition of Homogeneous Units

The criteria for defining the classes of analysis in Ambergris are outlined below and followed by a more detailed description in the subsequent paragraphs.

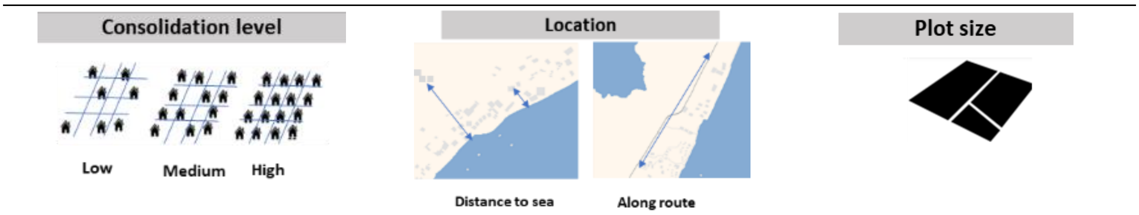
Figure 50 Criteria for the definition of Homogeneous Units



Source: IDOM, 2023

Due to the lack of information in Ambergris, it has been necessary to obtain data from different sources of information, according to the criteria for defining homogeneous units. This information, from secondary sources or collected by the IDOM team, has been gathered to characterize the territory.

Remote sensing observation

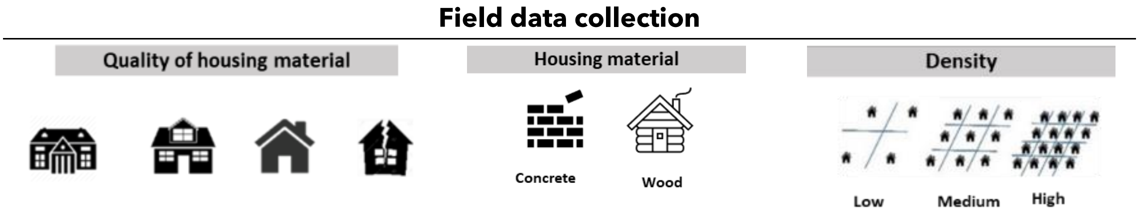


Through the observation of the 2023 orthoimage, information has been extracted regarding:

- Degree of consolidation or percentage of occupation of plots.
- Distribution of development and its relationship with the territory
- Size of buildings and lots. Includes a survey of existing buildings and delineation of their footprint.
-

Figure 51 Footprint of buildings delimited by IDOM.

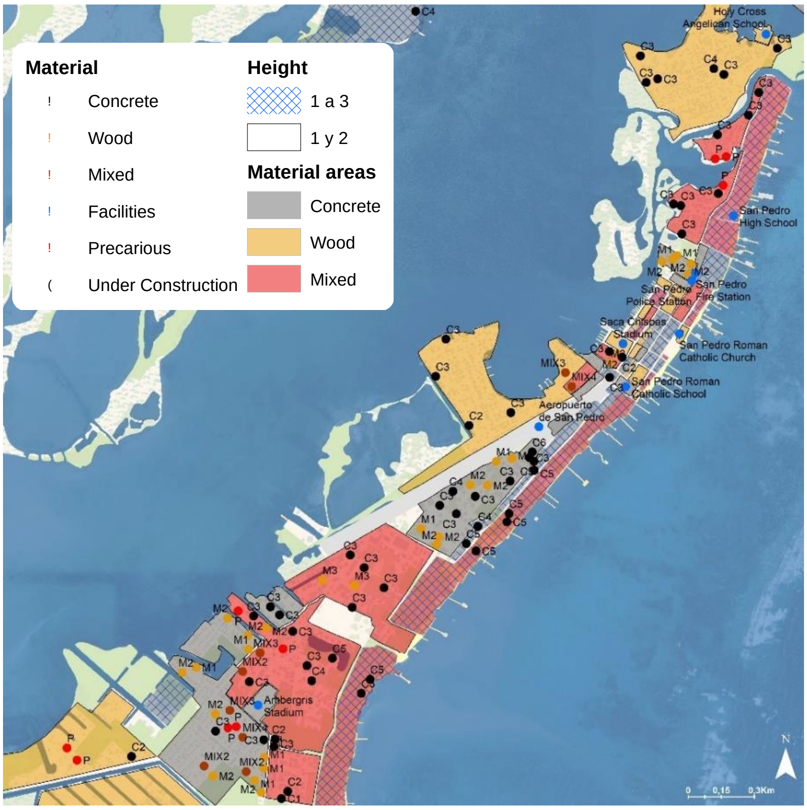
Source: IDOM, 2023



An exhaustive field survey of the predominant construction characteristics has been carried out, highlighting:

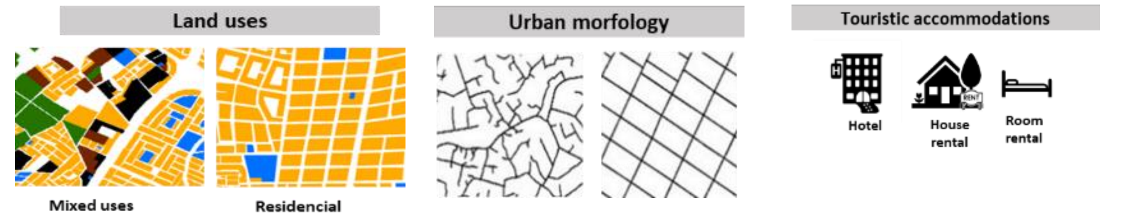
- Construction material
- Quality of construction
- Height of the constructions (apartment or single-family dwelling)

Figure 52 Sample of the information survey collected in the field.



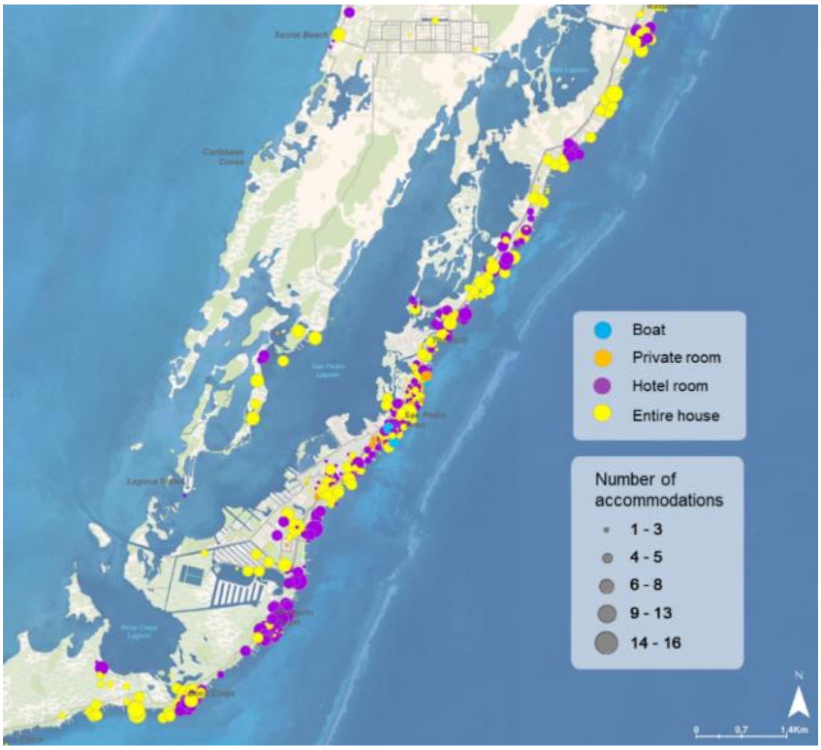
Source: IDOM, 2023

Secondary information



The information collected in Open Street Map (OSM) regarding land use, facilities, commerce, restaurants, among others, has been used as a source of information. The OSM road axes have also been taken, and their paving has been verified in the field. The survey of tourist accommodations was carried out by unifying data from Google, OSM and Airbnb.

Figure 53Information extracted from Airbnb.



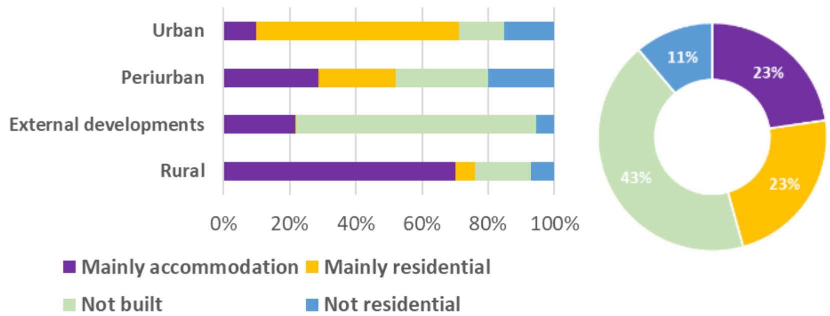
Source: IDOM, 2023

2.1.3.2. Description of Homogeneous Units

A total of 21 Homogeneous Units have been established, characterized in 4 groups of predominant use:

Figure 54 Distribution of sectoral groups in the urban and rural transition groups

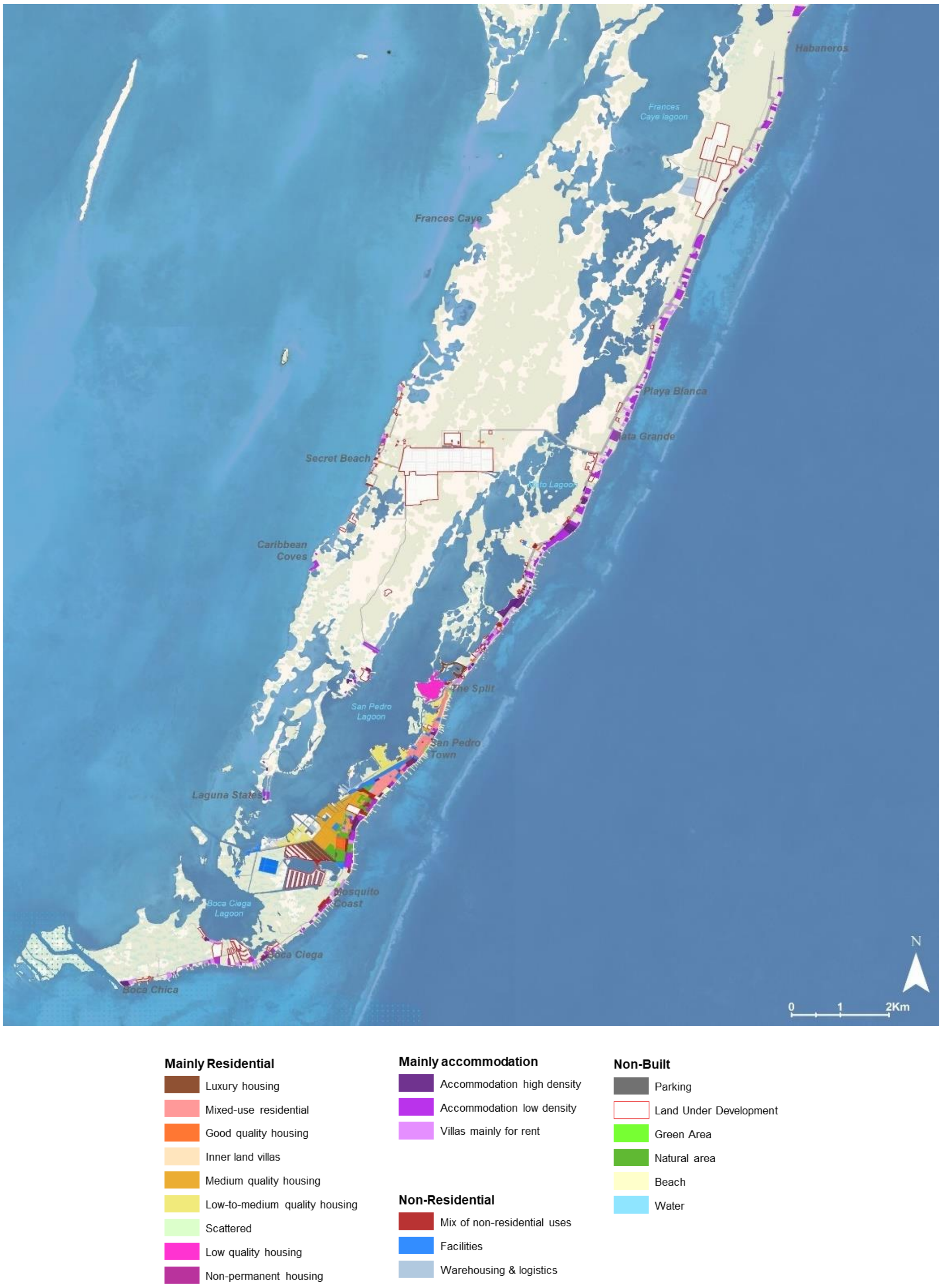
- **Mainly Residential**
- **Mainly Accommodations**
- **Not residential**
- **Not built**



Source: IDOM, 2023

As is shown in the graph, most of the anthropized land is without construction, being mainly land under development. As for the built-up area, a distinction is made between Mainly Residential uses with different categories according to the quality of the construction, and Non-Residential, which considers warehouses, facilities, and another variety that mixes non-residential uses such as stores or restaurants: mix of non-residential uses. Given the tourist importance of the island, Mainly Accommodation land has been included, which encloses hotels and resorts of medium or low density, as well as villas for vacation rentals. The following map shows the Homogeneous Units in Ambergris Caye

Figure 55 Homogeneous Units



Source: IDOM, 2023

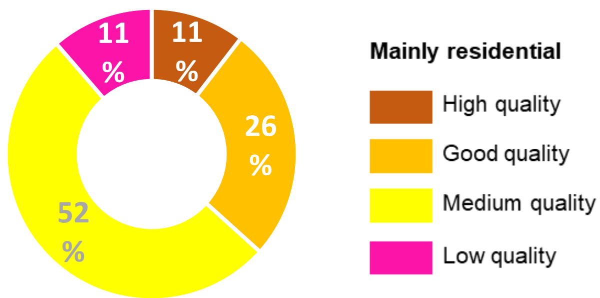
2.1.3.2.1. Mainly Residential

The residential group is divided into 4 Neighborhood quality that are broken down into 9 homogeneous units, which are explained below:

Figure 56 Mainly residential description

Neighborhood quality	Mainly Residential	Description	Building quality	Material	Height
High	Luxury housing	Maralaguna & Mahogany Bay Village Complex	Good	Concrete	1-2 y 3
Good	Mixed-use residential	San Pedro Town Center	Good	*various	*various
	Good quality housing	Medium size, tidy, good quality of materials	Good	Concrete/Wood	*various
	Inner land villas	Offshore Villas	Good	No Data	1-2
Medium	Medium quality housing	< 25 precarious	75%Good 25%bad	Wood	1-2
	Low-to-medium quality housing	50% precarious	50%Good 50%bad	*various	1-2
	Scattered	Small <75m2 and isolated	Bad	Wood	1-2
Low	Low quality housing	> 75% precarious	Bad	Wood	1-2
	Non-permanent housing	Outside the urban structure, small, clustered	Very bad	Wood	1-2

Source: IDOM, 2023

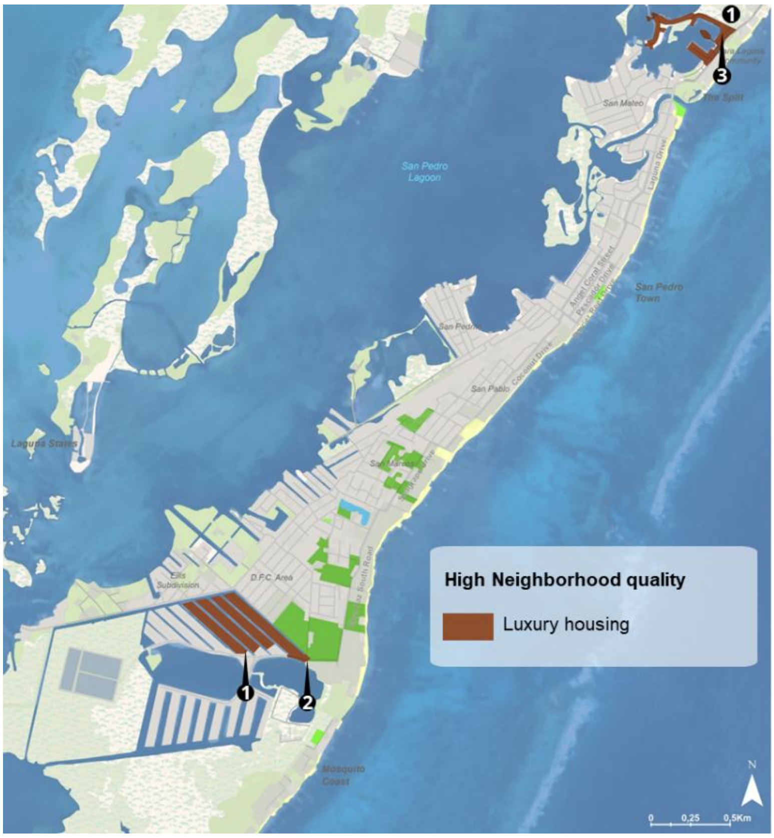


More than half of the residential land is occupied by medium quality neighborhoods, and a quarter by good quality neighborhoods, while high quality, luxury housing represents 11%. Low-quality, or substandard, neighborhoods account for 11% of the residential land.

High Neighbourhood quality

Located in Mahogany Bay Village Complex & Maralaguna, the latter with a mix of building typologies. It is estimated that 20% of this typology corresponds to vacation housing.

Figure 57 High neighborhood quality



25.1 dw/ha

1,370 inhabitants

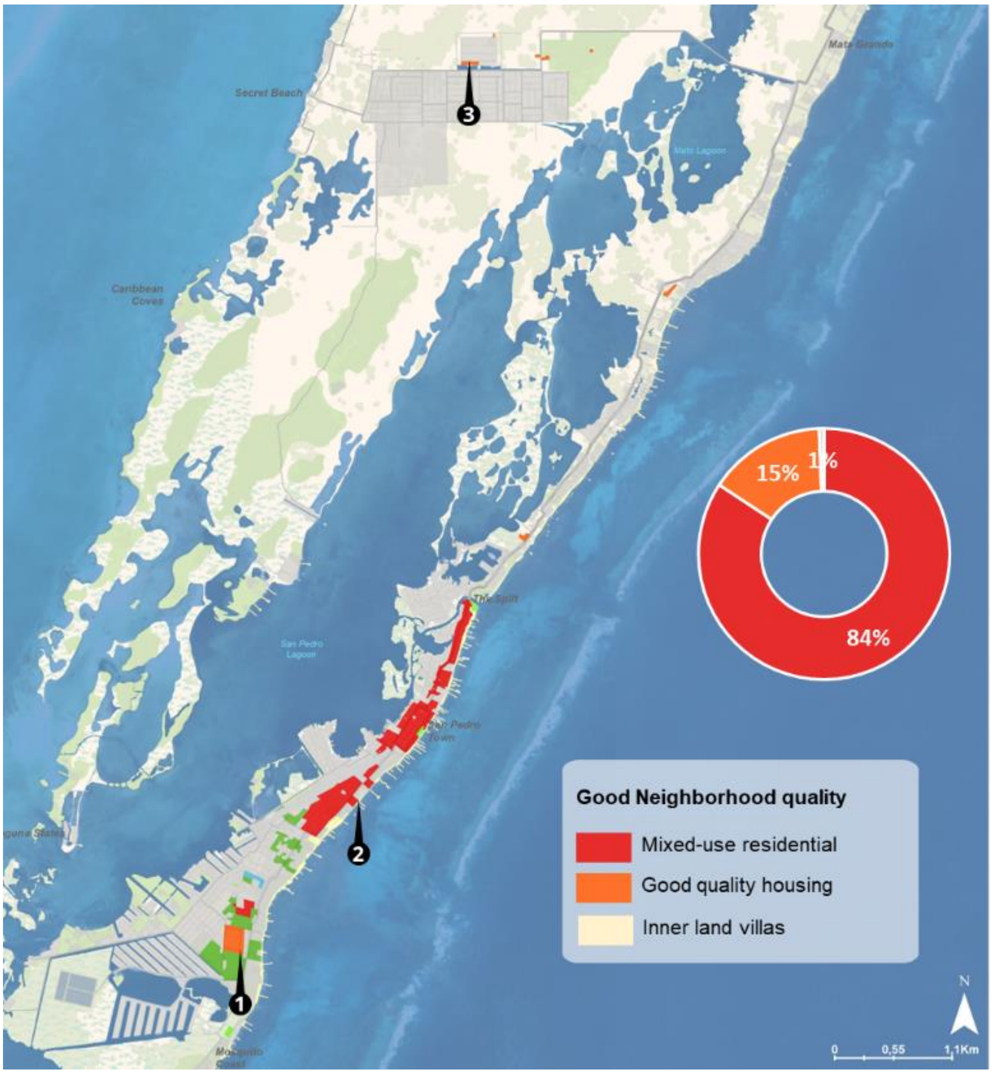
Source: IDOM, 2023

Good Neighbourhood quality

The more extensive class is Mix-use located at urban center, it is estimated that 25% of this typology corresponds to vacation housing. Good quality housing located among natural areas, near the center. And inner land villas are similar to vacation villas but located out of the waterfront.

Good quality housing	Mixed-use residential	Inner land villas
27.9 dw/ha	50 dw/ha	14,2 dw/ha
600 inhabitants	5,760 inhabitants	15 inhabitants

Figure 58 Good Neighbourhood quality



Source: IDOM, 2023

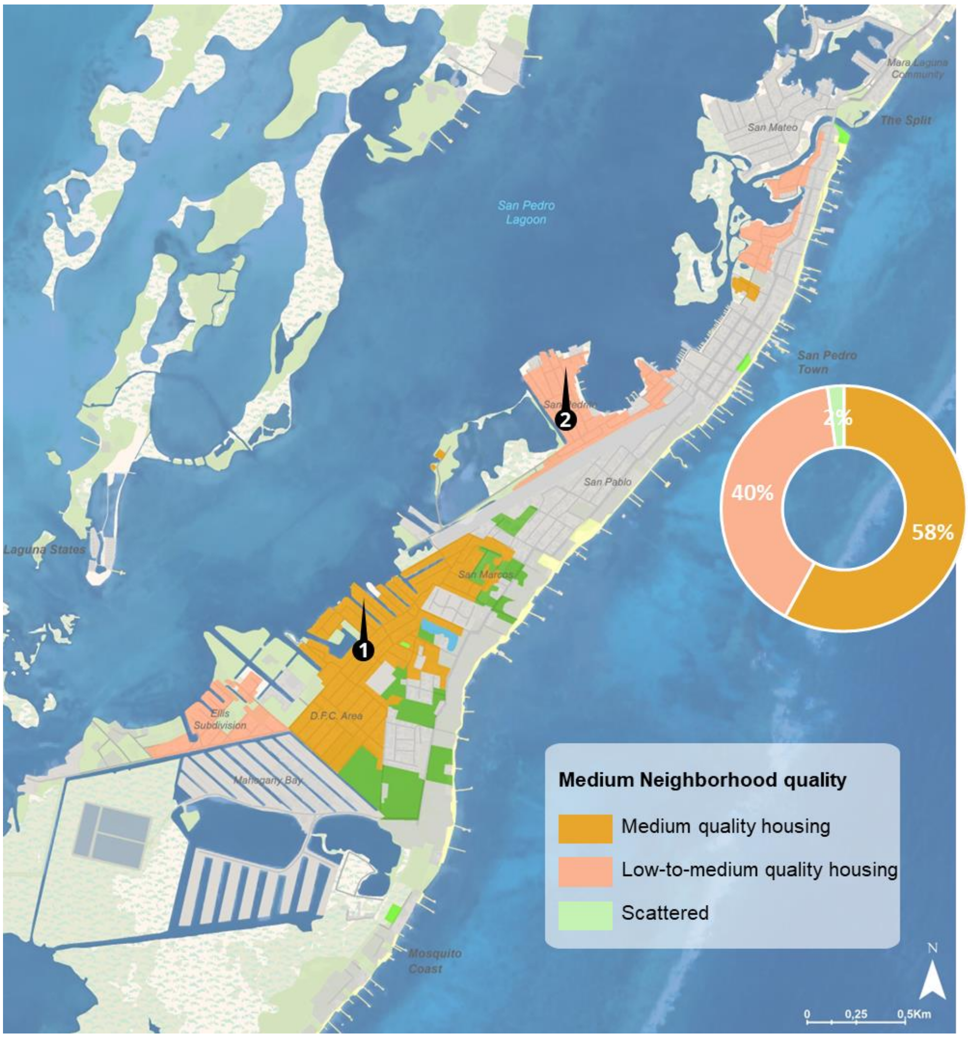
Medium Neighbourhood quality

Medium quality housing is located near urban center, as an urban sprawl. Estimated 25% of precarious housing. Low-to-medium quality located around the urban center too, with an estimated of 50% of precarious housing. Between both clases there are almost 900 precarious houses.

Medium quality housing	Low-to-medium quality housing	Scattered
32.3 dw/ha	26.9 dw/ha	9.6 dw/ha
5,000 inhabitants	2,900 inhabitants	65 inhabitants
400 precarious (25%)	**470 precarious (50%)**	**20 precarious (100%)**

❶  ❷  ❸ 

Figure 59 Medium Neighbourhood quality



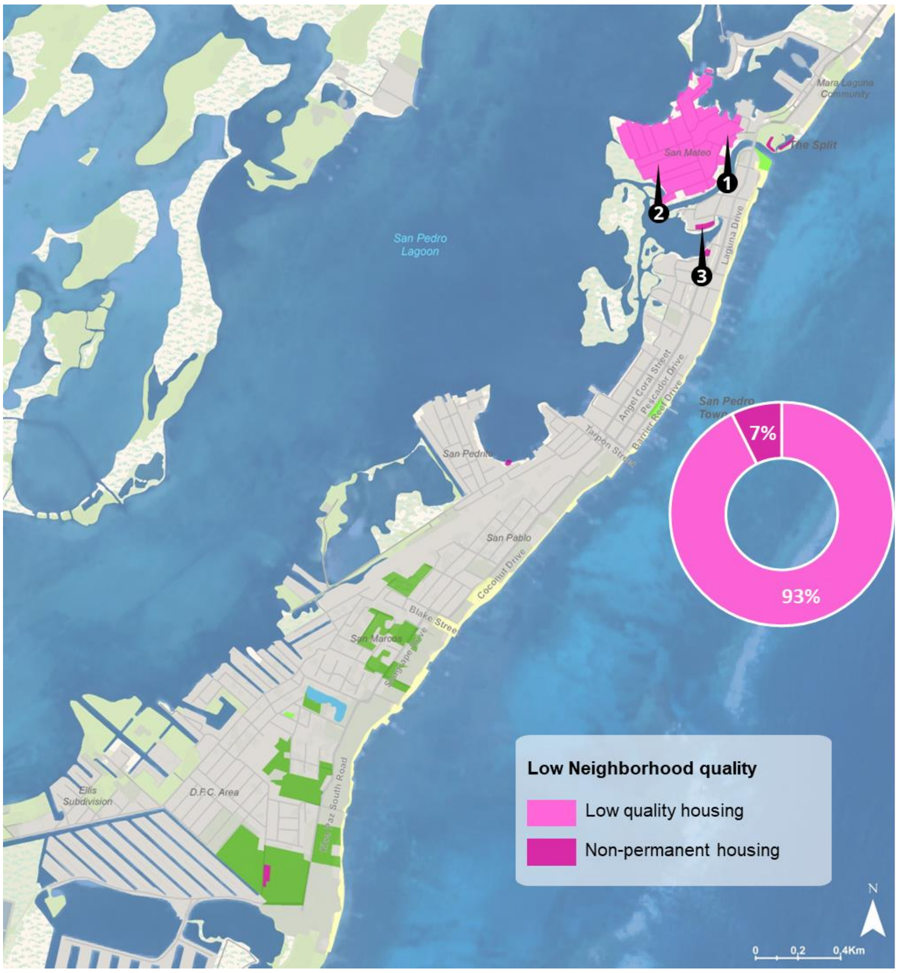
Source: IDOM, 2023

Low Neighbourhood quality

In the Low-quality housing area, 75% of the housing stock is estimated to be precarious. Located in the San Mateo area. Non-permanent housing are agglomerations of small dwellings in an irregular structure.

Low quality housing	Non-permanent housing
33.5 dw/ha	58.1 dw/ha
1,800 inhabitants	250 inhabitants
590 precarious (100%)	**80 precarious (100%)**

Figure 60 Low neighborhood housing



Source: IDOM, 2023

After the analysis carried out on the housing units, considering the preliminary 2022 census estimate of 6,112 dwellings, the following distribution has been obtained according to their characteristics:

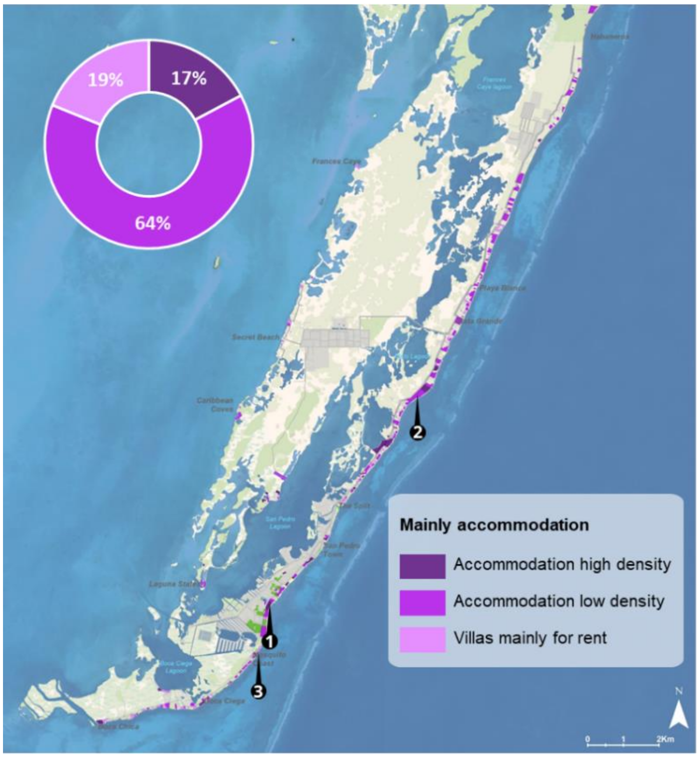
Table 21 – Estimation of housing characteristics

	Vacational	Apartments	Precarious	Dwelling
Luxury housing	88	76	0	439
Mixed-use residential	461	1655	0	1845
Good quality housing	0	191	0	184
Inner land villas	0	0	0	4
Medium quality housing	0	1337	406	1625
Low-to-medium quality housing	0	30	467	933
Scattered	0	0	18	18
Low quality housing	0	20	589	589
Non-permanent housing	0	0	81	81
Villas mainly for rent	247			247
Land Under Development				147

Source: IDOM, 2023

2.1.3.2.2. Mainly Accommodations

Hotels, resorts & villas distribution on a growing coastline to the north. 4.7% of the properties on the Caye are Vacation Villas.

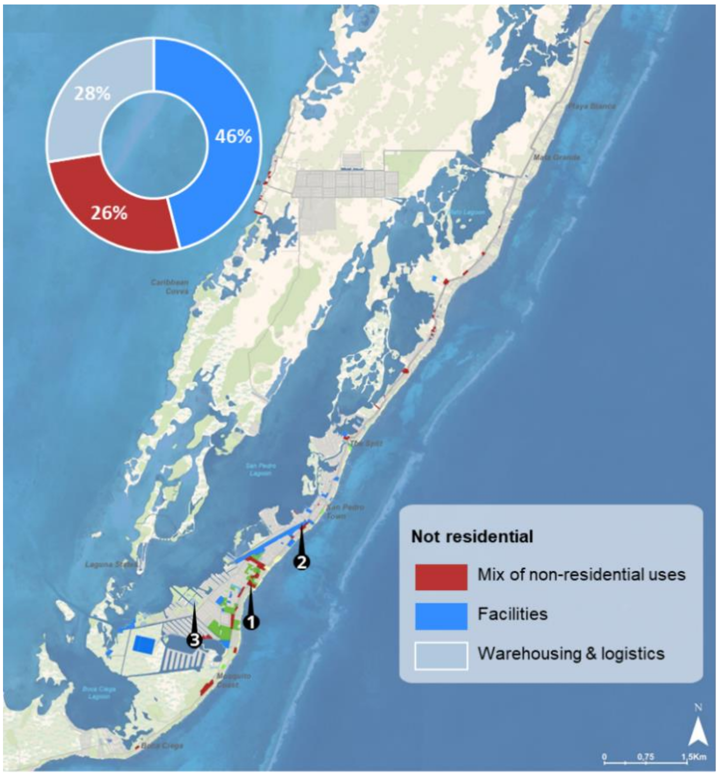


250 villas

235 Hotels & Resorts

2.1.3.2.3. Not residential

Mix of non-residential uses distributed on north - south road and Secret beach, and facilities concentrated in the center.

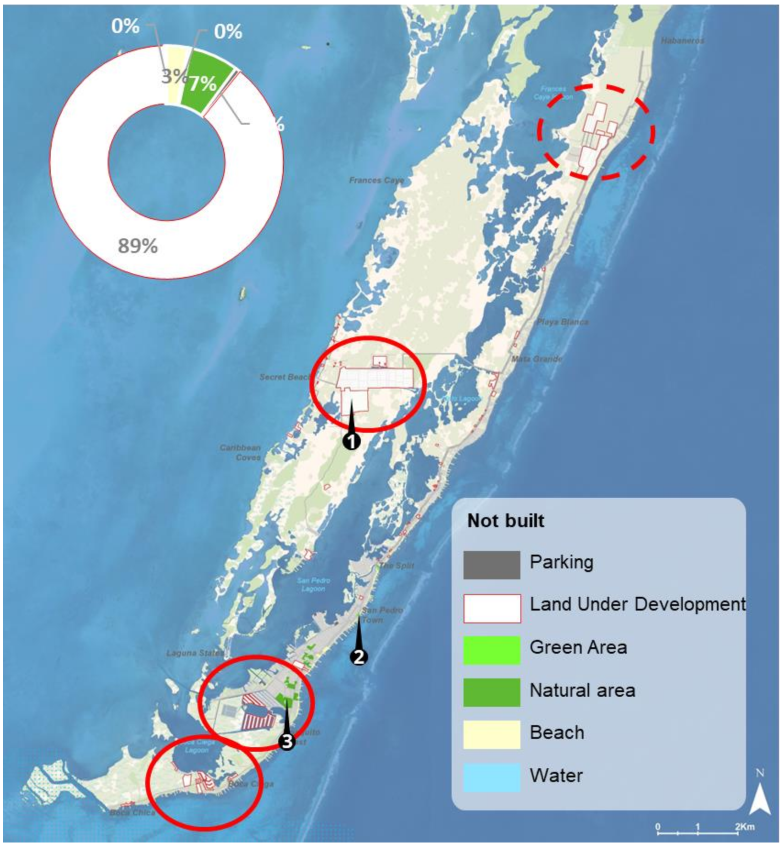


Types of facilities

Transport	Education
Cultural	Health
Institutional	Sports
Services	Security

2.1.3.2.4. Not built

There are three large pockets of land under development and a fourth in the extreme northeast. Only 55 acres of green areas, of which 3.3 qualified.



2.1.3.2.5. Homogeneous Units summarize.

Table 22 – Homogeneous Units summarize.

		Dwellings	Population	Area (acres)	Density (dw/ha)	Density (dw/acre)
High	Luxury housing	439	1,371	43.2	25.1	10.2
Good	Mixed-use residential	1,845	5,763	91.2	50.0	20.2
	Good quality housing	184	575	16.3	27.9	11.3
	Inner land villas	4	12	0.7	14.2	5.7
Medium	Medium quality housing	1,625	5,076	124.2	32.3	13.1
	Low-to-medium quality housing	933	2,914	85.6	26.9	10.9
	Scattered	18	56	4.6	9.6	3.9
Low	Low quality housing	589	1,840	43.4	33.5	13.6
	Non-permanent housing	81	253	3.4	58.1	23.5

	Dwellings	Population	Area (acres)	Density (dw/ha)	Density (dw/acre)
Mainly Vacational					
Accommodation high density	-	-	70.2		
Accommodation low density	-	-	260.0		
Villas mainly for rent	247	-	76.7	8.0	3.2
Not residential					
Mix of non-residential uses	-	-	52.9		
Facilities Transport, Cultural, Institutional, Services, Education, Health, Sports, Security	-	-	92.3		
Warehousing & logistics	-	-	55.2		
Not built					
Parking			5.6		
Land Under Development	147	459	688.1		
Green Area			3.3		
Natural Area			52.2		
Beach			22.7		
Water			2.7		
	6,112 dwellings	**18,319** inhabitants	**1,795** acres	**8.4** dw/ha	**2.8** dw/acre

Source: IDOM, 2023

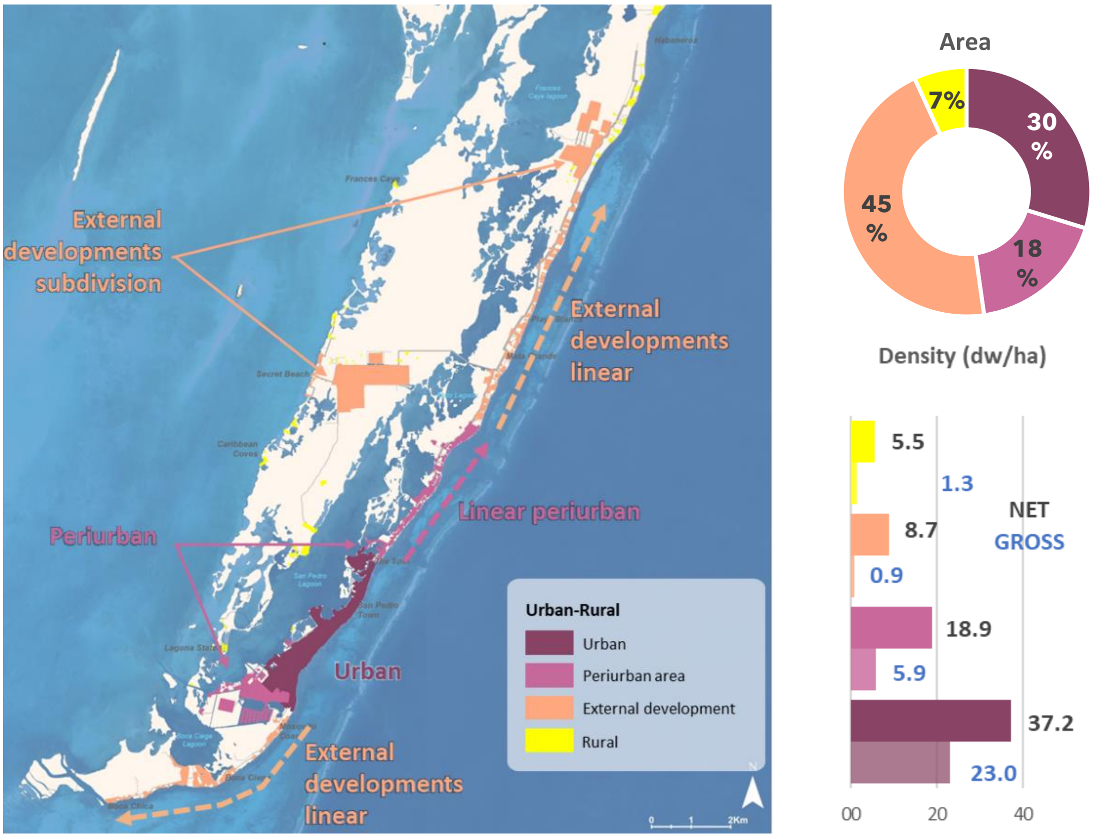
2.1.3.3. Urban and Rural Transition Groups

IDOM experience in the analysis of emerging cities shows that there is not a clear line between urban and rural areas, but that there is a gradual transformation from urban to purely rural land.

The characterization of these transitional lands is essential to understand the dynamics of growth and to detect problems in land consumption. Thus, four transition groups are defined for Ambergris:

A) **Urban**
B) **Periurban areas:** Periurban or linear periurban
C) **External developments:** Subdivisions or linear
D) **Rural**

Figure 61 Urban and Rural Transition Groups



Source: IDOM, 2023

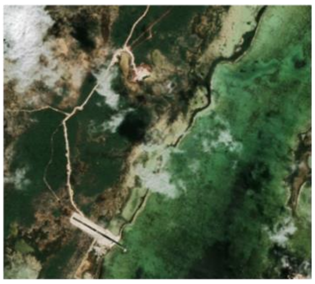
To differentiate between A and B transition groups, the consultancy uses a criteria of density, consolidation, connectivity, and intensity of urbanization, while the difference with C is defined according to urban continuity:

Figure 62 Examples of Urban and Rural Transition Groups

Urban (*Town Center*)

Periurban (*Ellis Subdivision*)

External development (*Secret Beach*)

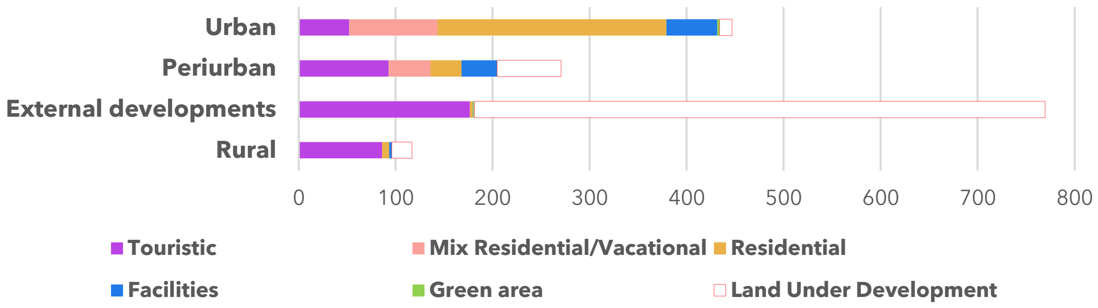


Rural (*West Side of San Pedro Lagoon*)

Source: IDOM, 2023

The following chart shows the land uses in each of the transition groups, as well as their acreage.

Figure 63 Urban and rural transition groups surfaces



Source: IDOM, 2023

Considering the above, there is a significant difference between gross and net periruban density, due to the accumulation of vacation land and land under development. In the periurban area there are more land occupied with vacational uses than in residential one. And the 66% of land under development is located in the external development's areas and only 23% in the periurban area, which shows a growth in expansion.

In conclusion, the analysis of homogeneous units reflects that there is a high percentage of Land under development on the island (38%), and this is most representative in the external developments (588 acres out of the total 688 acres on the island), reflecting the current real estate dynamics, oriented towards the growth of new subdivisions.

The land designated for vacation accommodations occupies a similar extent to the land primarily used for residential purposes (23% in both cases, the former with 407 acres and the latter with 413 acres), showing the pressure of vacation exploitation on the island. However, while vacation properties are predominant in peri-urban and external developments, 79% of the residential land is located in urban areas.

Regarding the housing typology, over 10% of the dwellings are used for vacation purposes, of which nearly 550 (70% of vacation housing) are located in San Pedro. As for residential housing, about 25% (approximately 1,500 homes) consist of precarious structures scattered throughout neighborhoods such as San Mateo or San Pedrito.

The provision of facilities concentrates in urban areas (57% of the facilities' surface in urban land) and is practically non-existent in rural areas and external developments, highlighting the deficit of facilities in these areas.

2.1.4. Demographic Analysis

The population is an essential resource of the territory, since it interacts in the configuration and dynamism of the different processes that define the urban footprint, both in quantity and quality: its shape, occupation, uses, densities, and economic activities, among others. In this way, the urban footprint model and land uses are strongly determined by the quantity of population and its behavior in the territory. In its quantitative aspect, population dynamics significantly conditions urban growth. Therefore, population growth or decrease determined by births, deaths and migratory flows are key elements to take into account when calculating land demand, and therefore the growth of the urban footprint.

This chapter presents the population diagnosis of Ambergris Caye, which constitutes the basis for the formulation of the Urban Growth Scenarios. The sources used for this analysis are the following:

- **Statistical Institute of Belize (SIB)**, national entity in charge of the collection, analysis, and dissemination of demographic statistics in Belize.
- **REDATAM**, site with complete and updated information from the 1991, 2000 and 2010 censuses.
- **Belize Tourism Board (BTB)**, entity with tourist arrival projections for the 2030 horizon.

It is important to clarify that although the last census in Belize was conducted in 2022, the detailed results of this count have not yet been officially published. For the purposes of this analysis, the population and housing estimates for 2022 according to the preliminary results provided by the Statistical Institute of Belize were used as the base information.

On the other hand, it should be mentioned that the estimated population information for the Town of San Pedro is not disaggregated at the neighborhood or block level. For this reason, the base information for the development of scenarios is based on general distributions, according to the analysis of homogeneous units.

2.1.4.1. Historical Population Growth

With an estimated population of 441,471 inhabitants as of 2022, Belize is the least populated country in continental Central America. According to SIB projections, the Belize District (to which San Pedro Town belongs) is home to approximately 30% of the country's total population by 2022, with Belize City being the country's largest urban center with 67,016 projected inhabitants by that year.

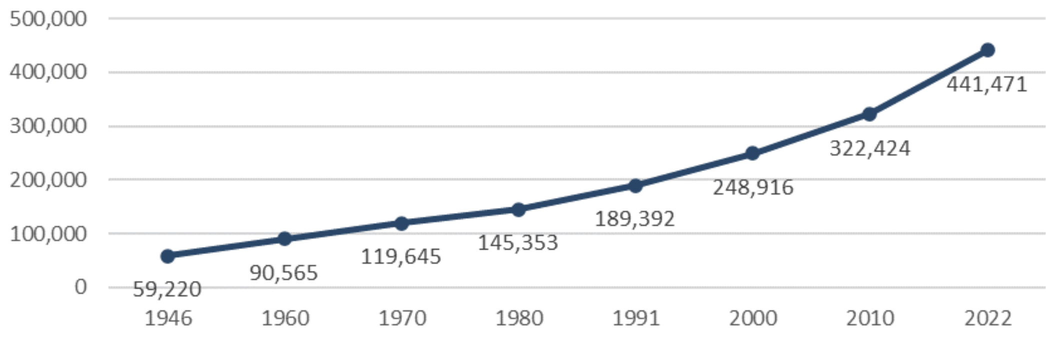
The table below illustrates the historical population growth at the national level, with 1946 as the starting year. As can be seen in the graph below, the country has experienced a steady population increase, with the most notable growth beginning in 1980.

Table 23 – National population growth

YEAR	NATIONAL POPULATION	AVERAGE ANNUAL GROWTH RATE (AAGR)
1946	59,220	N.D.
1960	90,565	3.08%
1970	119,645	2.82%
1980	145,353	1.97%
1991	189,392	2.44%
2000	248,916	3.08%
2010	322,424	2.62%
2022*	**441,471**	**2.65%**

Source: REDATAM – Statistical Institute of Belize, 2023 *Projection by 2010 Census

Figure 64 National population growth



Source: REDATAM – Statistical Institute of Belize, 2023 *Projection by 2010 Census

- **Historical population growth in San Pedro**

Taking as a framework of reference the population behavior at the national level, we will now analyze the historical growth in the Town of San Pedro. For this case, the base year is 1980, which information was included in the 1991 Census.

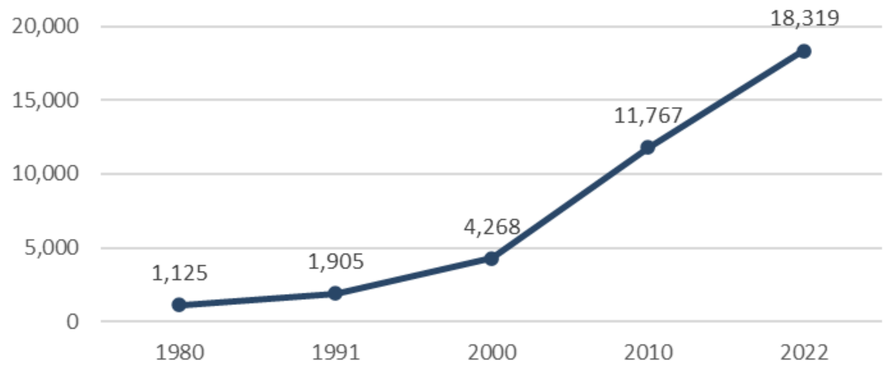
It is important to mention that, since San Pedro obtained the Township recognition in 1984, there are no detailed population records for periods prior to the 1980s, since it was considered part of the rural area of the Belize District. The following graphs illustrate the historical population growth in San Pedro, considering the estimate for 2022 projected by the Statistical Institute of Belize:

Table 24 – Historical population growth of San Pedro

YEAR	SAN PEDRO POPULATION	AVERAGE ANNUAL GROWTH RATE (AAGR)
1980	1,125	N.D.
1991	1,905	4.90%
2000	4,268	9.38%
2010	11,767	10.67%
2022*	**18,319**	**3.76%**

Source: Statistical Institute of Belize, 2023*Estimate information

Figure 65 Historical population growth of San Pedro



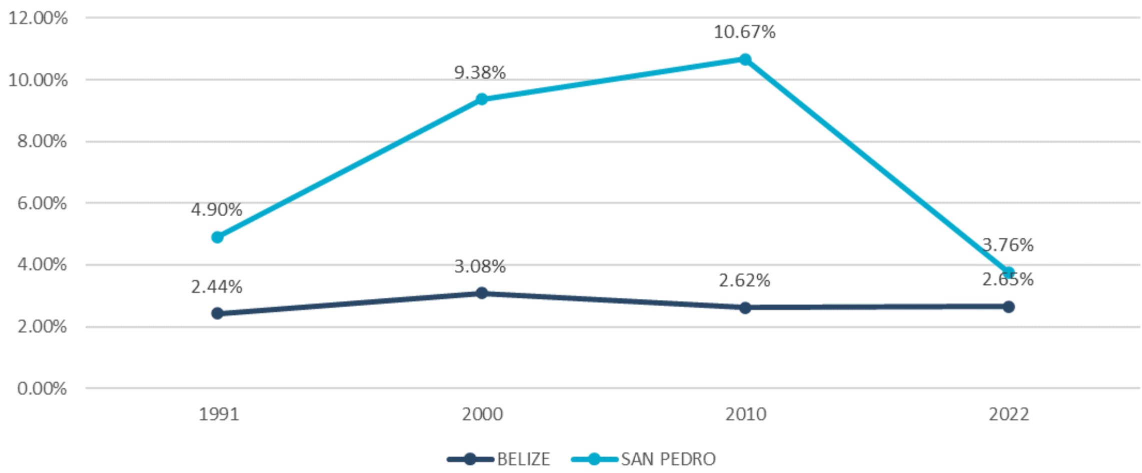
Source: Statistical Institute of Belize, 2023 *Estimate information

As can be seen in the previous graphs, population growth in San Pedro began to increase at an accelerated rate starting in the year 2000. The highest growth rates occurred in the period 1991 - 2000 (9.38%) and 2000 - 2010 (10.67%), showing a considerable drop for the period 2010 - 2022, where the growth rate was only 3.76%, according to estimates by the Statistical Institute of Belize.

Among the hypotheses put forward for this abrupt change in the trend is the impact of the COVID-19 pandemic and other factors which caused the closure of Belize's international borders, with its consequent impact on the economy of Ambergris Caye. However, it is worth reiterating that the population data for 2022 is an estimate and is not an official result of the 2022 Census.

The following is a comparison between the population growth rates at the national level and in San Pedro, where a much more accelerated growth behavior is evidenced in the last one, as opposed to the more moderate pace at the national level:

Figure 66 Historical Average Annual Growth Rate (AAGR) comparative between Belize (National) and San Pedro



Source: REDATAM – Statistical Institute of Belize, 2023 *Projection by 2010 Census

2.1.4.2. Average ratio of Inhabitants per Dwelling

For the urban growth study, it is of great relevance to know the average number of inhabitants per dwelling, since this value affects the number of housing units that are needed or will be needed to meet the population demand in the territory. In this way, these values have an impact on the projection of the Urban Growth Scenarios to 2045.

For this analysis, official data from the 1980, 1991, 2000 and 2001 censuses are used, as well as estimates for 2022 prepared by the Statistical Institute of Belize. These data are shown in the following table:

Table 25 – Historical Ratio of Inhabitants Per Dwelling in San Pedro

YEAR	SAN PEDRO POPULATION	DWELLINGS IN SAN PEDRO	RATIO OF INHABITANTS PER DWELLING
1991	1,905	510	3.74
2000	4,268	1,248	3.42
2010	11,767	3,784	3.11
2022*	**18,319**	**6,112**	**3.00**

Source: Statistical Institute of Belize, 2023 *Estimate information

Considering the estimated number of dwellings for 2022 (6,112), it can be seen that the ratio of inhabitants per dwelling in San Pedro has shown a continuous decrease since 1991. While in 1991 the rate was 3.74 inhabitants per housing unit, in 2022 it would have decreased to 3.00. This is a common behavior in many cities in Latin America and the Caribbean, where the size of households has been gradually reduced this year.

2.1.4.3. Population and housing projections to 2045

Considering the historical analysis of population growth, the demographic projections (inhabitants and number of dwellings) for the 2045-time horizon are presented below. This is a fundamental input for the subsequent simulation of the Trend and Smart Urban Growth scenarios.

2.1.4.3.1. Population projection:

To make the population projection to 2045, a process was implemented using two methodologies, through which a comparative framework was established. As a reference, the national demographic projections formulated for Belize by ECLAC were also considered.

2.1.4.3.2. Methodology 1 – AAGR Projection

By calculating the decrease in the Average Annual Growth Rate (AAGR) between the years 2010 and 2022 (Decrease of AAGR (DAAGR)), we can estimate the expected rates for the period between 2023 and 2045. We then proceeded to calculate the population per year using the formula below:

AAGR = (Population Final Value/Population Initial Value) ^(1/(Final Year – Initial Year))-1

DAAGR = (AAGR Final Value/AAGR Initial Value) ^(1/(Final Year – Initial Year))-1

Table 26 – AAGR and DAAGR between 2010 and 2022

YEAR	SAN PEDRO POPULATION	AAGR	DAAGR
2010	11,767	10.67%	-
2022*	**18,319**	**3.76%**	**-8.3%**

*Estimate information

Source: IDOM, with information from the Statistical Institute of Belize, 2023

The results of this methodology are displayed below:

Table 27 – Population projection using the AAGR and DAAGR methodology

YEAR	SAN PEDRO POPULATION	AAGR
2010	11,767	10.67%
2022	18,319	3.76%
2023	18,950	3.44%
2024	19,548	3.16%
2025	**20,114**	**2.89%**
2026	20,648	2.65%
2027	21,150	2.43%
2028	21,621	2.23%
2029	22,063	2.04%
2030	**22,477**	**1.87%**
2031	22,863	1.72%
2032	23,223	1.57%
2033	23,558	1.44%
2034	23,869	1.32%
2035	**24,159**	**1.21%**
2036	24,427	1.11%
2037	24,676	1.02%
2038	24,907	0.93%
2039	25,120	0.86%
2040	**25,317**	**0.78%**
2041	25,499	0.72%
2042	25,667	0.66%
2043	25,823	0.60%
2044	25,966	0.55%
2045	**26,098**	**0.51%**

Source: IDOM, with information from the Statistical Institute of Belize, 2023

2.1.4.3.3. Methodology 2 – Linear Projection

Using the Linear Forecast process, population growth to 2045 is estimated based on data from 2022 and 2010.

LINEAR FORECAST = FOREST.LINEAR(2023;11,767:18,319;2010:2022)

The results of this methodology are displayed below:

Table 28 – Population projection using Methodology 2

YEAR	TOWN POPULATION	AAGR
2010	11,767	10.67%
2022	18,319	3.76%
2023	18,865	2.98%
2024	19,411	2.89%
2025	**19,957**	**2.81%**
2026	20,503	2.74%
2027	21,049	2.66%
2028	21,595	2.59%
2029	22,141	2.53%
2030	**22,687**	**2.47%**
2031	23,233	2.41%
2032	23,779	2.35%
2033	24,325	2.30%
2034	24,871	2.24%
2035	**25,417**	**2.20%**
2036	25,963	2.15%
2037	26,509	2.10%
2038	27,055	2.06%
2039	27,601	2.02%
2040	**28,147**	**1.98%**
2041	28,693	1.94%
2042	29,239	1.90%
2043	29,785	1.87%
2044	30,331	1.83%
2045	**30,877**	**1.80%**

Source: IDOM, with information from the Statistical Institute of Belize, 2023

2.1.4.3.4. Comparison between methodologies

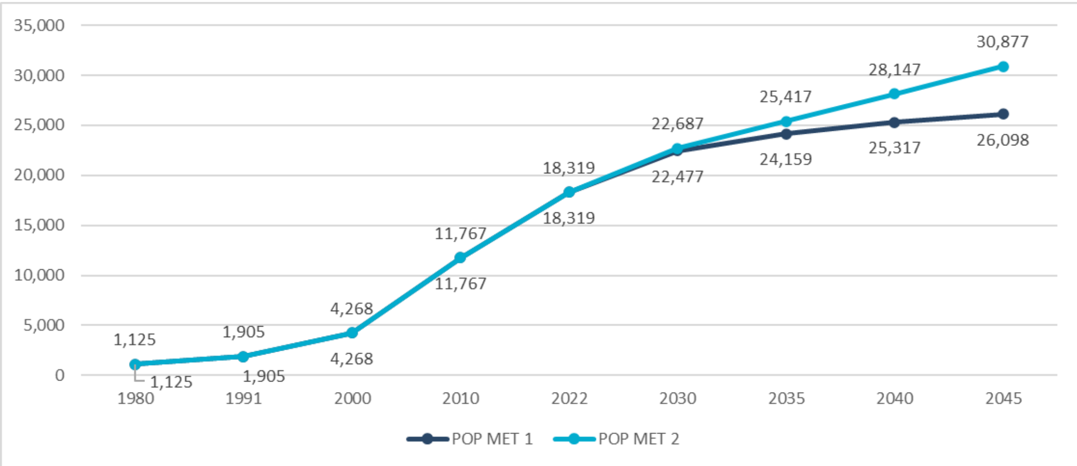
A comparison of the results obtained after calculating the projections using the two methodologies is presented below:

Table 29 – Comparison of methodologies

YEAR	POPULATION METHODOLOGY 1	POPULATION METHODOLOGY 2	AAGR METHODOLOGY 1	AAGR METHODOLOGY 2
2010	11,767	11,767	10.67%	10.67%
2022	18,319	18,319	3.76%	3.76%
2025	20,114	19,957	2.89%	2.81%
2030	22,477	22,687	1.87%	2.47%
2035	24,159	25,417	1.21%	2.20%
2040	25,317	28,147	0.78%	1.98%
2045	**26,098**	**30,877**	**0.51%**	**1.80%**

Source: IDOM, with information from the Statistical Institute of Belize, 2023

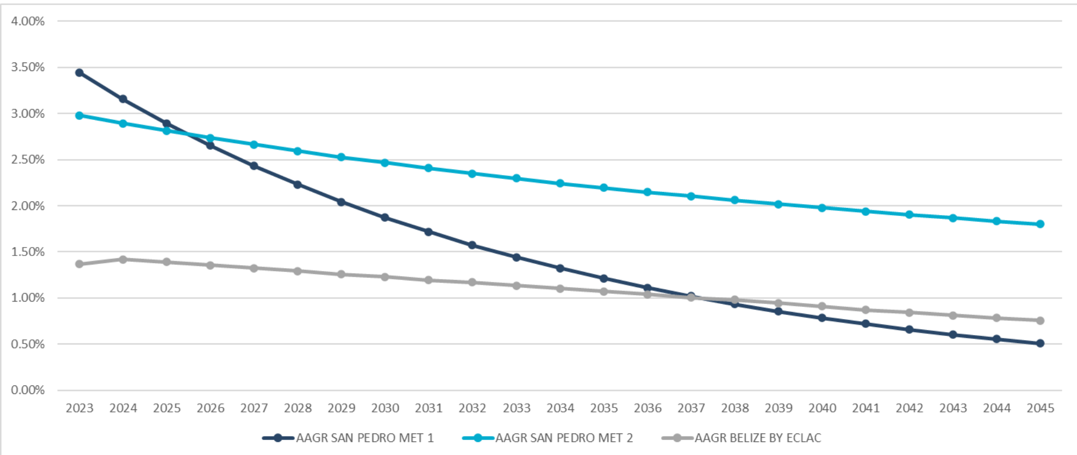
Figure 67 Population projection of San Pedro – Methodology 1 vs. Methodology 2



Source: IDOM, with information from the Statistical Institute of Belize, 2023

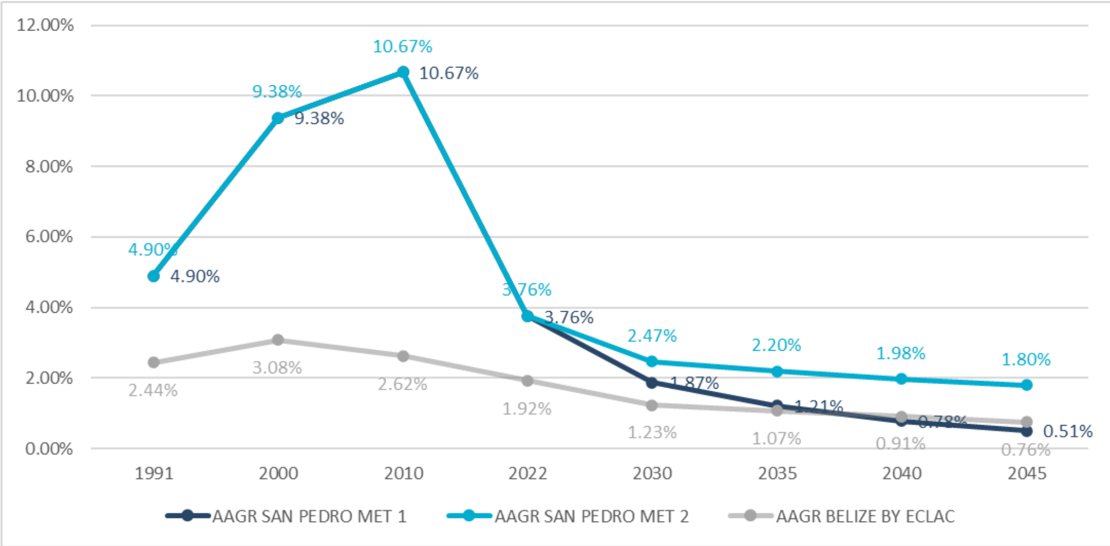
The following graph shows the variation in the Average Annual Growth Rate (AAGR) of both methodologies. The national AAGR for Belize projected by ECLAC is added as an additional reference:

Figure 68 AAGR projection comparison



Source: IDOM, with information from the Statistical Institute of Belize and ECLAC, 2023

Figure 69 Historic and AAGR projection for San Pedro and Belize (National)



Source: IDOM, with information from the Statistical Institute of Belize and ECLAC, 2023

As can be seen in the previous graphs, methodology 1 projects a population of 26,098 inhabitants in 2045, with an AAGR for that year of 0.51%. Methodology 2 estimates a population of 30,877 inhabitants and an AAGR for 2045 of 1.80%.There is a considerable difference between the values obtained after the application of the methodologies, where methodology 1 projects a lower population growth, with lower growth rates than the estimation through the linear projection.

In the case of Ambergris Caye, it is important to consider, in addition to natural population growth, other potential factors that could lead to population increase:

1. The arrival of migrant population to the island, especially from neighboring countries.
2. The dynamics of tourism and real estate activities, which require an important labor force and highly influence the arrival of new residents to the Island.

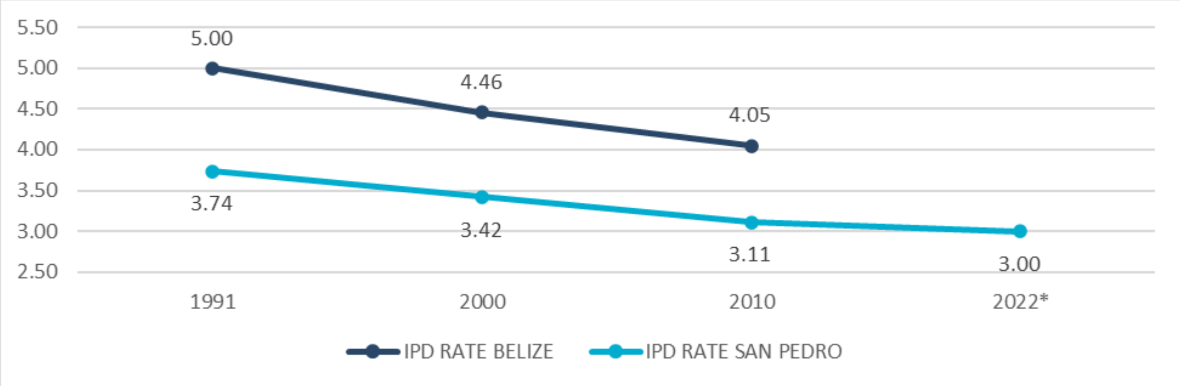
With respect to these two aspects, it is important to mention that there are no specific data for San Pedro regarding the establishment of new foreign residents or the working population that has settled on the island. However, there are national data and estimates elaborated by the BTB, which are studied in greater depth in the Document 4 of Tourist Analysis.

Considering the above, the estimate provided by methodology 2 has been taken as the population projection to be used for the construction of the Growth Scenarios to 2045 (30,877 inhabitants), considering the influence of factors additional to natural growth.

- **Housing projection:**

This section determines the average number of inhabitants per dwelling for the 2045 horizon. This is a valuable data to identify the type and number of housing units that the island will need to provide, considering its population. For this purpose, we will start from the base information analyzed in the historical ratio of inhabitants per dwelling, considering the national data of Belize and those related to the Town of San Pedro.

Figure 70 Inhabitants per Dwelling (IPD) Rate in Belize and San Pedro



Source: IDOM, with information from the Statistical Institute of Belize, 2023

Considering the above, applying the analysis of Annual Average Growth Rates of the Ratio of Inhabitants per Dwelling, the number of dwellings for 2045 on the Island is projected as follows:

Table 30 – Estimation of Dwellings and Rate of Inhabitants Per Dwelling in San Pedro

YEAR	TOWN POPULATION	DWELLINGS	RATE OF INHABITANTS PER DWELLING
2010	11,767	3,784	3.11
2022	18,319	6,112	3.00
2023	18,865	6,506	2.90
2024	19,411	6,690	2.90
2025	**19,957**	**6,875**	**2.90**
2026	20,503	7,181	2.86
2027	21,049	7,368	2.86
2028	21,595	7,622	2.83
2029	22,141	7,879	2.81
2030	**22,687**	**8,104**	**2.80**
2031	23,233	8,368	2.78
2032	23,779	8,618	2.76
2033	24,325	8,870	2.74
2034	24,871	9,136	2.72
2035	**25,417**	**9,396**	**2.71**
2036	25,963	9,664	2.69
2037	26,509	9,936	2.67
2038	27,055	10,208	2.65
2039	27,601	10,488	2.63
2040	**28,147**	**10,770**	**2.61**
2041	28,693	11,055	2.60
2042	29,239	11,346	2.58

2043	29,785	11,640	2.56
2044	30,331	11,938	2.54
2045	**30,877**	**12,241**	**2.52**

Source: IDOM, with information from the Statistical Institute of Belize, 2023

In conclusion, according to the demographic information analyzed and the projections described above, it is expected that Ambergris Caye will continue to experience population growth over the next few years, reaching 30,877 inhabitants by the year 2045. It is also expected that the ratio of inhabitants per dwelling will continue to decrease, reaching 2.52 Inh/dw, following the trend shown in other Latin American cities studied with the ICES methodology.

On the other hand, it is estimated that the number of dwellings in the 2045 horizon will be 12,241, representing 6,129 new dwellings between 2023 and 2045. This means approximately double the number of existing dwellings according to the count estimated by the Statistical Institute of Belize, posing an important challenge in terms of carrying capacity and sustainable development in the territory.

2.1.5. Territorial Systems

General systems are considered the general structure for urban development. These define urban development determinants, as well as conditioning and limiting factors. The following is an analysis of the predominant key systems: environment, mobility and connection, public space, facilities of different approaches and public services.

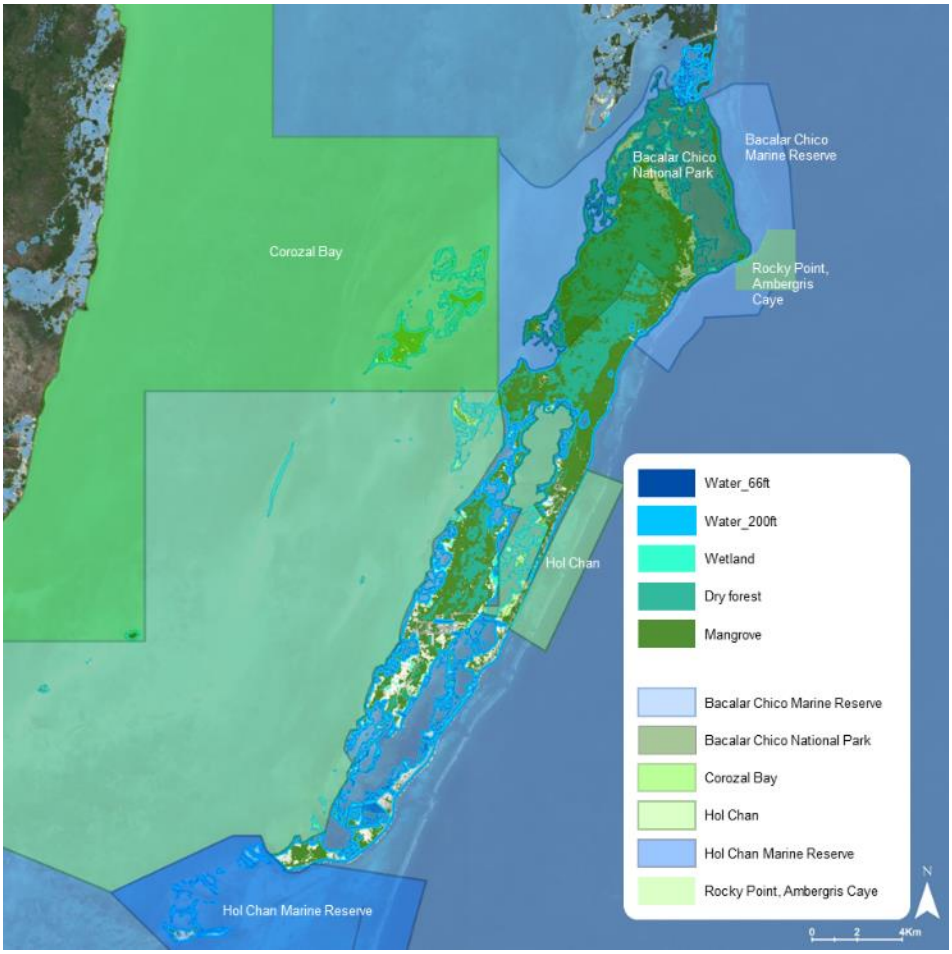
The analysis of each of these elements is crucial to understand the dynamics of Ambergris Caye as a territory and the different services it offers to its population to guarantee an adequate quality of life. Considering the tourist attractiveness, these analyses include coverage for the resident population and tourists.

2.1.5.1. Environmental System and Protected Areas

Ambergris Caye is located within the network of islets, cays and atolls that make up the Belize Barrier Reef (declared a World Heritage Site by UNESCO in 1996), which in turn is part of the Mesoamerican Barrier Reef System, considered the largest barrier reef in the Western Hemisphere. Below is a map showing the different environmental zones on the island. The Caye is renowned for its natural beauty and rich biodiversity. With its pristine beaches, vibrant coral reefs, and lush mangrove forests, this ecologically diverse region holds great importance in terms of its environmental system.

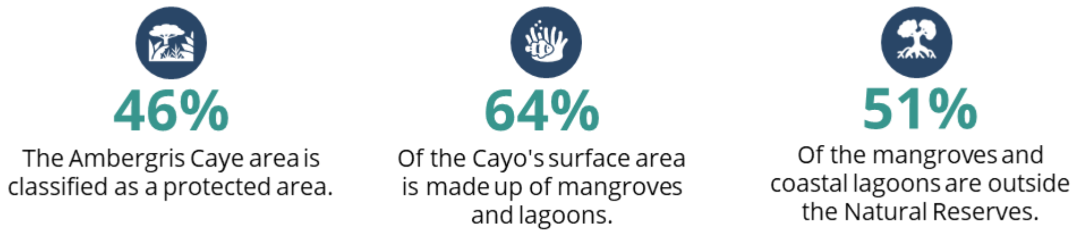
In this chapter, we will explore in detail the natural reserves, protected areas, marine reserves, and overall biodiversity that make Ambergris Caye a true ecological gem.

Figure 71 - Ambergris Caye Environmental Zones Distribution



Source: IDOM, 2023 & Management Plans

Figure 72 - Ambergris Caye Environment Key Data



Source: IDOM, 2023

2.1.5.1.1. Natural Reserves and Protected Areas

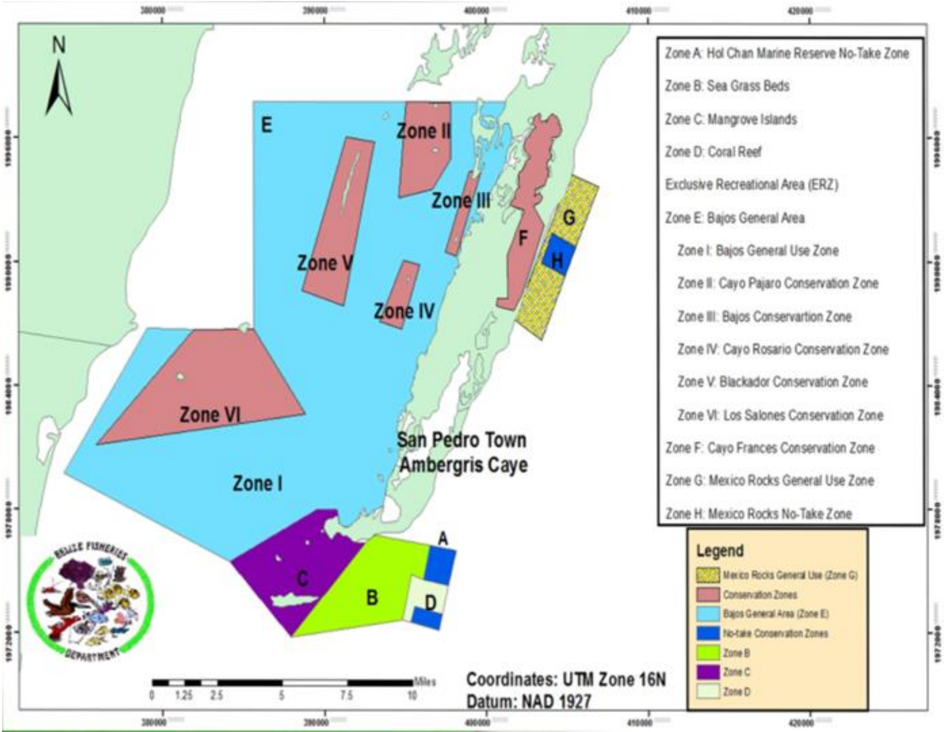
Ambergris Caye has several natural reserves and protected areas, some of the most representative are:

1. **Hol Chan Marine Reserve (HCMR):** it is a Marine Reserve, whose "Hol Chan," means "little channel" in Mayan, because of the natural cut in the barrier reef that acts as an entryway to this underwater wonderland.

   Established in July 1987, Hol Chan is the first marine protected area declared in Belize. It occupies a total area of 102,400 acres (41,439.8 ha) and is distributed in 8 zones, which harbor a great diversity of coral reef ecosystems, seagrasses, and coastal mangrove forests. In addition to the marine areas, the Reserve includes the Cayo

Frances Conservation Zone, located in the interior of the island and comprising more than 7,600 acres (3,108 ha) of lagoons and mangroves.

Figure 73 - Hol Chan Marine Reserve Zonification



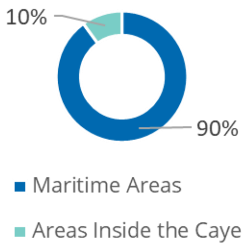
Source: Belize Fisheries Department, Hol Chan Marine Reserve 2019 – 2024 Management Plan

Figure 74 - Key Data Hol Chan Marine Reserve

Surface

102,400 acres
41,439.8 ha

Distribution of the Reserve's Surface area



Permitted and Restricted activities in the HMCR

Zone	Sports and Recreation	Commercial Fishing
A (Hol Chan Channel)	✓	✗
B (Sea Grass Beds)	✓	✓
C (Mangrove Islands)	✓	–
D (Shark Ray Alley)	–	✗
E (Bajos General Area)	✓	✗
F (Cayo Frances)	✓	✗
G (Mexico Rocks General Use Zone)	✓	–
H (Mexico Rocks No-Take Zone)	✓	✗

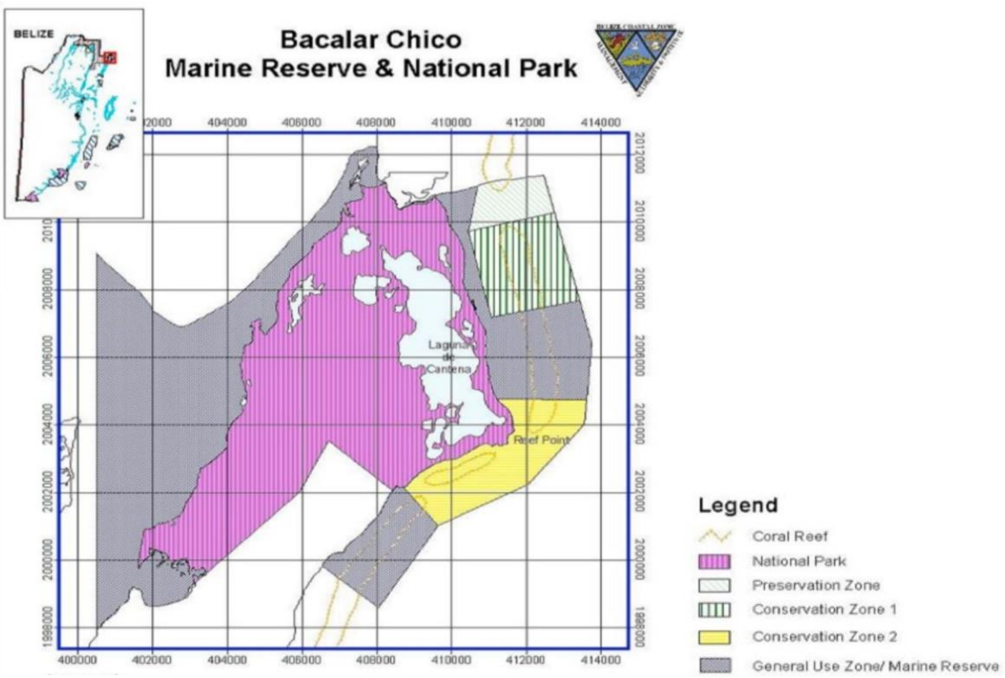
✓ Permitted – Restricted ✗ Frobbiden

Source: Belize Fisheries Department, Hol Chan Marine Reserve 2019 – 2024 Management Plan

2. **Bacalar Chico National Park and Marine Reserve (BCMR):** Bacalar Chico is a National Park and Marine Reserve. This UNESCO´ World Heritage Site is part of the larger Mesoamerican Barrier Reef System. The park encompasses a diverse range of habitats, including mangroves, seagrass beds, lagoons, and sandy beaches.

This natural reserve, located north of Ambergris Caye on the Mexican border, was established through the National Parks System Act in 1996. It covers an area of 28,169 acres (11,399.6 ha), of which 12,640 acres (5,115.2 ha) correspond to the interior of the Caye. The Marine Reserve is divided into 4 management zones: one for general use, one for preservation and two for conservation.

Figure 75 - Bacalar Chico Marine Reserve & National Park Zonification



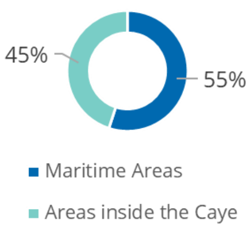
Source: Belize Fisheries Department, Bacalar Chico National Park & Marine Reserve 2004 Management Plan

Figure 76 - Key Data Bacalar Chico Marine Reserve & National Park

Surface

28,169 acres
11,399.6 ha

Distribution of the Reserve's Surface area



Permitted and Restricted activities in the BCMR

Zone	Sports and Recreation	Commercial Fishing
General Use Zone	Restricted	Restricted
Preservation Zone	Forbbiden	Forbbiden
Conservation Zone 1	Restricted	Forbbiden
Conservation Zone 2	Permitted	Restricted

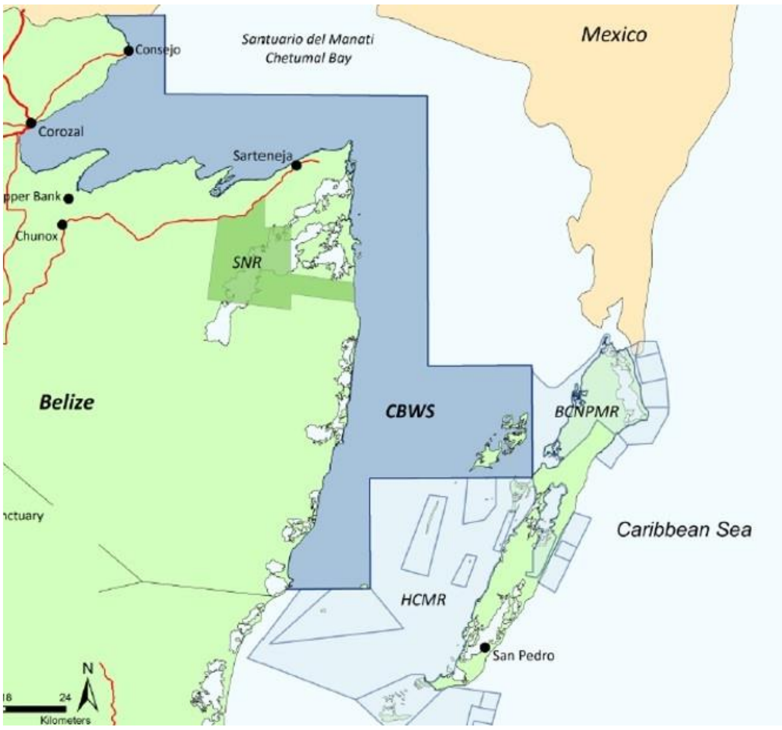
Permitted Restricted Forbbiden

Source: Belize Fisheries Department, Bacalar Chico National Park & Marine Reserve 2004 Management Plan

3. **Corozal Bay Wildlife Sanctuary (CBWS):** It was incorporated into the National Protected Areas System by Statutory Instrument 48 of 1998. It has an area of 178,000 acres (72,034 ha), bordered to the north by the Chetumal Bay Manatee Sanctuary (Mexico) and to the southeast by the Bacalar Chico and Hol Chan Marine Reserves.

Although the Sanctuary extends to the western coast of Ambergris Caye, it does not include land areas, or the cays located above the Bay. According to the National Protected Areas Act of 2015, Corozal Bay is listed as a Wildlife Sanctuary (2), which indicates that its main purpose is to protect the biotic communities and ecosystems present in that area, allowing the sustainable and traditional use of natural resources.

Figure 77 - Corozal Bay Wildlife Sanctuary Zonification



Source: Management Plan Corozal Bay Wildlife Sanctuary

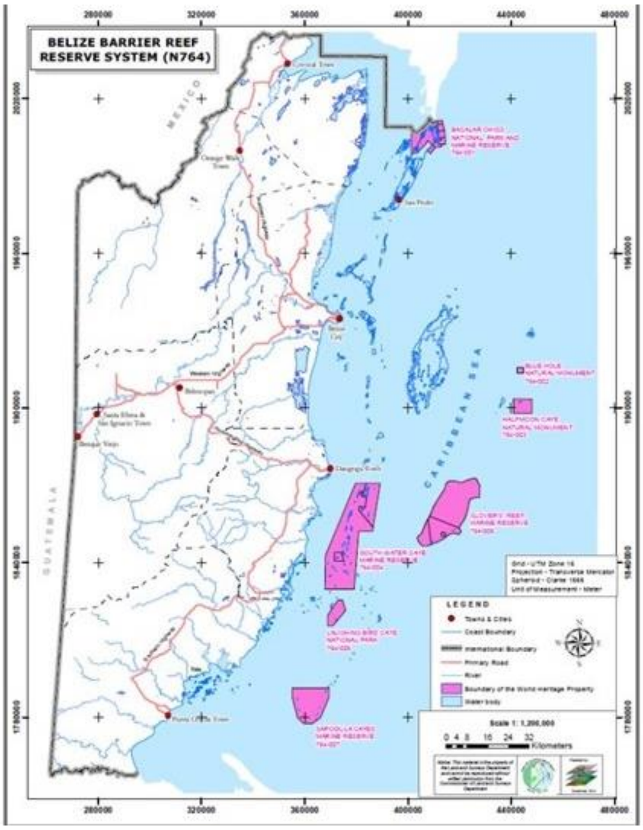
Figure 78 - Key Data Corozal Bay Wildlife Sanctuary

Source: Management Plan Corozal Bay Wildlife Sanctuary

2.1.5.1.2. Coral Reefs

Ambergris Caye is connected to the extensive coral reef system, known as the Mesoamerican Barrier Reef System (MBRS). Stretching for over 600 miles along the coast of Mexico, Belize, Guatemala, and Honduras, the MBRS is the second-largest barrier reef in the world. It is the most important tourist destination in Belize.

Figure 79 - Belize Barrier Reef Reserve System



Source: Managing for World Heritage Values: Outstanding Universal Value and Climate Change in the Belize Barrier Reef System, a World Heritage Site 2015

The coral reefs surrounding Ambergris Caye support an incredible diversity of marine life. These ecosystems are alive with an abundance of corals, sponges, and sea anemones, creating a kaleidoscope of colours beneath the surface.

The reef system has a great diversity of species, among them the coral shark and the lemon shark, as well as soft coral species like the sea fan, and hard ones like the brain coral. The reef is characterized by its colours: Green, white, violet, pink, red and even black corals.

The effects of hurricanes and very warm waters can have a devastating effect on reefs. With Hurricane Mitch (1998), Belize experienced a 50% loss in coral life in 1997-1998.

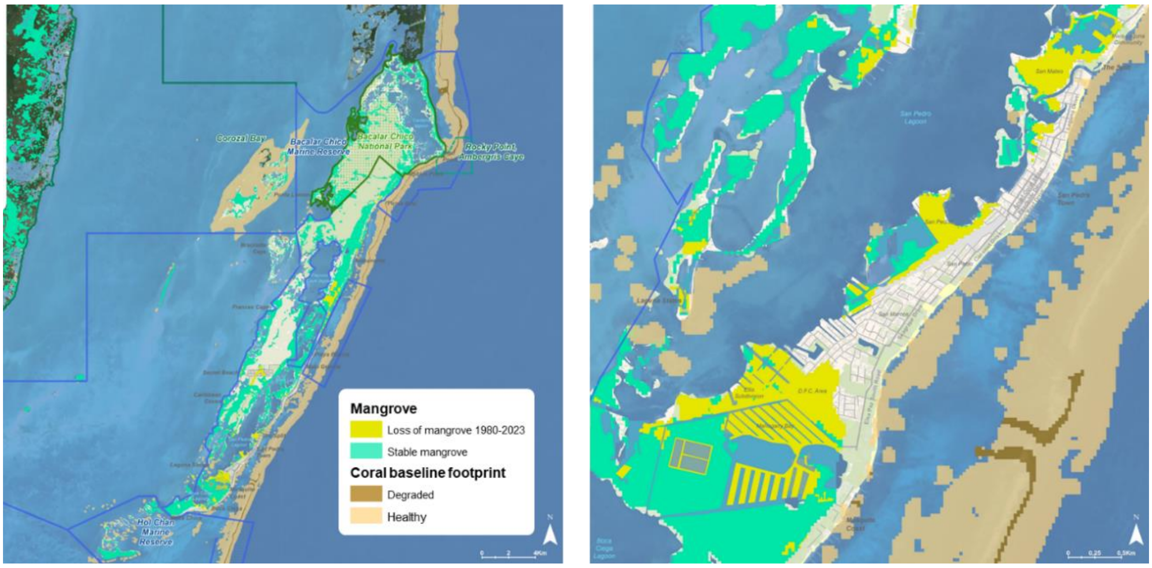
2.1.5.1.3. Mangroves

Along the coast of Ambergris Caye, the mangrove forests play a crucial role in maintaining the environmental balance and protecting the island's coastline. These unique ecosystems serve as a natural barrier against erosion, storm surges, and coastal flooding. Mangroves not only stabilize the coastline but also serve as nurseries for countless marine species. As well as they act as natural water purifiers, filtering sediments and trapping pollutants before they reach the sea, thus contributing to the overall health of the marine ecosystem.

Three main species of mangroves thrive in this area: red mangroves (Rhizophora mangle), black mangroves (Avicennia germinans), and white mangroves (Laguncularia racemosa).

However, this system has been affected thanks to the human intervention. Urban growth is one of the causes of the loss of mangrove areas. Between 1980 and 2023 7% of Mangrove Degraded. It means a loss of 19 acres per year. This Degradation affects 3% of Ambergris Caye Coral.

Figure 80 - Mangrove Removal Maps



Source: IDOM, 2023

7% of mangrove loss between 1980 and 2023.

A loss rate of 19 acres per year

Degradation affects 3% of Ambergris Caye Coral.

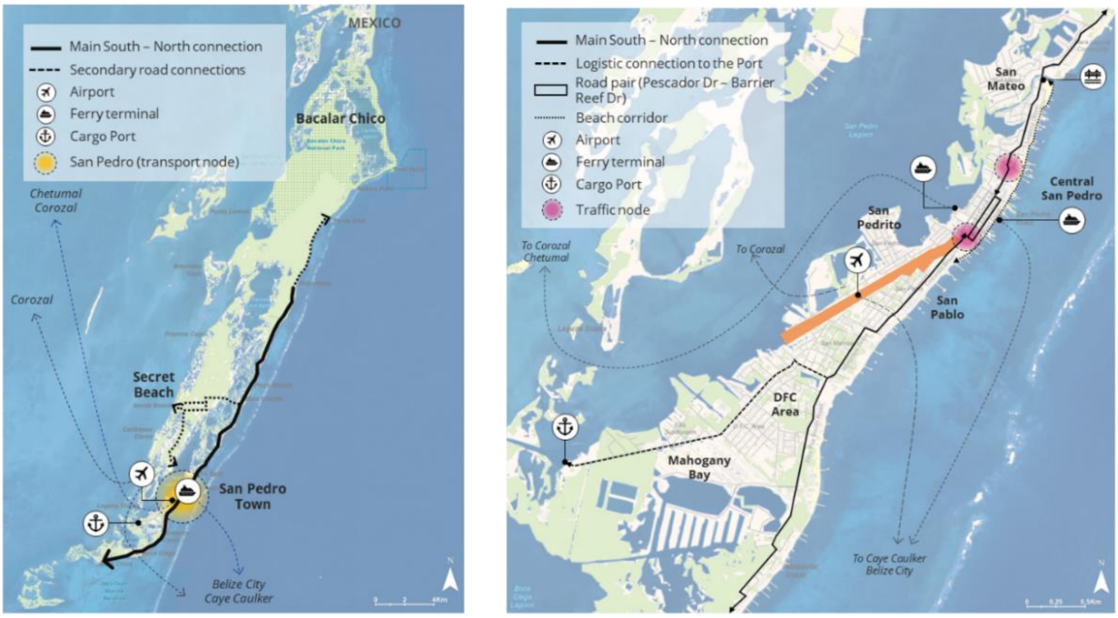
Data Source: WWF + IDOM 2023

According to the above analysis, the environmental system is a conditioning element for urban growth in Ambergris Caye, considering that 46% of the island is classified as a protected area. This is, therefore, a determining factor in guiding future urban development in order to reduce the impact of anthropogenic activity on the ecosystems.

2.1.5.2. Mobility System

Ambergris Caye's mobility system is composed of three main modes of transportation: air, boats and terrestrial. Each of those modes relates to a specific motivation: Air is mainly used to carry foreign population to the island. Boats, in addition to transport foreign population, it has a local role in transporting people to maritime attractions or maritime activities. Finally, terrestrial mode, is mainly used to move around San Pedro town or from the town to the rest of the Caye.

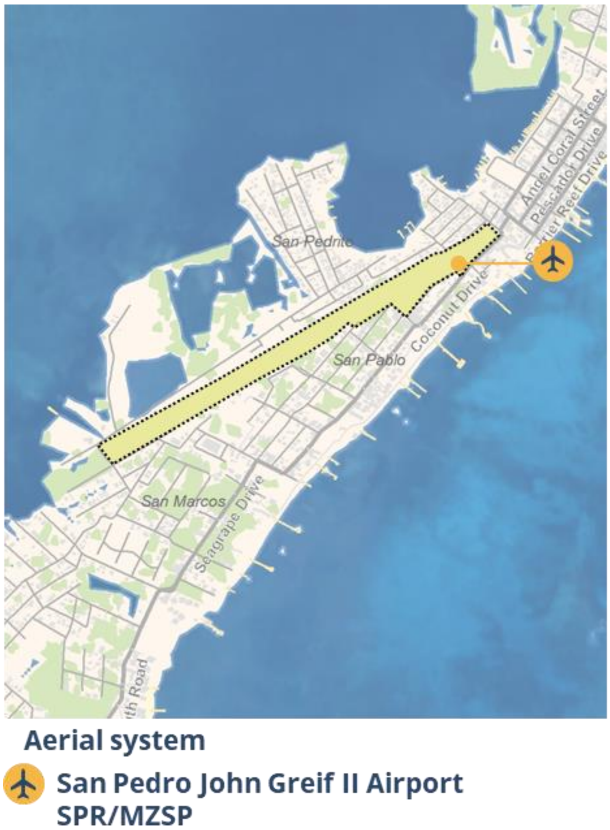
Figure 81 - Ambergris Caye Mobility System Maps



Source: IDOM, 2023

2.1.5.2.1. Air Transportation

Figure 82 - San Pedro Air transportation system



Source: IDOM, 2023

Ambergris Caye is served by John Greif II Airport, located in the central area of San Pedro town. This airport operates with domestic flights, connecting the island to Belize City.

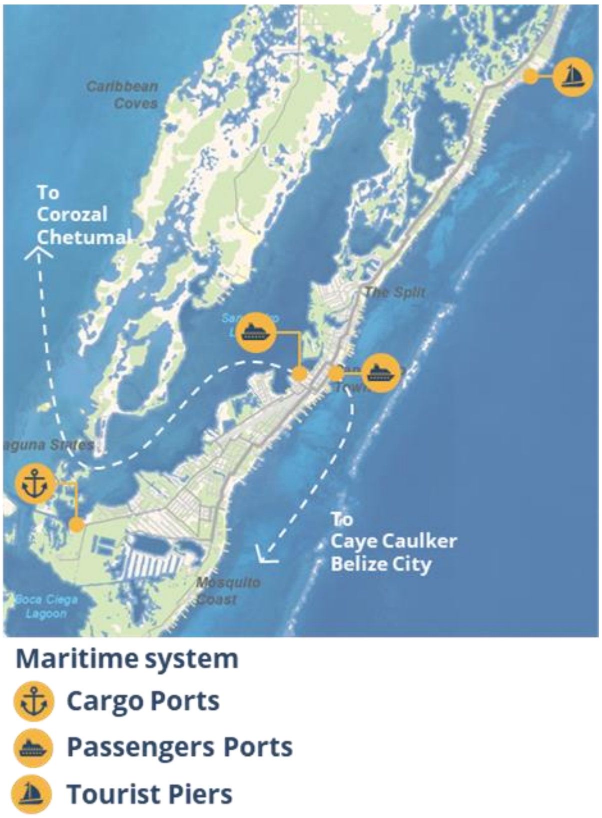
Currently, two local airlines are operating on the island: Tropic Air and Maya Island Air. These airlines have played a pivotal role in developing and expanding air travel connections to and from the island. They offer high-frequency daily flights.

The airport's strategic location within San Pedro town offers convenient access to various accommodations, restaurants, and tourist attractions.

Although the central location brings benefits, as it is within the consolidated area of San Pedro, it could limit the operation's expansion possibilities. Some of those specific analysis will be developed further on the document.

2.1.5.2.2. Maritime Transportation

Figure 83 - San Pedro Maritime transportation system



Source: IDOM, 2023

Maritime transportation plays a vital role in the connectivity and accessibility of Ambergris Caye. The presence of the cargo port, and tourism docks enables seamless movement of people and goods. The San Pedro Ferry Terminal serves as a hub for passenger ferry services, connecting the island to mainland Belize, while tourism docks provide access to the Belize Barrier Reef. Some alternatives presented.

- Passenger transportation
- Freight transportation
- Private and Tourist docks. Associated to hotels and maritime activities.

Some characteristics of each one:

- Passenger transportation: There are three main ferry terminals "San Pedro Belize Express", "Caribbean Sprinter" and "Chetumal water taxi". The three of them are Express Water Taxi services, providing regular and reliable connections between San Pedro and Belize City or Chetumal, for locals and tourists, via ferry. The first one is located on the east part of San Pedro, the second one on the west part.

- Freight transportation: The island also features cargo ports that handle the import and export of goods, ensuring the island's supply chain remains robust. The San Pedro Cargo Port serves as the primary hub for cargo shipments, accommodating vessels that transport essential supplies and commodities to support the island's economy.

- Private and Tourist docks. Associated to hotels and maritime activities. The island is equipped with tourism docks that cater to a range of vessels, including water taxis, excursion boats, and private yachts. These docks provide access to popular tourist attractions such as snorkelling and scuba diving sites, ensuring seamless connectivity for visitors seeking to explore the underwater wonders of the Belize Barrier Reef.

Due to the proximity to the Belize Barrier Reef, cruise ships are not allowed on the island.

2.1.5.2.3. Terrestrial Transportation

The Terrestrial Mobility System analyzes 3 elements:

- Vehicular mobility system
- Public transportation system and
- Active mobility (bicycle and pedestrian mobility)

- Vehicular mobility system: The mobility system of Ambergris Caye lacks information, therefore, the following analysis is based on field work.

The road network is concentrated in the center of San Pedro and acts as a backbone that connects to the south and north of the island. The north part of the island is linked with San Pedro, thanks to the "bridge of the north".

Due the lack of information, main roads are identified as those with the most traffic, the greatest number of activities or those that connect the island to the largest extent. Some of the main roads:

- Pescador Dr
- Barrier Reef Dr.
- Angel coral street
- Almond St.
- Coconut Dr
- Elsa Paz South Road
- Tarpon St.
- Caribeña St.
- Laguna Drive

Figure 84 - Main roads in Ambergris Caye

Honorauble Heredia Jr. North Road is the main land connection corridor in the northern sector.

Angel Coral Street, Pescador Drive and Barrier Reef Drive are the main roads in the center of San Pedro.

Elsa Paz South Road is the main land connection corridor in the southern sector.

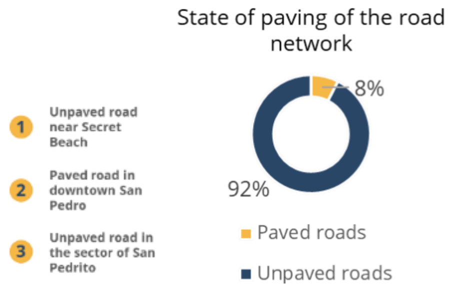
Source: IDOM, 2023

An important consideration to this system is that golf carts are the main way to move around the island, regardless of the distance.

Road conditions:

Figure 85 - San Pedro Road conditions

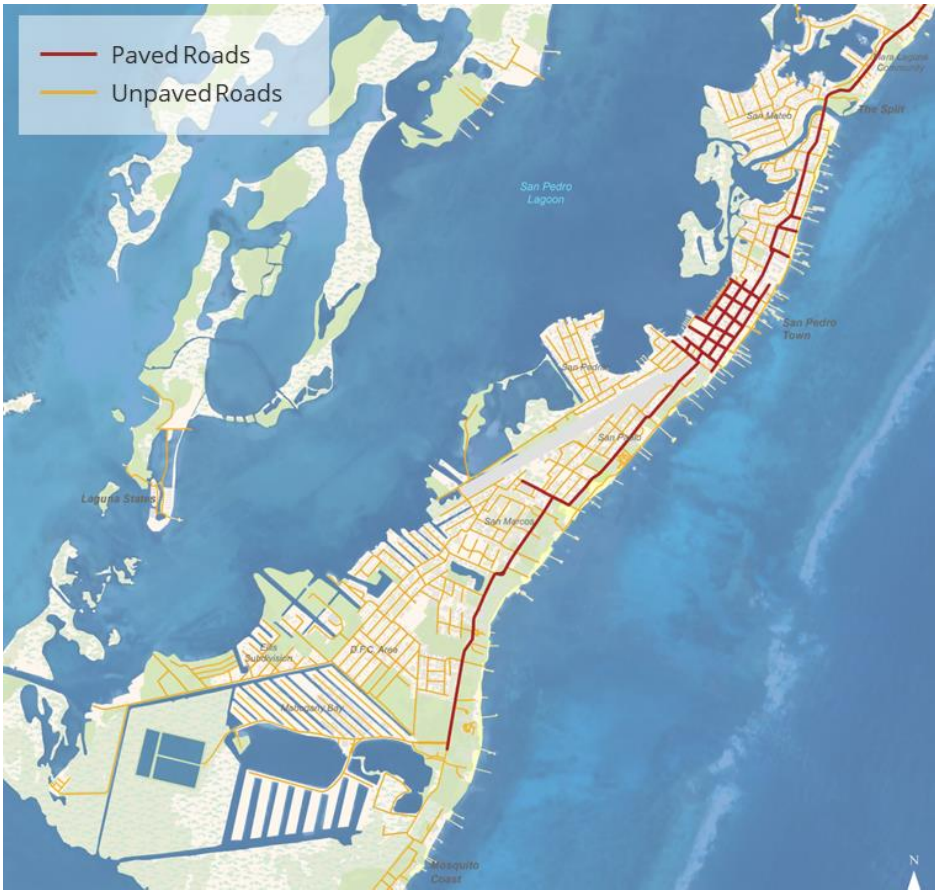
Source: IDOM, 2023



Only **8% of the road network is paved or cemented,** corresponding only to roads located in the center of San Pedro and the connecting road to the north and south of the island. Local government is currently working to improve the system and increase the percentage of paved roads.

The system **also lacks road lighting, drainage system and signs.**

Figure 86 – San Pedro Paved and Unpaved Roads Map



Source: IDOM, 2023

Parking areas:

Photo 4 - San Pedro Parking areas

Source: IDOM, 2023

The parking areas has the following characteristics:

- Parking mainly on-street.
- Few parking areas in parcels.
- Prohibition of on-street parking in specific areas. These are marked with a red line.
- Omission of parking prohibition.

- Public transportation system: Ambergris Caye does not have a massive public transportation system such as: buses, minibuses, or similar means. There is a cab system that provides service mainly to tourists.

- Active mobility (bicycle and pedestrian mobility): Most of the roads do not have adequate sidewalks and spaces for pedestrian mobility, as well as for the bicycle system.

Photo 5 - San Pedro sidewalk areas

Source: IDOM, 2023

Lack of safe sidewalks and crosswalks for pedestrians.

As is evident in the previous analysis, the mobility system in Ambergris Caye presents considerable deficiencies in terms of accessibility, multimodality of transportation modes and quality of infrastructure. This is reflected in the high dependence on the use of Golf Carts, as there are currently no other efficient ways to move around the island.

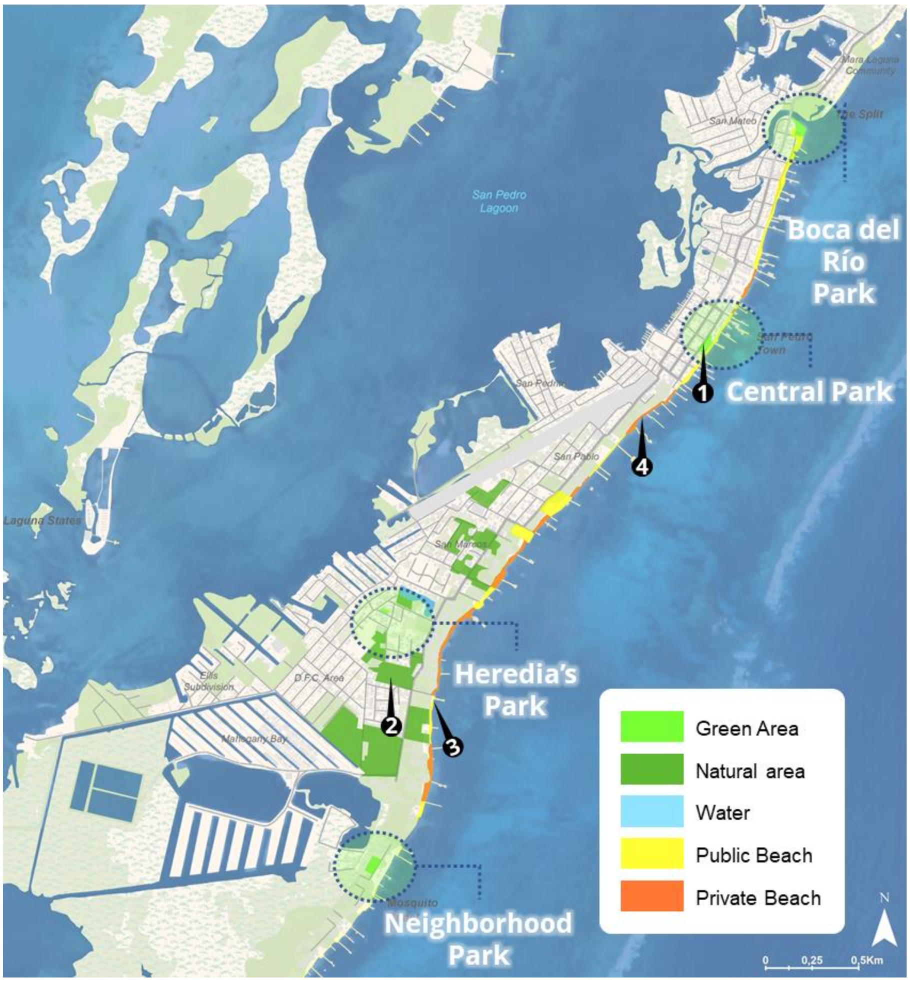
2.1.5.3. Public Space System

The Public Space is composed of spaces provided for social gatherings, recreation, sports, culture, and the recognition of citizens. These spaces include open space, such as parks, squares, squares, small squares, pedestrian streets. Those in general allow interaction, recreation, collective events, transportation, cultural activities, among other developments characteristic of human life.

As Ambergris Caye lacks regulation on this matter, this consultancy proposes identifying different types of public spaces based on their main purposes. Consolidate green areas

- Natural areas
- Public beach
- Private beach

Figure 87 - Public Space elements



Source: IDOM, 2023

2.1.5.3.1. Consolidated Green Areas

Green public spaces play a vital role on the island due to their versatile functions. They provide opportunities for citizens to engage in various activities in their daily lives, encouraging human interaction, sports, recreation, games, and contemplation of the landscape, among others. Some of the characteristics of these spaces include:

Photo 6 - Public Space elements – Green areas

Source: IDOM, 2023

- Development of activities.
- Free spaces that structure the city.
- Vegetation and green areas.
- Human interaction.

The following are the green areas on Ambergris Caye:
- Central Park,
- Boca del Rio Park
- Heredia's Park
- Some Neighborhood Parks

2.1.5.3.2. Natural Areas

Given the ecological importance of the island, natural parks are recognized as one of the spaces that can provide recreational areas for citizens.

Photo 7 - Public Space elements – Natural areas

Source: IDOM, 2023

San Pedro town has mangroves, wetlands, and nature reserves, which provide habitats for a rich variety of flora and fauna.

These elements are analysed to the entire island, further on in the chapter on delimitations and limitations to development.

2.1.5.3.3. Public Beaches

Photo 8 - Public Space elements – Public beach

Source: IDOM, 2023

To maintain the accessibility and cleanliness of public beaches, the Island could implement measures to regulate commercial activities and enforce environmental protection laws. These efforts aim to strike a balance between tourism development and the preservation of the island's natural resources.

With the increasing number of visitors, it is necessary to monitor the impact on public beaches to prevent overcrowding and degradation of these valuable spaces.

Ambergris Caye has a few public beaches, they are mainly used as meeting places, leisure, recreation, and sports. Most of them are located on the east side of the Caye at the height of the urban center of San Pedro, from the north bridge to the height of Mahogany Bay resort. While on the west side, in the center-north of the island, the beaches of secret beach are identified. The following are public spaces, providing access to the island's scenic coastline.

2.1.5.3.4. Private Beaches

Due to the island's development, most of the beaches are private, those belong to resorts and hotels. These exclusive areas provide a more secluded and luxurious experience for guests.

Photo 9 - Public Space elements – Private beach

Source: IDOM, 2023

It is important for the local government to ensure that private beachfront properties do not encroach upon or restrict access to public beaches. Collaborative efforts between private landowners and the government can help strike a balance between private interests and the public's right to enjoy the island's natural resources.

Finally, the areas occupied by each of the typologies of public space are identified, to identify the square meters of public space per inhabitant. This is a measure of the quality of life of the population.

Table 31 – Quantification of Public Spaces

PUBLIC SPACE	ACRES
Green Area	3.3
Natural Area	52.2
Total, Beach urban	22.7
Beach urban private (36,5%)	8.29
Total, Beach (total Caye)	79
Total Beach private (total Caye) (45%)	35.9

Source: IDOM, 2023

Considering a population of 18,319 inhabitants, the public space indicator for Ambergris Caye is 8.6 square feet per inhabitant (0.8 square meters). According to the World Health Organization (WHO), the optimal indicator should be between 107 sqft and 161 sqft of green areas per inhabitant.

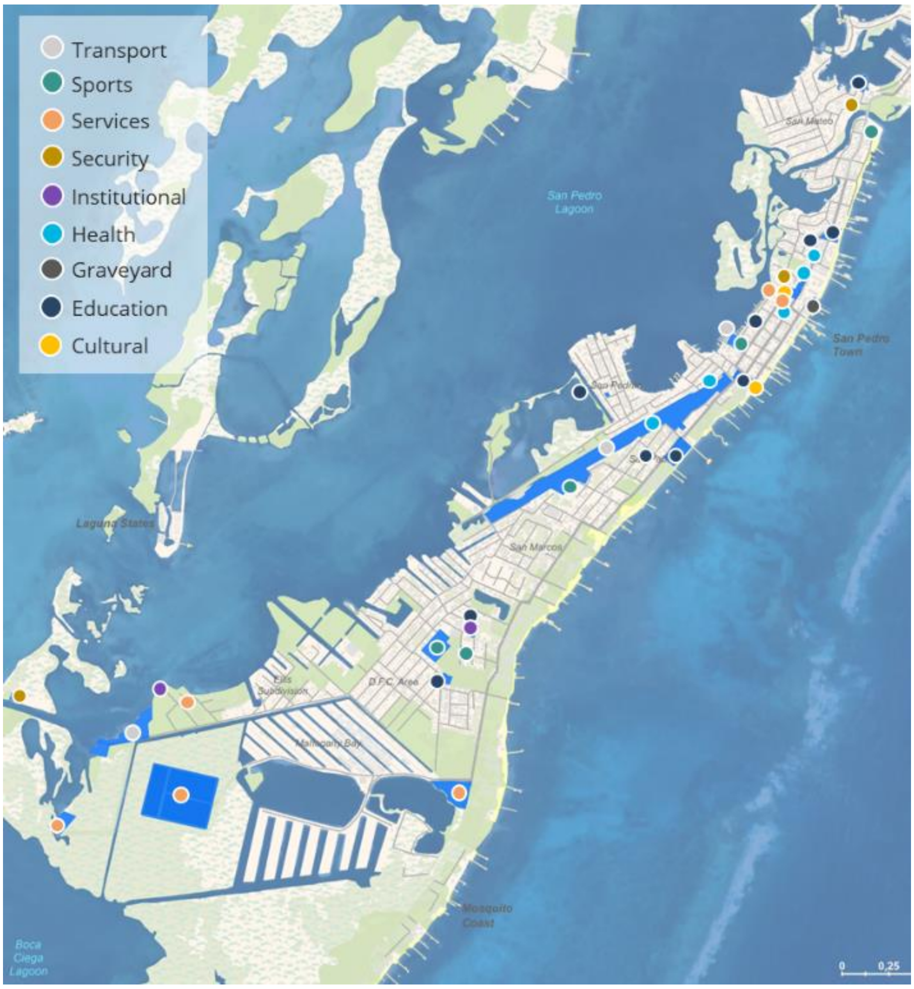
In conclusion, according to the above analysis, the public space system in Ambergris Caye is highly concentrated in the center of San Pedro, where the identified green areas do not comprise an articulated network. On the other hand, it is important to mention that the island only has 3.3 acres of qualified green areas, which is reflected in a deficit indicator of public space per inhabitant.

2.1.5.4. Urban Facilities System

The facilities system gathers the set of spaces, buildings, facilities or temporary constructions, infrastructure, destined to provide the citizens of the Caye, in a balanced way. The main propose is to guarantee the balance of facilities between central, and peripheral areas.

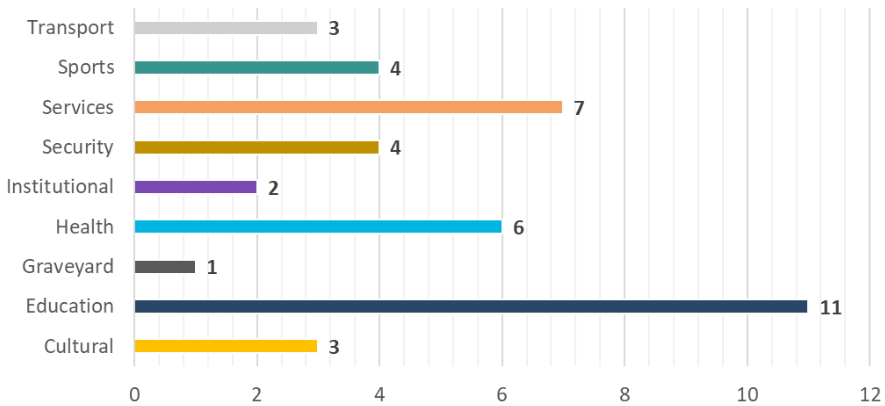
The key facilities identified are transportation, sports, security, institutional, health, education, and culture. Those are fully concentrated in San Pedro Town, while north and south part lack them.

Figure 88 - Facilities Network Map



Source: IDOM, 2023

Figure 89 - Facilities Quantification



Source: IDOM, 2023

2.1.5.4.1. Transportation Facilities

The island's transportation has several facilities. There are 4 types:

Photo 10 - San Pedro Cargo Port

Source: IDOM, 2023

- San Pedro Cargo Port
- San Pedro airport
- Express water taxi (Via Chetumal, via Belize city)

Due there is not facilities about public transport, the south-to-north flow it is rely on private vehicles, cabs, or golf cart rentals.

Table 32 – Quantification & Key Data Transportation Facilities

Type	Name	Urb_Rur	Acres
Transport	San Pedro Cargo Port	Periurban	6.5
Transport	San Pedro Airport	Urban	26.6
Transport	Chetumal Express Water Taxi	Urban	0.3

Source: IDOM, 2023

2.1.5.4.2. Sports Facilities

San Pedro Town has different sports facilities, both for public and private use. A well-maintained stadium (Ambergris Stadium) and various sports clubs, catering to both locals and tourists. The community actively participates in sporting events, demonstrating a strong appreciation for these facilities.

Those facilities are:
- Ambergris Stadium
- Battle Point
- San Pedro Tennis & Fitness Club
- Saca Chispas Footlball Field

Photo 11 - Ambergris Stadium

Source: IDOM, 2023

Likewise, there are different multi-sport courts for public use around the island. These facilities are regularly used by people for recreation and physical development.

Most of them are in the interior of the town center, segregating the southern and northern sectors, where the community would like to have this type of facilities.

Table 33 – Quantification & Key Data Sports Facilities

Type	Name	Urb_Rur	Acres
Sports	Ambergris Stadium	Urban	3.7
Sports	Battle Point	Urban	0.7
Sports	San Pedro Tennis & Fitness Club	Urban	2.7
Sports	Saca Chispas Football Field	Urban	1.5

Source: IDOM, 2023

2.1.5.4.3. Service infrastructure Facilities

Those are facilities focus on service infrastructure. Further information will be analyzed in the next chapter because those belong to the public services system.

The island has a large infrastructure of public services, such as:

- Desalination Plant
- Transfer Station
- Sewage Pond
- Gas Station
- Electrical substations
- Communication tower
- Solid waste transfer stations, among others.

This infrastructure is located mainly on the urban area, from here the whole island is supplied.

Photo 12 - San Pablo Gas Station

Source: IDOM, 2023

To guarantee a solid coverage of urban facilities, they must be strategically located so that these locations are close to the greatest number of inhabitants. The importance of being able to have the different day-to-day services close to home is becoming more and more necessary for the human being because in this way it is possible to obtain an adequate and comfortable quality of life.

Table 34 – Quantification & Key Data Services Facilities

Type	Name	Urb_Rur	Acres
Services	Desalination Plant	Urban	4.8
Services	Transfer Station	Periurban	2.3
Services	Sewage Ponds	Periurban	25.7
Services	Gas Station	Periurban	0.1
Services	Electric Substation	Urban	1.2
Services	Gas Station	Urban	0.1
Services	Communication tower	Linear developments	0.3

Source: IDOM, 2023

2.1.5.4.4. Security Facilities

Ambergris Caye has 3 security facilities, which are located mainly in the center of town. From this point the entire island is served. Those facilities are:

Photo 13 - San Pedro Police Station

Source: IDOM, 2023

- San Pedro Coast Guard Station
- Police Station and fire station
- Belize coast guard Post
- Police Post Booth.

Coast guard headquarters and fire station are in San Pedro town, as well as the main Police Station. Those services serve the whole Caye. Nevertheless, in the north and south sectors there are also smaller sub-stations or posts/booths.

Table 35 – Quantification & Key Data Security Facilities

Type	Name	Urb_Rur	Acres
Security	San Pedro Coast Guard Station	Rural	0.5
Security	Police Station and Fire Station	Urban	0.4
Security	Belize Coat Guard Post	Rural	1.0
Security	Police Post Booth	Urban	0.2

Source: IDOM, 2023

2.1.5.4.5. Health Facilities

The island lacks public health facilities. Six private health facilities were identified:

- Four of which are medical offices in the urban center.
    - Dr. Otto Rodriguez San Pedro Polyclinic
    - San Carlos Medical Center
    - Daniel Gonzales
    - Dr. Rayo Medical Office and Pharmacy
- One is an emergency clinic located in the peri-urban zone.
    - SSS Hyperbaric Chamber

Photo 14 - San Pedro Urgent Care

Source: IDOM, 2023

- There is also a hyperbaric chamber in the center of town, which is necessary to treat divers who have had an accident.
    - San Pedro Urgent Care

In general, the island has a basic network of health facilities, but there is a lack of a public hospital that can serve the population quickly and efficiently.

Table 36 – Quantification & Key Data Health Facilities

Type	Name	Urb_Rur	Acres
Health	Dr. Otto Rodriguez San Pedro Polyclinic	Urban	0.2
Health	SSS Hyperbaric Chamber	Urban	0.0
Health	San Carlos Medical Center	Urban	0.0
Health	Daniel Gonzales	Urban	0.0
Health	Dr. Rayo Medical Office and Pharmacy	Urban	0.0
Health	San Pedro Urgent Care	Linear periurban	0.2

Source: IDOM, 2023

2.1.5.4.6. Education Facilities

The network of educational facilities in Ambergris Caye consists of preschools, primary and secondary schools. Different facilities can be found around the island.

Photo 15 - San Pedro Roman Catholic Primary School

Source: IDOM, 2023

Most of the educational facilities are in the center of town. These types of facilities should be established in the southern and northern sectors to ensure an easy connection for the inhabitants living in these areas.

Although the island has a fair coverage for the size of the population at present, population growth has been accelerating and the time will come when this system will not be able to meet the needs of the population.

Table 37 – Quantification & Key Data Education Facilities

Type	Name	Urb_Rur	Acres
Education	Ambergris Caye Elementary School	Urban	0.2
Education	New Horizon Seventh Day Adventist School	Urban	0.6
Education	The Island Academy	Urban	2.8
Education	Brighter Tomorrow School	Urban	0.1
Education	San Pedro Roman Catholic Primary School	Urban	1.3
Education	San Pedro Prim	Urban	0.0
Education	San Pedro High School	Urban	1.4
Education	La Isla Bonita Elementary School	Urban	0.1
Education	Living Tree Academy	Linear periurban	1.7
Education	Holy Cross Anglican Primary School	Urban	1.4
Education	Washington University of Health and Science	Urban	0.3

Source: IDOM, 2023

2.1.5.4.7. Other Facilities

The island also has cultural facilities such as museums, sanctuaries, and some large art galleries. There is also the island's cemetery and institutional facilities such as government offices like the San Pedro Town Council, located in the center of town and administrative buildings of other approaches.

Table 38 – Quantification & Key Data Other Facilities

Type	Name	Urb_Rur	Acres
Institutional	Port Authority San Pedro Branch	Periurban	0.1
Institutional	San Pedro Town Council Barrack	Urban	0.8
Cultural	Library	Urban	0.4
Cultural	Iguana Eco Sanctuary	Urban	0.1
Cultural	Bacalar Chico NP & MR Museum	Rural	1.1
Graveyard		Urban	0.3

Source: IDOM, 2023

The following chart shows the final result the full urban facilities mentioned previously.

Table 39 - Quantification of Facilities by Categories

URBAN FACILITIES	COUNT	ACRES
Cultural	3	1.606521
Education	11	10.129834
Graveyard	1	0.348293
Health	6	0.583904
Institutional	2	0.917373
Security	4	2.160707
Services	7	34.470399
Sports	4	8.596647
Transport	3	33.46312

Source: IDOM, 2023

Considering that Ambergris Caye has a population of approximately 18,319 inhabitants, the analysis shows that 84% of the population can reach the different facilities offered by the island by walking less than ten minutes.

Regarding location, it is concluded that the center of San Pedro has the greatest supply of facilities, while the north and south require some planning and management. This should be aligned with urban growth.

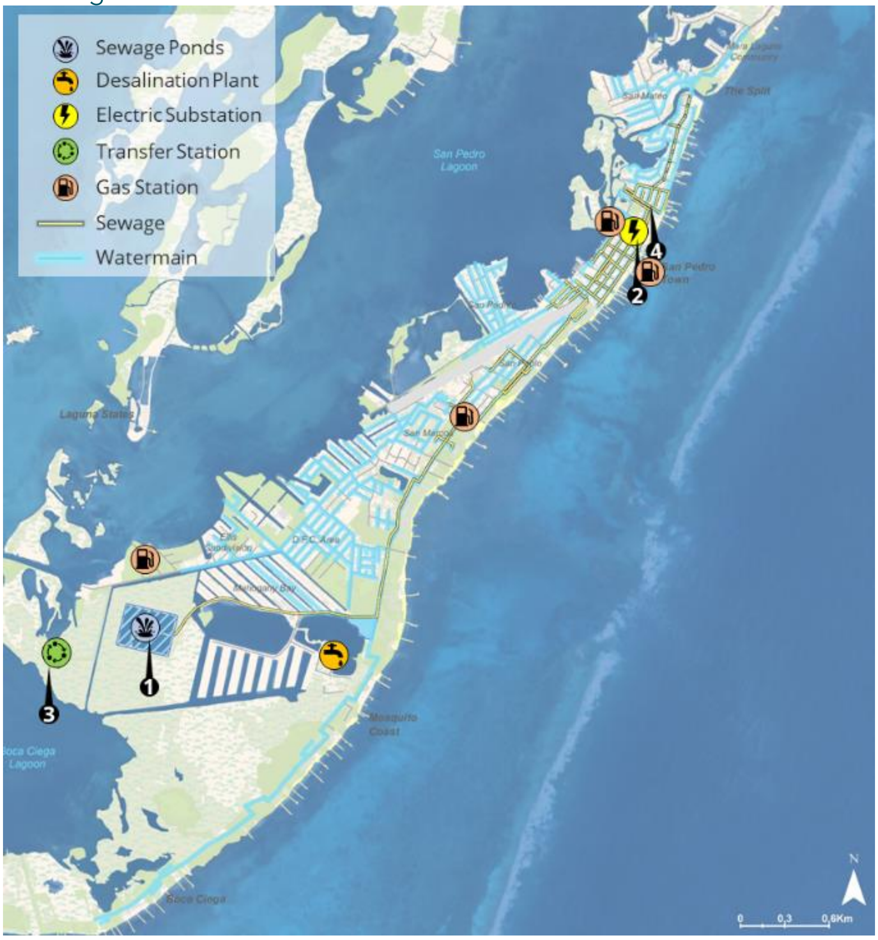
2.1.5.5. Public Services System

The public services on the island are in San Pedro Town, those serve mainly the local government boundary. The following are the infrastructure identified:

- Sewage Pond System
- Desalination Plant
- Electrical substation
- Solid waste transfer station
- Gas station
- Sewage Management and Water Distribution Network

These are shown in the following figure.

Figure 90 - Existing Public Services



Source: IDOM, 2023

2.1.5.5.1. Sewage Pond System

The sewage system is in the south of the urban area. Those ponds provide primary and secondary treatment processes to ensure standards prior to discharge. According to the Belize Water Services Ltd (BWSL), the operation of the Sewage Pond System in San Pedro is as follows:

"Two facultative lagoons operating in series followed by one maturation pond with impermeable layers at their bottoms are used to treat the collected sewage in San Pedro Town.

Photo 16 - Sewage Pond

Source: IDOM, 2023

The treated effluent from the maturation pond is discharged to the surrounding mangrove wetland, via a dispersion pipe, for polishing before final disposal into the natural lagoon environ (the Caribbean Sea). The cells are each designed to provide a hydraulic retention time of 10 days. The sewerage system currently serves approximately 3,400 consumers and treats about 160,000 gallons of sewage per day."

Source: Belize Water Services

2.1.5.5.2. Desalination Plant

Given the limited of freshwater resources, Ambergris Caye relies heavily on a desalination plant to supply potable water to its residents and businesses.

Photo 17 - Desalination plant

Source: IDOM, 2023

The desalination plant has played a crucial role in meeting the water demand of San Pedro. However, it is essential to continuously assess the plant's capacity and efficiency to ensure a sustainable and uninterrupted water supply for the growing population. Additionally, exploring alternative water sources and conservation methods can help alleviate the strain on the desalination plant.

2.1.5.5.3. Electrical Substation

There is an electrical substation which serve the enter island. It receives power from the mainland and distributes it to residential, commercial, and industrial areas through an extensive network of power lines.

Photo 18 - Electric substation

Source: IDOM, 2023

The current electrical substation has been effective in providing reliable electricity to the population of San Pedro. However, as the demand for energy increases with population growth and economic development, upgrades and expansions may be required to ensure a stable power supply and meet future energy demands. For example, the Secret Beach area is not on the power grid.

2.1.5.5.4. Solid Waste Transfer Station

The island has a solid waste transfer station located in the south of the urban. On this station is collected, sorted, and transported the waste from de island to the mainland for final disposal.

In collaboration with the Inter-American Development Bank and the Belize Solid Waste Management Authority, this project was developed in 2013. Its inauguration was in July 2015 and has undoubtedly been a great contribution to the island to keep it clean and generate an appropriate waste management considering the population increase.

Photo 19 - Transfer station

Source: IDOM, 2023

The solid waste transfer station has been instrumental in maintaining cleanliness and minimizing environmental pollution on the island. However, as the population and tourism industry continue to grow, it is crucial to assess the station's capacity and explore waste reduction and recycling initiatives to manage the increasing waste volume effectively.

2.1.5.5.5. Gas Stations

Ambergris Caye relies on gasoline stations to provide fuel for transportation and various industries on the island. These stations play a critical role in meeting the energy needs of the community, including transportation and power generation.

Photo 20 - Gas station

Source: IDOM, 2023

There are four gas stations around the island.

- The first one is at the southern end of the Caye, it is mainly for ships arriving at the San Pedro Cargo Port.
- Second one and third one, both are in the center of San Pedro: Those serve mainly local activities like cars, and golf carts.
- The last one is located on the dock next to Central Park and is for the exclusive use of boats.

The north side of the island has no infrastructure related to gasoline service stations for vehicles.

The quantity of gas stations on Ambergris Caye is currently acceptable. However, careful monitoring and regulation are necessary to ensure the safe storage and handling of fuel, as well as the prevention of environmental contamination.

2.1.5.5.6. Sewage Management and Water Distribution Network

The sewage management system collects and treats wastewater, while the water distribution network ensures the supply of potable water to homes, businesses, and public facilities.

Photo 21 - Sewage management and water distribution

Source: IDOM, 2023

San Pedro Town has a sewage management and water distribution network; however, it is not sufficient since there are several homes in the area that do not have this coverage. Regular maintenance, capacity evaluation, and infrastructure upgrades are crucial to accommodate population growth, prevent system failures, and ensure the health and well-being of the community.

In conclusion, the analysis of the territorial systems provides an overview of the existing conditions of infrastructure and functionality on the island. In this sense, it is evident that urban development in Ambergris Caye has been disjointed, generating a fragmented and inequitable territory in terms of accessibility and coverage of public spaces, urban facilities and public services. Some of the relevant per territoral system

Territory System	Conclusion
Environmental System and Protected Areas	• 46% the ambergris caye area is classified as a protected area • 64% of the Caye surface area is made up of mangroves and lagoons • 51% of the mangroves and coastal lagoons are outside the natural reserves. • 7% of mangrove were remove between 1980 and 2023. • Degradation affects 3% of Ambergris Caye Coral
Mobility System	• The mobility system presents deficiencies in terms of accessibility, multimodality of transportation modes and quality of infrastructure. • Only 8% of the road network is paved or cemented • The system also lacks road lighting, drainage system and signs • Regulation on parking areas is nedeed • There is not a massive public transportation system • Most of the roads do not have adequate areas for the bicycle system • Lack of safe sidewalks and crosswalks for pedestrians
Public Space System	• The public space system in Ambergris Caye is highly concentrated in the center of San Pedro • The Caye has 3.3 acres of qualified green areas. • The public space indicator is 8.6 square feet per inhabitant (0.8 square meters). According to the (WHO), the optimal indicator should be between 107 sqft and 161 sqft of green areas per Inh.
Urban Facilities System	• Most of the facilities are concentrated en san pedro town. North and south area require some planning and management. • 84% of the population can reach the different facilities offered by the island by walking less than ten minutes
Public Services System	• Public services system are Sewage Pond System; Desalination Plant; Electrical substation; Solid waste transfer station; Gas station; Sewage Management and Water Distribution Network • Capacity evaluation (with the inputs received), and infrastructure upgrades are crucial to accommodate population growth.

2.1.6. Governance and planning framework analysis

2.1.6.1. Governance Analysis

In terms of territorial planning, Governance is understood as the processes and practices through which decisions related to a territory are made, with the purpose of directing it along the path of equitable, sustainable, and responsible development, through the relationship suitable between the social and economic dynamics, as well as the guidelines and public regulations of urban and environmental order.

According to Belize's territorial organization, there are two levels of governance: the National Level, which is comprised of the Ministries, Departments and Organizations with jurisdiction throughout the entire country, and the Local Level, which includes the City Councils (Belize City and Belmopan), the Town Councils of urban centers with Township status and the Village Councils.

- **National Level of Governance**

The territorial planning and the management of natural resources on Ambergris Caye strongly depend on decisions made at the National Level. The main entities with competence in the Island’s planning processes are the following:

Ministry of Infrastructure, Development & Housing

Its main objective is the development and maintenance of the country's transportation infrastructure, as well as the management of national assets. It also has within its functions the establishment of an affordable and quality housing policy, which allows improving the living conditions of the population. The Central Building Authority (CBA) is registered within this Ministry and has as functions to regulating construction standards, issuing permits for new works and establishing controls on building activity in the country.

Ministry of Sustainable Development, Climate Change and Disaster Risk Management

Within this Ministry there are different entities in charge of environmental protection, the management of natural parks and the implementation of sustainability policies. It also includes the National Meteorological Service and the National Emergency Management Organization (NEMO), whose function is to establish disaster preparedness and response actions in order to reduce the risk and impact on the population in disaster events such as hurricanes and floods.

Ministry of Natural Resources, Petroleum & Mining

This Ministry is responsible for the proper management of water resources, the efficient use of land, responsible mining and oil exploitation, and the proper management of solid waste in Belize. As part of the Ministry is the Mining Unit, in charge of issuing permits for marine dredging works, as well as the Lands and Surveys Department, responsible for land subdivision and titling processes.

Ministry of Education, Culture, Science and Technology

Its objective is to guarantee equitable access to quality education for all Belizeans, in order to improve the possibility of achieving better opportunities to increase their quality of life. The National Institute of Culture and History (NICH) is registered as part of this Ministry and its main objective is to increase visibility and awareness for Belize’s heritage, as well as highlight initiatives which contribute to its safeguarding. For this purpose, the NICH works in partnership with local communities, living heritage practitioners, cultural organizations, and other stakeholders.

Ministry of Blue Economy & Civil Aviation

Its main objective is to ensure a sustainable use of ocean resources, which will generate economic growth without affecting marine ecosystems. The Ministry of the Blue Economy includes the Coastal Zone Management Authority and Institute (CZMAI), which is responsible for the management of coastal ecosystems and planned coastal development, as well as the Fisheries Department, which is in charge of the sustainable use of fishery resources and the management of Marine Reserves, among other functions.

The Department of Civil Aviation and Belize Airports Authority are also part of this Ministry. They are responsible for the management and operation of airports and aerodromes in the country, as well as ensuring the application of international aeronautical standards and regulations.

Agriculture, Food Security & Enterprise

This Ministry, through the Department of Agriculture, aims to provide a suitable environment to increase production and productivity in the agribusiness sector, promoting investment and increasing competitiveness, based on the principle of sustainability.

- ## Local Level of Governance

Land planning and urban control at the local level is the responsibility of the San Pedro Town Council, through the Building Unit. This division is in charge of issuing construction permits for new buildings, swimming pools, enclosures and authorizations for demolitions. Although the Building Unit acts autonomously within the Island, the Central Building Authority is in charge of issuing construction permits for buildings of more than four (4) stories or for those located on the coastline or in front of bodies of water.

Figure 91 – Governance structure by levels

	MINISTRIES	DEPARTMENTS AND ORGANIZATIONS
NATIONAL LEVEL	Infrastructure, Development & Housing	Central Building Authority (CBA)
	Sustainable Development, Climate Change & Disaster Risk Management	Department of the Environment
		Forestry Department
		National Emergency Management Organization (NEMO)
		National Meteorological Service
	Natural Resources, Petroleum & Mining	Lands and Surveys Department
		Department of Land Registry
		Mining Unit
	Education, Culture, Science and Technology	National Institute of Culture and History (NICH)
	Blue Economy & Civil Aviation	Fisheries Department
		Coastal Zone Management Authority and Institute (CZMAI)
		Department of Civil Aviation
		Belize Airports Authority
	Agriculture, Food Security & Enterprise	Department of Agriculture
LOCAL LEVEL	SAN PEDRO TOWN COUNCIL	Building Unit Department

Source: IDOM, 2023

In summary, the Governance system in Belize is highly centralized at the National Level, limiting the management capacity and decision-making power of local authorities for the ordering and control of Ambergris Caye. The lack of an Intermediate Level between the National Government and San Pedro Town Council makes it difficult to establish a comprehensive and articulated planning for the entire territory of the Island.

2.1.6.2. Planning regulatory framework

Within the exercise of urban planning, one of the most important factors that contribute to the construction of an integrated diagnosis is the evaluation of the national and local regulatory framework. In Belize there are various regulations that address issues related to urban development, land management, natural resource management and heritage protection.

The regulations listed below are several of the key acts and laws in force that directly impact territorial planning process on Ambergris Caye. Some of these are detailed below in greater depth:

Table 40 – National regulatory framework

NATIONAL LAWS AND REGULATIONS IN FORCE	
Town planning and building regulations	Chapter 182 - Housing and Town Planning Act
	Chapter 131 - Belize Building Act
	Chapter 133 - Dangerous Buildings (Demolition) Act
Land management	Chapter 181 – Belize Land Development Authority Act
	Chapter 183 - Land Acquisition (Promoters)
	Chapter 184 - Land Acquisition (Public Purposes)
	Chapter 185 - Land Adjudication Act
	Chapter 188 - Land Utilization Act
	Chapter 191 – National Lands Act
Local government	Chapter 87 – Town Councils Act
Environment and natural resources	Chapter 213 - Forests Act
	Chapter 215 - National Protected Areas System Act
	Chapter 217 - Private Forests Conservation Act
	Chapter 222.01 - National Integrated Water Resources Act
	Chapter 224 - Solid Waste Management Authority Act
	Chapter 221 – Electricity Act
	Chapter 328 - Environmental Protection Act
	Chapter 329 - Coastal Zone Management Act
Cultural heritage	Chapter 331.01 – National Cultural Heritage Preservation Act
Civil Aviation	Chapter 239 – Civil Aviation Act

Source: The Attorney General's Ministry of Belize, 2023

Town planning and building regulations.

In terms of land development, there are two key regulations: The Housing and Town Planning Act (Chapter 182) and the Belize Building Act (Chapter 131). The first establishes the Central Housing and Planning Authority (CHPA), which has the authority to acquire land or buildings for the development of approved urban housing schemes or slum clearance actions. The Belize Building Act, on the other hand, determines the creation of the Central Building Authority (CBA) and establishes the functions of the Building Units at the City and Town Council level. This Act also dictates the general regulations regarding building permits and urban control.

Land management

Through Chapter 181 is created the Belize Land Development Authority, with powers to acquire, divide and develop land. Likewise, there are laws that regulate land acquisition processes by private developers and public actors (Chapters 183 and 184). Finally, Chapter 191 establishes all the regulations related to the development and management of National Lands, which include land for mineral and agricultural exploitation and beaches, among others.

Local government

The Chapter 87 determines the competencies and powers of the Town Councils, which act as the highest authorities at the local level. Their functions include urban control according to the zoning plans in place, as well as the approval of construction permits, within the framework of the competencies determined by the Central Building Authority. The Town Councils also handles drainage and sewage and general sanitation of the city, and they have functions for the operation of local urban infrastructure, the management of public spaces and the development of new urban facilities.

Environment and natural resources

There are different laws that determine regulations for the protection of the environment and the management of natural resources. One of the most important is Chapter 215, which dictates national policies and plans for Protected Areas, with the purpose of preserving their biodiversity and ecological integrity. This law is complemented by Chapter 328, which establishes a Department of the Environment, with for the prevention and control of pollution, conservation, and management of natural resources, and to define when and how environmental impact assessments are to be done.

For the management of water resources, Chapter 222.01 establishes the National Integrated Water Resource Authority, with powers for the use, control and protection of surface water and groundwater, with the competence to establish sanctions in cases of contamination and misuse of water resources. On the other hand, Chapter 224 creates the Solid Waste Management Authority with functions to efficiently manage and establish controls for the collection and disposal of solid waste.

Cultural heritage

Chapter 331.01 creates the National Heritage Advisory Council and the National Heritage Fund, which are responsible for the preparation, review, and implementation of the National Heritage Protection Plan, which will serve as a tool to identify heritage properties at risk and establish actions to protect and conserve their historic values.

Civil Aviation

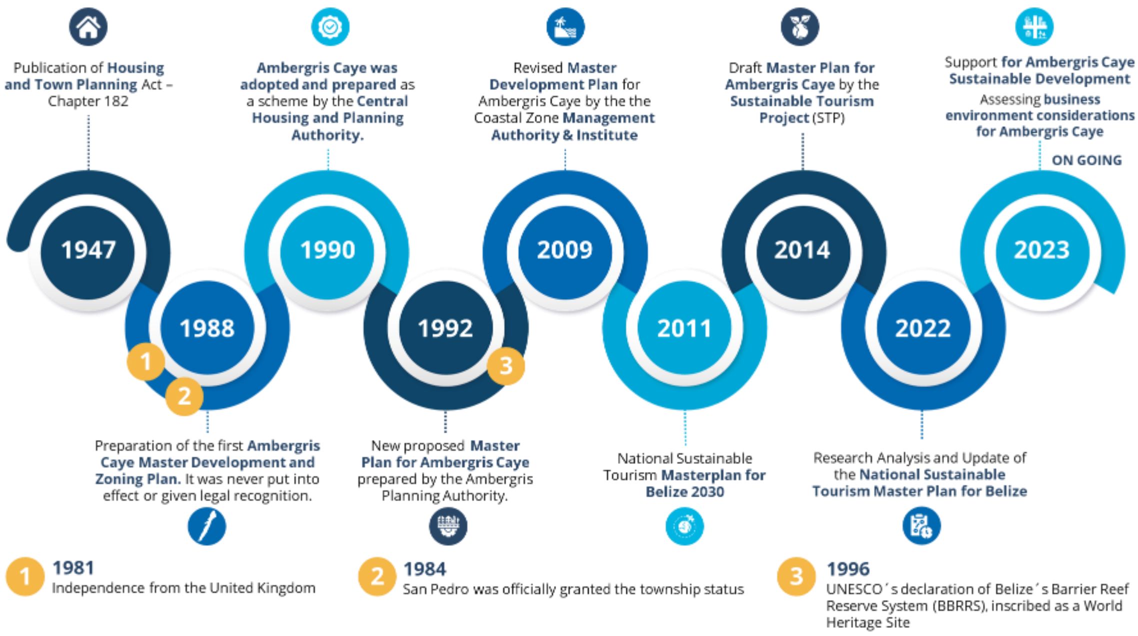
Regulations regarding aeronautical operations in Belize are established in Chapter 239 - Civil Aviation Act. This law determines the provisions for the development and management of airports and aerodromes, as well as the restrictions to be considered for the development of any building or structure in the vicinity of airports that may represent an obstacle or risk to air operations.

In conclusion, although current legislation in Belize establishes specific regulations for different fields with an impact on territorial development, there is a need to define a regulatory framework that generates a more comprehensive vision for planning.Likewise, the specific dispositions in terms of urban regulations and planning instruments are not developed in detail in the current legislation, which makes their interpretation more discressional. Finally, it is important to mention that some of the authorities created in the different Chapters have not been officially created to the present date, generating an institutional gap for the application of the national rules.

2.1.6.3. Past and current planning processes in Ambergris Caye

The approval and implementation of a master plan has been a long-standing ambition in Ambergris Caye. Since the granting of the township status to San Pedro in 1984, five master plans have been prepared, none of which have been officially adopted to date. As a result, urban development on the island has been expansive and without adequate planning, resulting in damages to areas of high ecological value.

Figure 92 – Timeline of planning processes on Ambergris Caye



Source: IDOM, 2023

The following are the planning processes that have been prepared for Ambergris Caye throughout its history:

1988 – Ambergris Caye Master Development and Zoning Plan

Four years after San Pedro's recognition as a Township, the first formulation of a master plan for Ambergris Caye was completed. This was prepared with the support of the United Nations Development Program (UNDP) and remained a draft proposal as it was not legalized and implemented by the authorities.

1990 – Ambergris Caye scheme

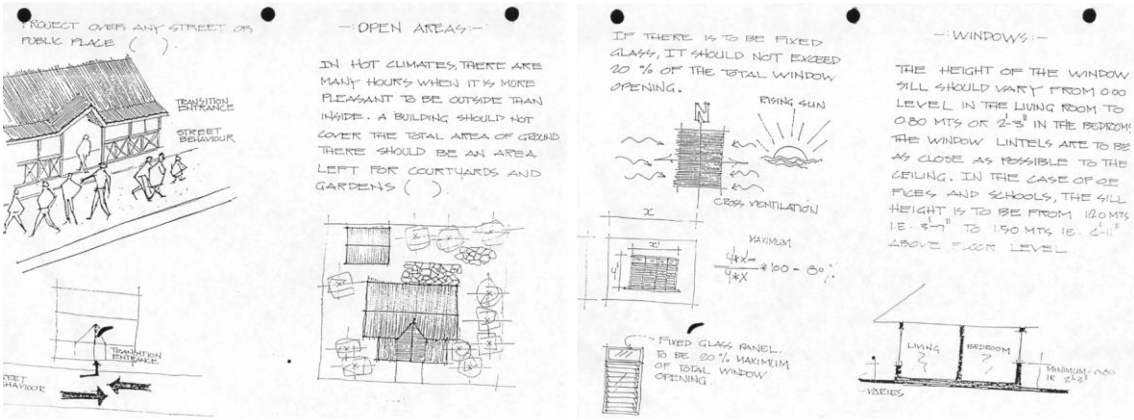
Following the failed 1988 Master Plan attempt, the Central Housing and Planning Authority (CHPA) prepared and adopted a development scheme for Ambergris Caye in March 1990, in exercise of its powers under the Housing and Town Planning Act (Chapter 182). Since the approval date this scheme has not been modified or updated.

1992 – Master Plan proposed by the Ambergris Caye Planning Authority

A new master plan for the Island was prepared in 1992 by the Ambergris Planning Authority. The development concept of this instrument proposed the division of the north of the Island (established from Boca del Rio), in two areas: the East Coast Zone and the Hinterland. It also established restrictions for development in the northeast area, due to the presence of ecologically sensitive zones. Finally, the plan defined a strategy for the expansion of downtown San Pedro and established specific urban standards (permitted uses, heights, occupancy rates, number of parking lots, etc.) for new buildings on the island.

Despite the level of development of this master plan, this proposal was not officially implemented by the authorities.

Figure 93 – Bioclimatic design considerations proposed in the 1992 Master Plan



Source: Ambergris Planning Authority, 1992

2009 – Revised Master Development Plan for Ambergris Caye

17 Years after the plan formulated by the Ambergris Planning Authority, the Coastal Zone Management Authority and Institute (CZMAI) prepared, with the support of the Hol Chan Marine Reserve, a Master Plan with a special focus on the protection of coastal ecosystems, considering the declaration of the Belize Barrier Reef as a World Heritage Site by UNESCO.

This plan established development goals and recommendations for the protection of natural resources, the zoning of the island, the future urban development of San Pedro, as well as issues related to carrying capacity, with an action plan focused on reducing land speculation, control of subdivision procedures and land tax management. The master plan was submitted to the Town Council but was not ratified by the national authorities.

2011 – National Sustainable Tourism Masterplan for Belize 2030

Although it is an instrument developed at the national level, this master plan prepared by the Ministry of Tourism and the Belize Tourism Board proposes a 2030 vision for Ambergris Caye under the premise of consolidating and containing development. This plan identifies the problems with respect to the carrying capacity of the Island and suggests a growth model with moderate densities, proposing an improvement in connectivity and the delimitation of conservation and Special Purpose Areas with restrictions for development.

2013 – Land Use Development Plan for Ambergris Caye

The Ambergris Caye Local Planning Working Group, with the support of the San Pedro Town Council, the Sustainable Tourism Program and IDB funding, formulated a Land Use Plan for the island in 2013, addressing the challenges and prospects for tourism, as well as the threats posed by urban dynamics to the Island's ecosystems and natural resources.

The Plan's basic principles were: (1) to allow a balanced tourism development in accordance with Ambergris Caye's capacities; (2) to preserve the scale and compatibility of new projects with the Island's urban and natural image; (3) to protect natural areas and fragile ecosystems; (4) to improve connectivity and mobility on the Caye; and (5) to seek social equity and facilitate access to affordable housing.

Despite institutional coordination efforts, as in previous cases, this Land Use Plan was not finally adopted and implemented by the Authorities.

Figure 94 – Land Use Development Plan for Ambergris Caye

Source: The San Pedro Sun, 2014

2022 – To present

With the formation of the Northern Ambergris Caye Development Committee in 2022, efforts to implement a framework for the sustainable development of the Island were reactivated. In addition to the consultancy that is the subject of this report, the following studies have been developed to date:

- **Research Analysis and Update of the National Sustainable Tourism Master Plan for Belize** (2022 - 2023), prepared by the University of Melbourne for the BTB, in order to adjust the tourism development strategy at the national level.

- **Assessing business environment considerations for the development of the Ambergris Caye in Belize** (2023 - ongoing), under development by ICR Facility for the Ministry of Finance (MoF) of Belize, to identify needs and opportunities for private sector growth on the Island.

In conclusion, there is an urgent need to establish a regulatory framework that provides clear guidelines to orient the urban development in Ambergris Caye, considering the unique characteristics of this territory and the carrying capacity that the Island could assume in the future. Likewise, institutional decentralization and the strengthening of local entities should

be sought in order to generate greater control and management of the island's planning decisions.

2.1.7. Real Estate Market Analysis

This chapter analyses the real estate dynamics of buying and selling of building activity and land availability. This analysis is carried out throughout the island and considers the different real estate agencies. The supply will be analysed considering the following criteria:

- Vacant land
- Condominiums
- Residential areas

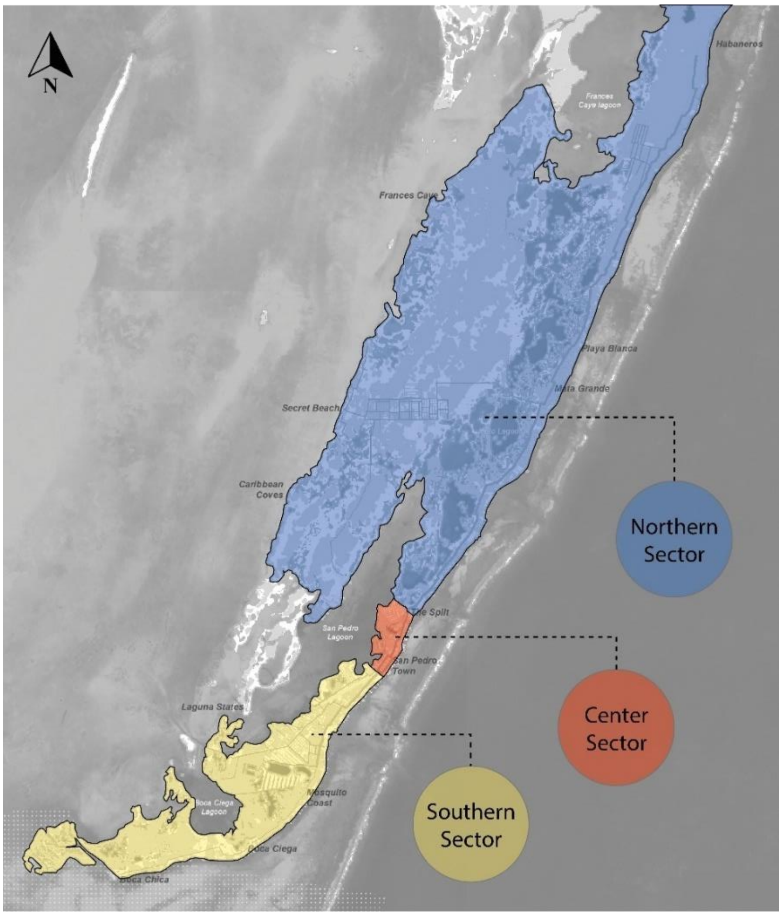
The analysis is based on secondary information obtained from the main real estate agencies. This information will be used to determine land and housing demand trends in the different areas of the island and will later be used for the construction of the scenarios defined in the contract.

2.1.7.1. Land Value Analysis

This analysis will show real estate dynamics and opportunities, including beachfront estates, luxury condominiums, vacation rentals, and undeveloped land awaiting transformation.

Therefore, the land value analysis identifies three main sectors: north, center and south.

Figure 95 - Delimitation of Sectors Map

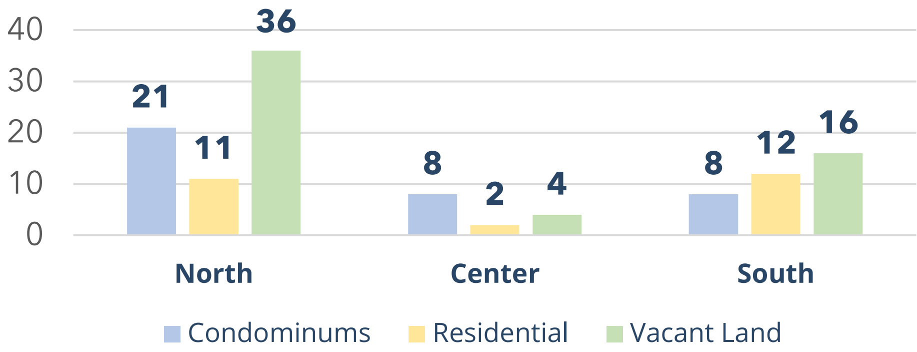


Source: IDOM, 2023

As result of the sectors by vacant land, condominiums, and residences.

Figure 93 shows the property types in the three areas. In total, there were 37 apartments, 25 residences, and 56 vacant lands identified.

Figure 96 - Quantities of Properties Offered by Sector



Source: IDOM, 2023

Some analyses were made to differentiate the land value of each of the properties for sale. Depending on characteristics such as location, view, equipment, services, construction quality, among other elements, increase or decrease the value that one of them may have. Categories analysed were vacant lands, condominiums, and residences. The following graph shows the results.

Figure 97 - Location Types

Source: IDOM, 2023

2.1.7.2. Current Real Estate Offer

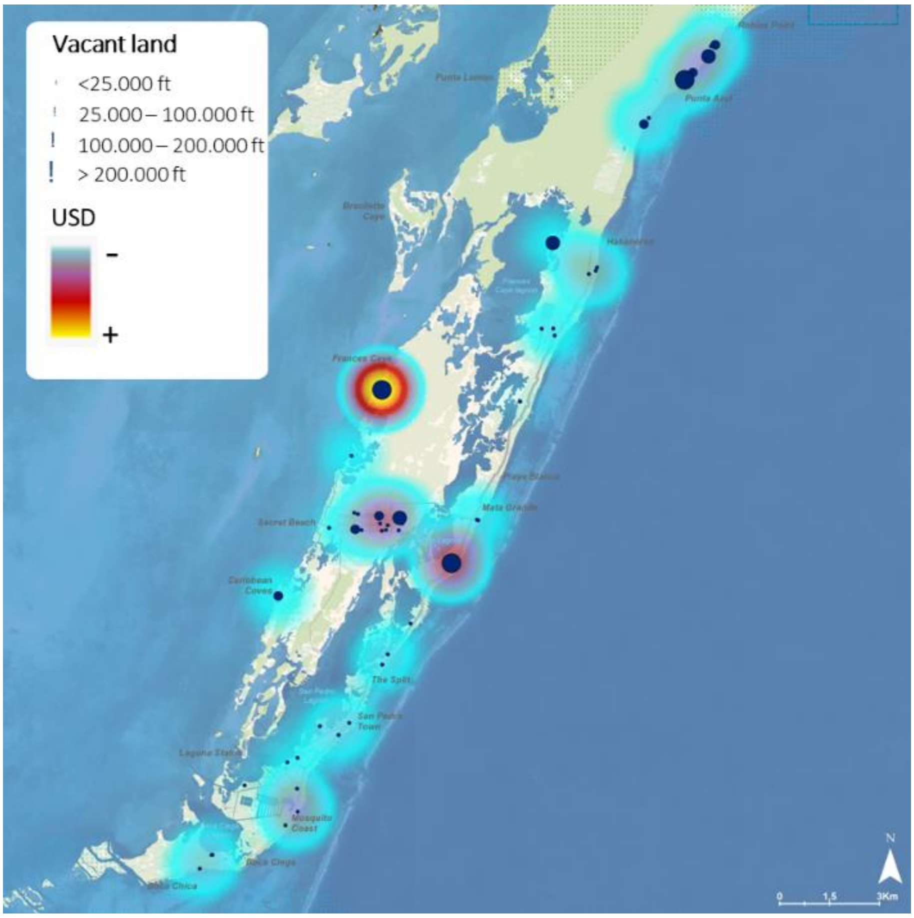
According to some real estate companies on San Pedro, Belize's prime location, skilled bilingual workforce, and attractive tax incentives make it a top choice for foreign direct investment. The country's supportive political environment benefits businesses of all sizes, from startups to multinational corporations, and this support is set to grow through Belize's National Investment Policy and Strategy.

When analysing the offerings of the largest real estate companies on the island, it became evident that the properties that produce the most sales and purchases are condominiums, residences, and vacant lands. The data collected for each of these categories will be detailed below to build a base of prices, sizes, and averages.

2.1.7.2.1. Vacant land

According to the development characteristics, vacant land for sale was identified in the center and north center of the island with some spots in the very south and north of the Caye.

Figure 98 - Vacant Land Map Analysis



Source: IDOM, 2023

Regarding to the cost:

- West part of the island has the highest value, as well as the central part. This is linked with the more attractive areas to be develop on the island.
- This vacant land has a characteristic of empty parcel which has some vehicular access and clear plots to develop any construction.

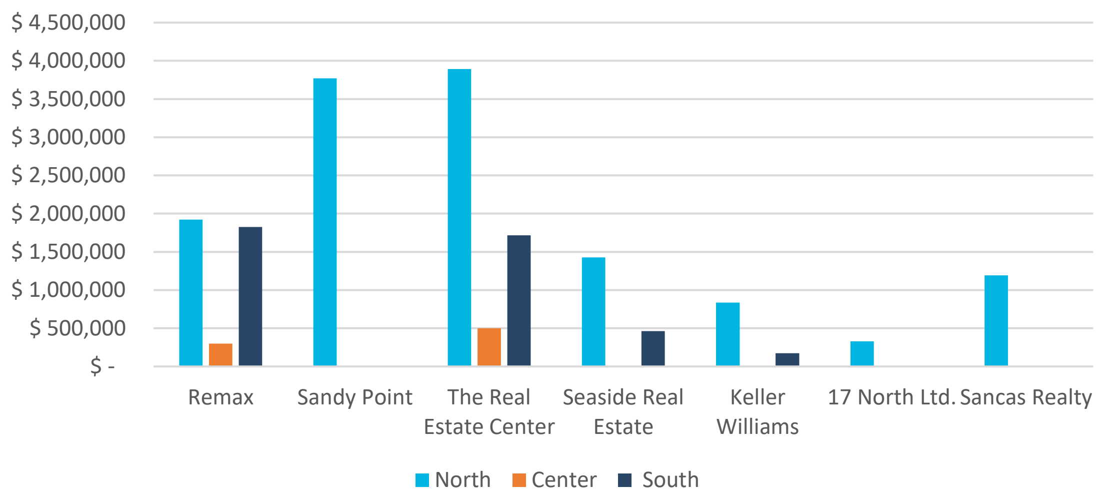
- The cost of the land depends on different factors, like size, location and amenities, an estimate of price per square feet was obtained for each of the sectors.

Table 41 - Prices Vacant Land per Sectors

	PRICE		
REAL ESTATE COMPANY	North	Center	South
Remax	$ 1.920.549	$ 300.000	$ 1.825.500
Sandy Point	$ 3.768.999		
The Real Estate Center	$ 3.891.500	$ 499.500	$ 1.714.900
Seaside Real Estate	$ 1.426.000		$ 464.000
Keller Williams	$ 835.000		$ 175.000
17 North LTD.	$ 328.000		
Sancas Realty	$ 1.194.000		
TOTAL	$ 13.364.048	$ 799.500	$ 4.179.400
	$ 18.342.948		

Source: IDOM, 2023

Figure 99 - Prices Vacant Land per Sectors



Source: IDOM, 2023

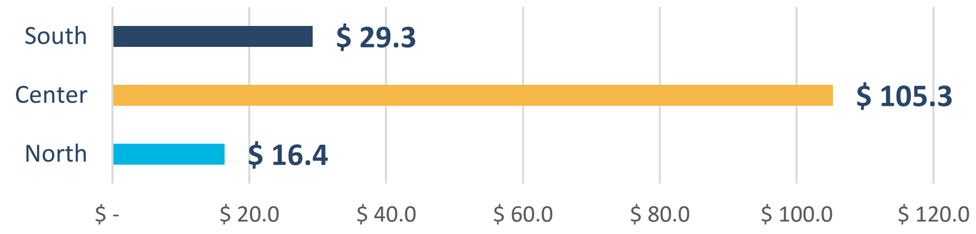
Prices on vacant land per square was also analyse:

Table 42 - Prices Vacant Land per Square Feet for the Sectors

	PRICE/sqft. AVERAGE		
REAL ESTATE COMPANY	North	Center	South
Remax	$ 16,0	$ 172,4	$ 48,4
Sandy Point	$ 3,2		
The Real Estate Center	$ 22,6	$ 38,1	$ 38,0
Seaside Real Estate	$ 6,3		$ 12,8
Keller Williams	$ 15,2		$ 17,9
17 North LTD.	$ 19,2		
Sancas Realty	$ 32,0		
AVERAGE	$ 16,4	$ 105,3	$ 29,3
	$ 50,3		

Source: IDOM, 2023

Figure 100 - Prices Vacant Land per-Square Feet for the Sectors



Source: IDOM, 2023

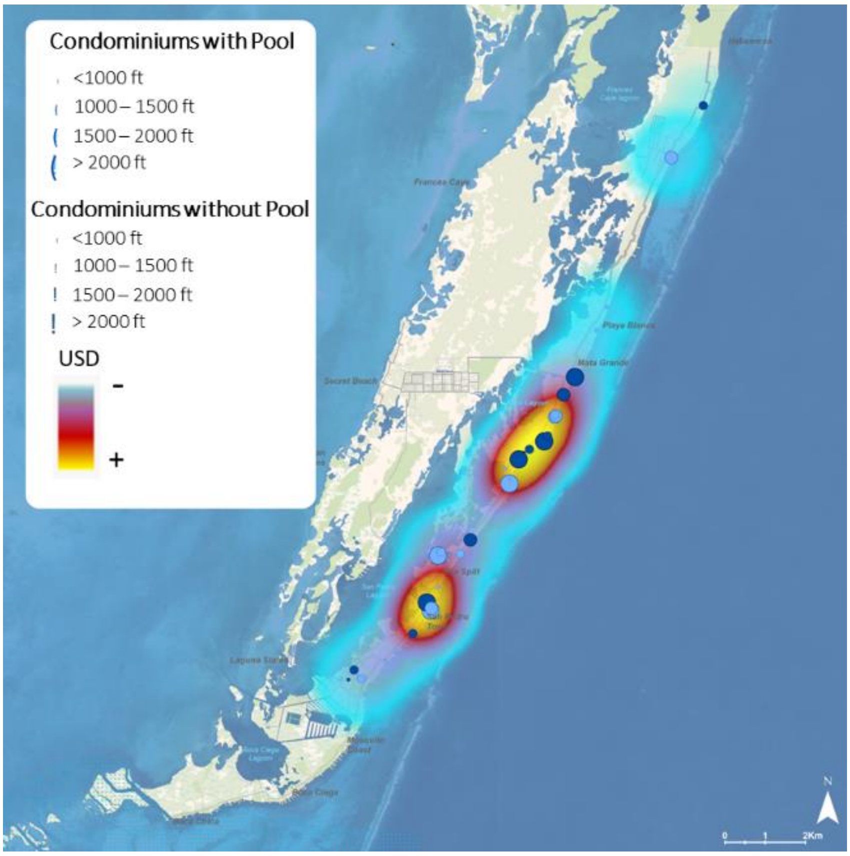
The highest prices per square meter are found in the central sector, related to having a convenient location, thanks to being a consolidated area, which is integrated with urban systems, providing access to a better quality of life indicator.

The second-best prices are found in the southern part of the island, which was the first part of urban growth of the island and therefore, has a second level of consolidation and services. Finally, the northern part has the lowest price, as it is the area that is currently undergoing urban growth.

2.1.7.2.2. Condominiums

Condominiums were identified in two main hubs. First one on the center of the island and the second one on the coast east at the north part. Those will be analyzed with further detail.

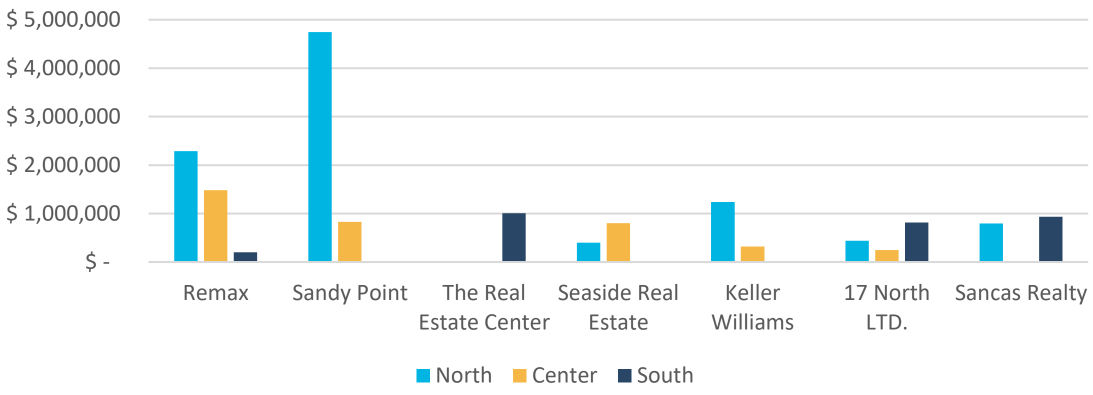
Figure 101 - Condominiums Map Analysis



Source: IDOM,2023

According to the different real estate companies, the northeast zone is defined as the one with the highest prices, followed by the center and finally the south.

Figure 102 - Prices on Condominiums by Sectors



Source: IDOM,2023

Table 43 - Prices on Condominiums by Sectors

	PRICE		
REAL ESTATE COMPANY	North	Center	South
Remax	$2.289.900	$1.484.000	$199.000
Sandy Point	$4.744.499	$830.000	$ -
The Real Estate Center	$ -	$ -	$ -
Seaside Real Estate	$399.000	$799.000	$ -
Keller Williams	$1.241.000	$319.000	$ -
17 North LTD.	$438.000	$247.500	$814.900
Sancas Realty	$798.000	0	$932.000
TOTAL	$9.910.399	$3.679.500	$2.952.900
	$ 16.542.799		

Source: IDOM,2023

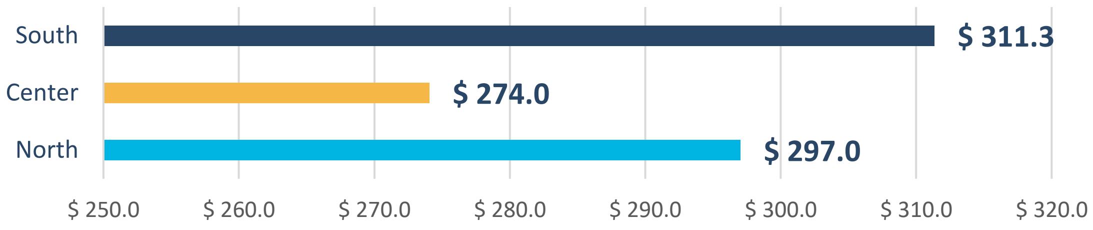
Prices on condominiums per square feet was also analyse:

Table 44 - Prices Condominiums per Square Feet for the Sectors

	PRICE/sqft. AVERAGE		
REAL ESTATE COMPANY	North	Center	South
Remax	$ 302,8	$ 370,5	$ 221,1
Sandy Point	$ 347,1	$ 190,5	
The Real Estate Center			$ 375,8
Seaside Real Estate	$ 215,0	$ 413,1	
Keller Williams	$ 282,4	$ 226,7	
17 North LTD.	$ 324,3	$ 169,5	$ 339,6
Sancas Realty	$ 310,5		$ 308,8
AVERAGE	$ 297,0	$ 274,0	$ 311,3
	$ 294,1		

Source: IDOM, 2023

Figure 103 - Prices Condominiums per-Square Feet for the Sectors



Source: IDOM, 2023

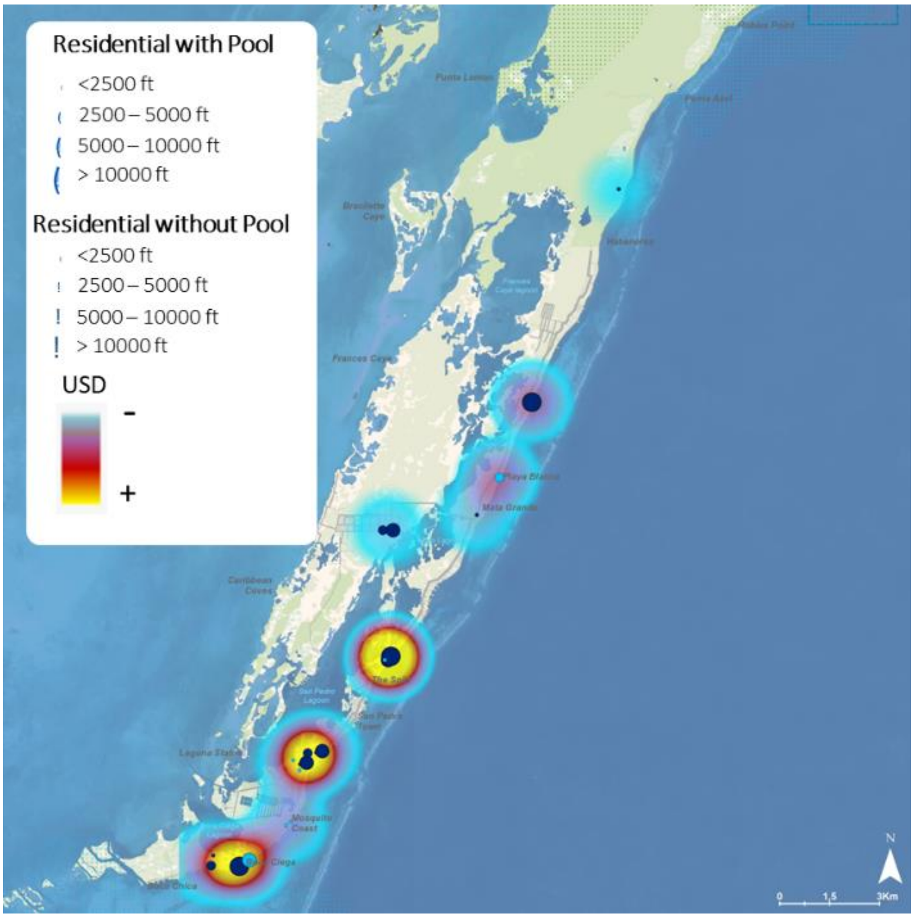
Related to the cost per square meter:

- The areas with the highest value per square meter in the condominium category are in the south and northeast sector.
- The main characteristics of the condominiums are that they are tourist complexes with access to private beaches and well connected to the mobility system.
- Most of them have direct access to the seacoast and therefore to activities related to the main tourist activity of the island.

2.1.7.2.3. Residential

Residential areas were identified with high potential mainly on the south part and San Pedro Town, following by the north sector.

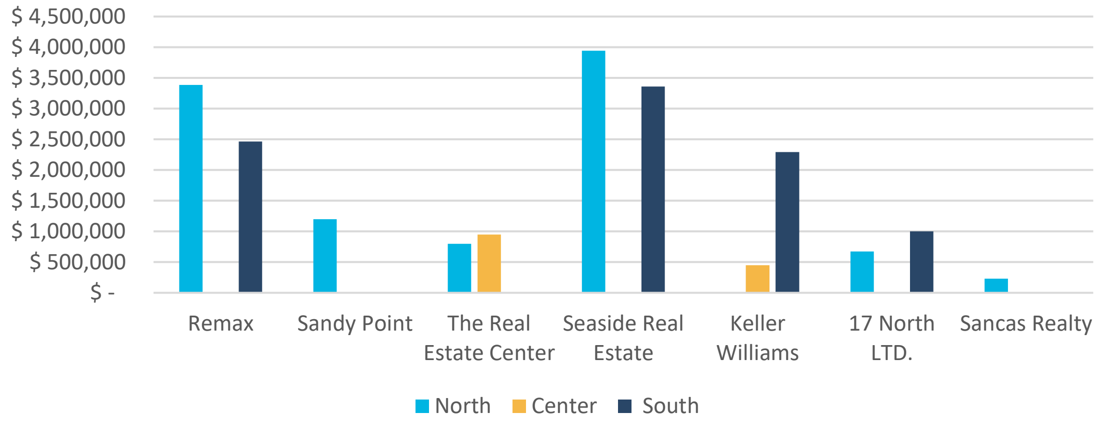
Figure 104 - Residential Map Analysis



Source: IDOM, 2023

Analyzing the stock of residential properties for sale according to the real estate companies, it is identified that the north and south zones have the most properties available.

Figure 105 - Residential prices by Sectors



Source: IDOM, 2023

Table 45 - Residential prices by Sectors

PRICE			
REAL ESTATE COMPANY	North	Center	South
Remax	$ 3.385.000		$ 2.462.000
Sandy Point	$ 1.200.000		
The Real Estate Center	$ 799.000	$ 950.000	
Seaside Real Estate	$ 3.945.000		$ 3.359.000
Keller Williams		$ 450.000	$ 2.295.000
17 North LTD.	$ 674.000		$ 1.002.500
Sancas Realty	$ 229.000		
TOTAL	$ 10.232.000	$ 1.400.000	$ 9.118.500
	$ 20.750.500		

Source: IDOM, 2023

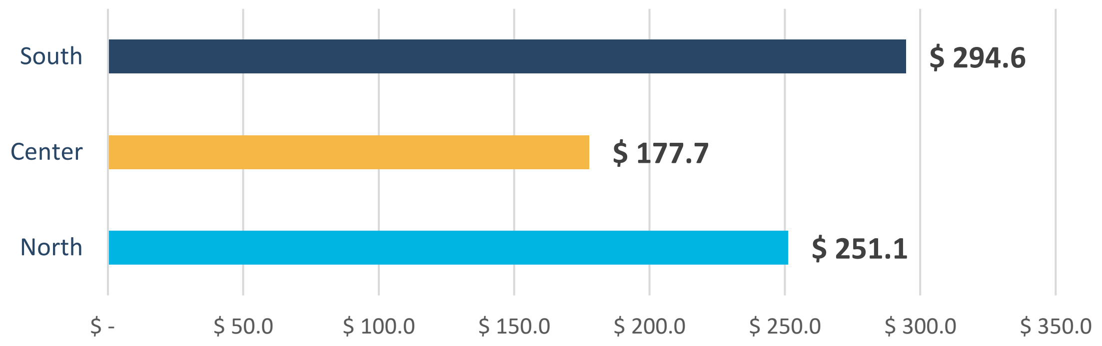
Prices on residential properties per square feet was also analyse:

Table 46 - Residential prices per-Square Feet by Sectors

PRICE/sqft. AVERAGE			
REAL ESTATE COMPANY	North	Center	South
Remax	$ 311,9		$ 302,7
Sandy Point	$ 184,6		
The Real Estate Center	$ 665,8	$ 184,9	
Seaside Real Estate	$ 96,5		$ 171,9
Keller Williams		$ 170,5	$ 279,5
17 North LTD.	$ 197,0		$ 424,4
Sancas Realty	$ 50,9		
AVERAGE	$ 251,1	$ 177,7	$ 294,6
	$ 241,1		

Source: IDOM, 2023

Figure 106 - Residential prices per-Square Feet by Sectors



Source: IDOM, 2023

Related to the cost per square meter:

- The areas with the highest value per square meter are found in the southern and northern sectors.
- The cost per square meter depends on size, location, and amenities. Excluding architectural details.
- Some residential areas include private beaches.

In conclusion, the real estate market in Ambergris Caye was analysed on three categories : vacant land, condominiums and residential developments. Market trends in the southern sector for residential complexes ($251.00 sqft. approx.) and apartments ($311.00 sqft. approx.) as it is quite consolidated. Realted to condominiums soth and north sector are attractive ($274.00 sqft. approx.). And, vacant land ($105.00 sqft. approx.) the highest prices per square meter are found in the central sector.

On the other hand, the current legislation in Belize allows important facilities for foreigners that allow them to purchase property in an agile way and enjoying the same rights in this field as Belizean citizens. This, added to the low property taxes, makes Belize a very attractive destination for real estate investments.

2.1.8. Determinants and Limitations to Development

This Chapter for consistency analyses the main constraining factors for future development and highlights the zones affected by those constraining factors. The study identifies some areas, which should not be developed and should be protected by environmental policies.

In this context, it is necessary to distinguish two concepts that bring together the different factors to analyse:

- **Constraining factors** can be defined as factors affecting areas where various forms of development are impractical which should be protected by urban growth policies.
- **Determining factor** can be defined as those factors that partially condition the urban development but not prohibit it. In this case, the development will be regulated by proposed urban parameters.

Within the Study Area, the growth-restricting factors identified are:

1. **Protected Areas**
    - Protected areas
    - Mangroves
2. **Natural Areas**
    - Forest
    - Wetlands
3. **Bodies of water**
4. **Infrastructures**
    - Road reserves
    - Airport easements
5. **Strategic áreas of interest (Heritage)**
6. **Natural Hazards**
    - Coastal flood

In order to represent these constraining and determining factors, thematic maps of the variables have been developed regarding its effect on urban growth. According to the methodology of this study, constraining or determining factors affect the growth of the city, especially in the smart and compound scenarios, and to a lower extent in the current trend scenario where growth often does not respect the physical or legal limitations (natural hazards, vulnerable areas, protected areas, etc.).

For that reason, firstly the affected areas by each determining factor are studied one by one and then these areas are used for a composition of the smart and compound scenarios.

2.1.8.1. Protected Areas

This group includes those elements that have been protected by legal regulations.

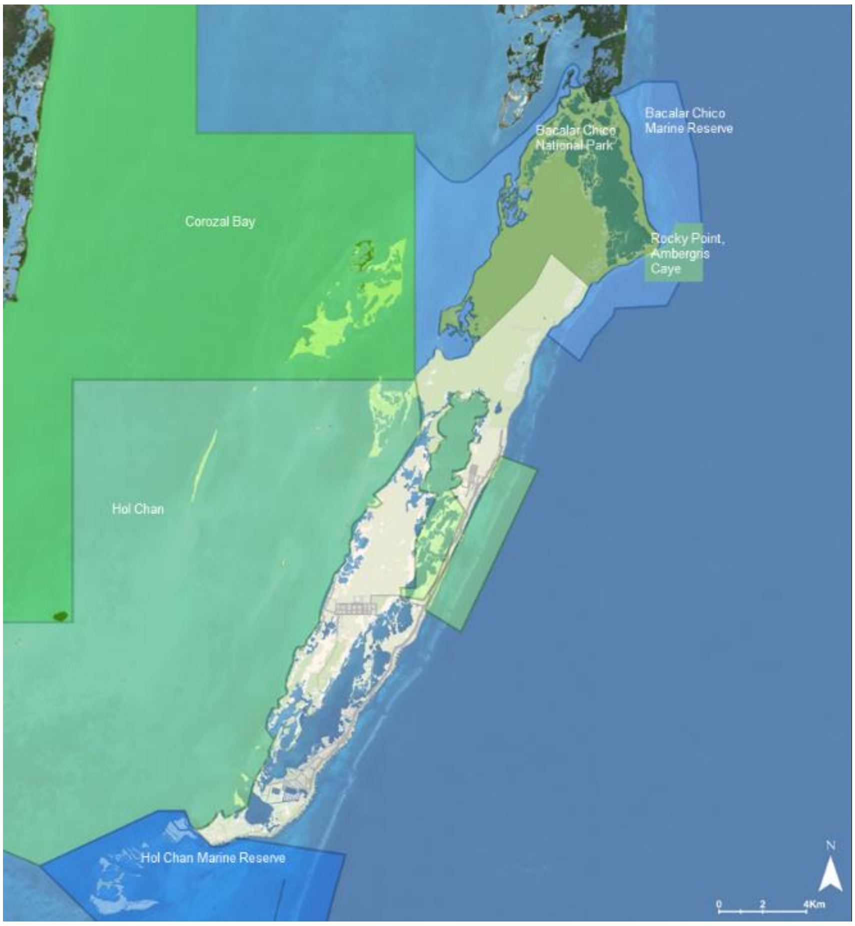
2.1.8.1.1. Protected areas.

In the area surrounding the Caye, 6 protection categories have been defined for the coastal, marine and land areas. In these areas, activities are limited according to national regulations or management plans defined by the competent authorities.

NAME	DESIGNATION	YEAR	MANAGEMENT AUTHORITY	
Hol Chan	Marine Reserve	1987	Fisheries Department & Hol Chan Trust Fund	Divided into four zones: Mangrove, Seagrass, Shark Ray Alley and Coral Reef
Bacalar Chico Marine Reserve	Marine Reserve	1996	Fisheries Department & Green Reef Environmental Institute	Divided into two zones: a conservation zone and a general use zone
Bacalar Chico National Park	National Park	1996	Forest Department & Green Reef Environmental Institute	
Rocky Point, Ambergris Caye	Spawning Aggregation Site Reserves	2003	Fisheries Department	Managed as part of Bacalar Chico Marine Reserve

Corozal Bay	Wildlife Sanctuary	1998	Forest Department & Sarteneja Alliance for Conservation and Development

Figure 107 - Protected areas



% Caye affected
43.1%

Affected built footprint (acres)
46.7

Affected vacational & residential footprint (acres)
44.1

Population
0

Source: IDOM, 2023

2.1.8.1.2. Mangroves

Forest Act 1989 amendment provided for the protection of national mangroves. These Regulations provide for the protection of this ecosystem in "jurisdictional waters" by prohibiting altering, or causing to be altered, any mangrove without first obtaining a permit from the Department of Forestry.

The following lines describe the reasons why mangroves are protected according to the Forest Act:

"(a) mangroves border much of the coastline and cayes of Belize and form an important component of the natural vegetation of the country;

(b) mangroves are well-known for their protective functions and mitigate the destructive forces of hurricanes and other natural disasters;

(c) each species of mangrove provides habitat for a diverse community of plants and animals, including fish and other species;

(d) mangroves play a crucial role in the ecology of coastal areas, coral reefs and estuaries and produce and trap concentrations or organic matter which are used by marine organisms in coastal food webs;

(e) many of Belize's commercial Ash species depend upon the nursery functions of mangrove communities; (mangrove communities in Belize provide a dependable water resting ground for a host of species of migratory birds and wildlife;

(g) mangrove communities, besides being environmentally protective, areesthetically attractive and can be incorporated into thelandscaping of waterfront residences and communities;"

No person may alter any mangrove in the jurisdictional waters of Belize without first obtaining a permit from the Forests Department. This prohibition applies both to privately-owned lands and public lands.

Figure 108 - Mangroves

% Caye affected
47.6%

Affected built footprint (acres)
236.7

Affected vacational & residential footprint (acres)
226.1

Population
695

Source: IDOM, 2023

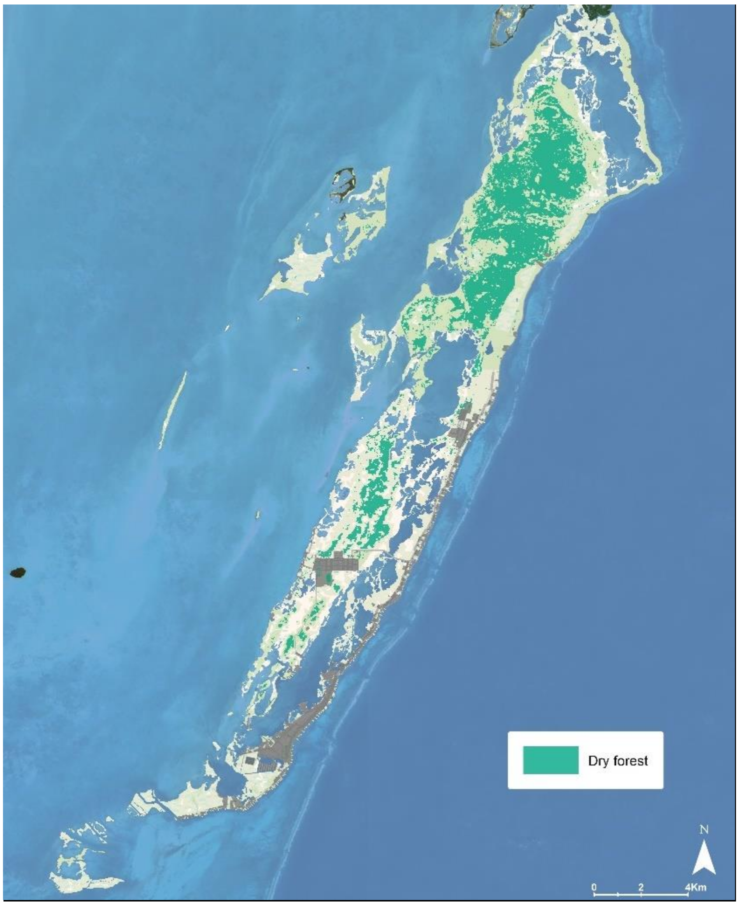
2.1.8.2. Natural Areas

This category of constraining factors is composed of those elements that are not completely protected by any law, but due to its own ecological value should be protected from the urban development.

2.1.8.2.1. Forest

Forest land is legislated under the Forest Act, Revised in 2000. This law allows for the establishment of Forest Reserves on national lands with the purpose of protection for controlled use. Nowadays, any forest with this type of protection is recognized within the study area However, there are remnants of forests with high ecological value that should be protected from the expansion of the urban footprint. These forests are basically composed by lowland broad-leaved moist forest ecosystems.

Figure 109 - Forest areas



% Caye affected
23.4%

Affected built footprint (acres)
11.9

Affected vacational & residential footprint (acres)
11.4

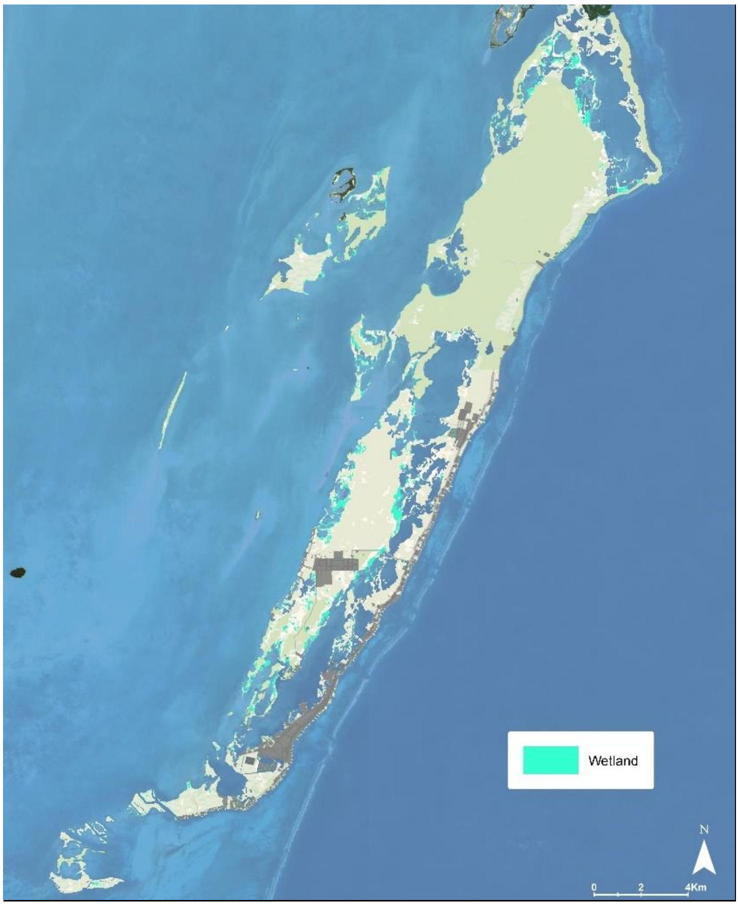
Population
26

Source: IDOM, 2023

2.1.8.2.2. Wetlands

Another ecosystem affected directly by urban development that should be protected are the wetlands. This habitat is an efficient buffer against storm surge, is important in flood control and can adapt to changing sea levels. Moreover, it thrives on nutrients and sediments derived from the land, and in so doing, it helps to trap them and limit transport to the sediment-sensitive reef systems. However, there is no legal protection figure for wetlands, so it is included in the analysis as a determinant but not a limiting factor.

Figure 110 - Wetlands



% Caye affected
4.5%

Affected built footprint (acres)
23.9

Affected vacational & residential footprint (acres)
8.2

Population
30

Source: IDOM, 2023

2.1.8.3. Bodies of water

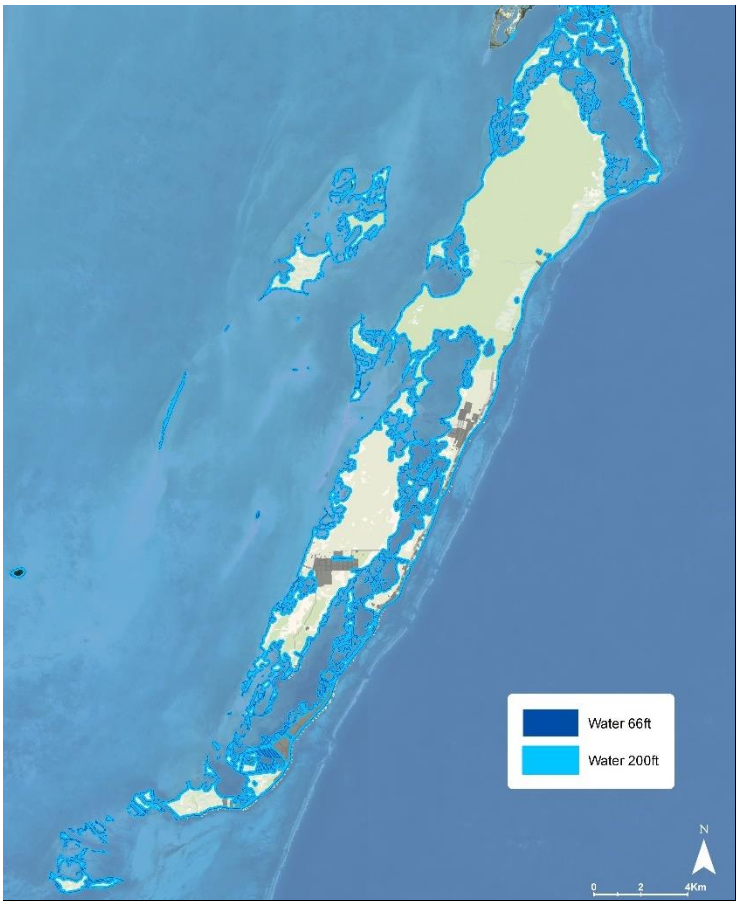
The Government of Belize, through the National Lands Act, states that National Lands that are leased outside a city, town, or village and adjoin any running stream, river, or open water, have to include a 66 ft buffer of land along such running stream, river, or open water which must be left in its natural state unless otherwise approved by the Minister to be used in a specified manner. This setback refers to a portion of land that is to be located a certain distance landward from the body of water measured from the mean high-water mark.

In addition, in selling National Lands in rural areas, reservations not exceeding 66 feet measured from high water mark along all water frontages must be reserved for Government or public purposes.

As recommended by Coastal Zone Management Authority & Institute (Belize Integrated Coastal Zone Management Plan, 2013), the buffer of 66 ft should be enforced alongside all bodies of water, and it should be increased this requirement up to 200 ft.

In view of this, the 200ft buffer is considered as constraint and the 66ft buffer as determinant.

Figure 111 - Bodies of water (constraint/determinant)



% Caye affected
10.9% / 26%

Affected built footprint (acres)
160 / 509

Affected vacational & residential footprint (acres)
129.6 / 441.6

Population
2,857 / 8,508

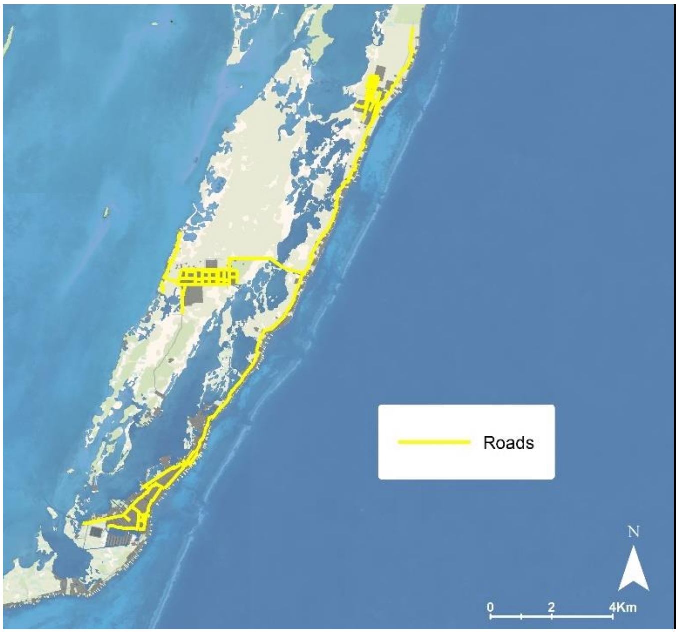
Source: IDOM, 2023

2.1.8.4. Infrastructures

2.1.8.4.1. Road Reserves

National Guidelines for Subdivision and Consolidation of Land in Belize defines a road hierarchy. The basic guidelines for road service establish the minimum dimensions for each road typology attending the service requirements. However, the road typology of the Caye is defined by small roads in the national hierarchy, so it has been decided to use a 15ft strip for all the main roads of the Caye. This measure is included in the PUBLIC ROADS ACT CHAPTER 232 where it specifies for the northern roads "*There shall be reserved for the protection and benefit of such road all such land that lies within 15' (fifteen feet) of the key.land that lies within 15' (fifteen feet) of the centre of the road, on each side of the centre line of such road. center line of such road*."

Figure 112 - Roads



% Caye affected
1.2%

Affected built footprint (acres)
187.7

Affected vacational & residential footprint (acres)
169.4

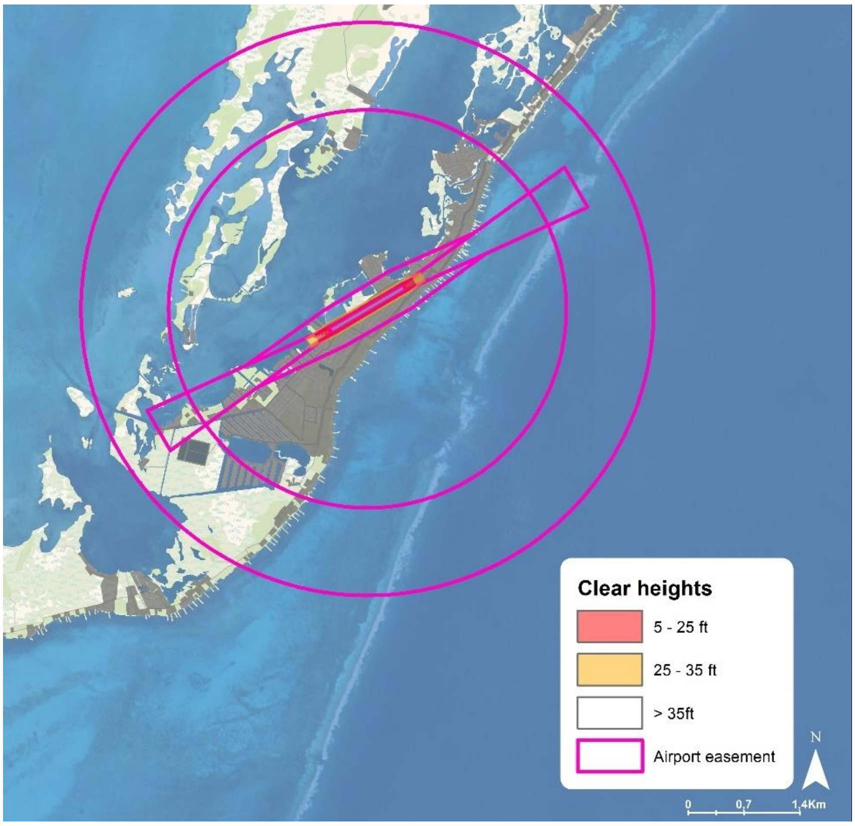
Population
3.623

Source: IDOM, 2023

2.1.8.4.2. Airport easements

In order to ensure the safety of aircraft operations in airports and aerodromes, it is necessary to establish restrictions on constructions and facilities which are located in the surrounding area, especially building height restrictions.

Figure 113 - Airport easement



% Caye affected
0.2%

Affected built footprint (acres)
38.3

Affected vacational & residential footprint (acres)
24.3

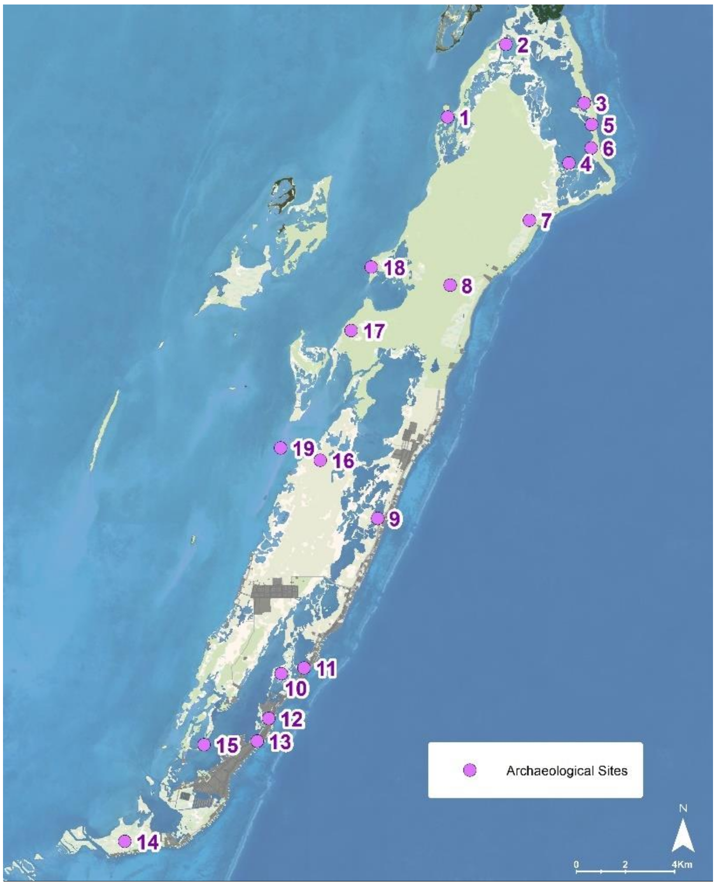
Population
792

Source: IDOM, 2023

2.1.8.5. Strategic areas of interest (Heritage)

19 areas of archaeological interest are located on the Caye, which should be considered in land use proposals.

Figure 114 - Archeological sites



1 San Juan
2 Chac Balam
3 Ek Luum
4 Burning Water
5 Valencia
6 Franco
7 Robles Point
8 Basil Jones
9 Los Renegados
10 Hancock
11 Tres Cocos
12 Guerrero
13 San Pedro
14 Marco Gonzalez
15 San Pedro Lagoon
16 Cayo Frances
17 Santa Cruz
18 Punta Limon
19 Yalamha

Source: IDOM, 2023

2.1.8.6. Natural Hazards

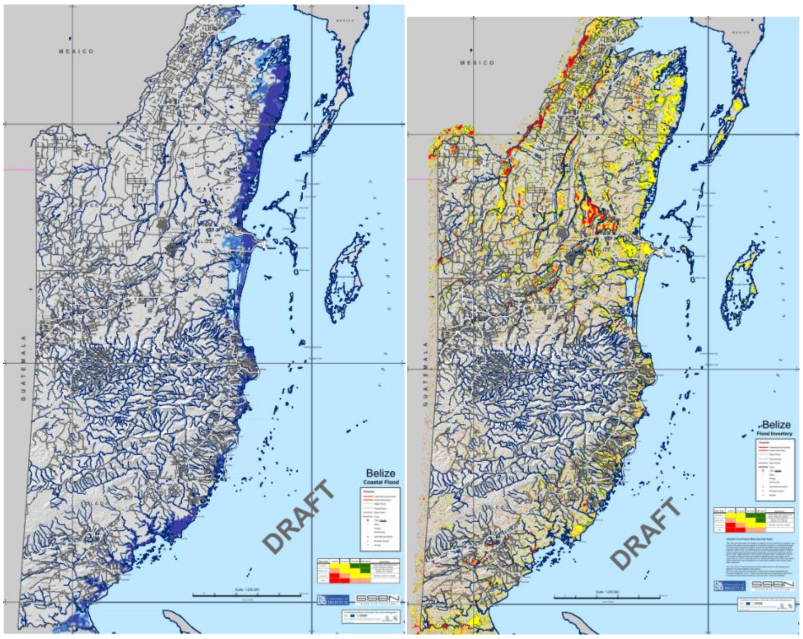
2.1.8.6.1. Coastal Flood

As part of the preview scheme, several studies conducted by various research centers have been analyzed. One notable example is the CHARIM Project (Caribbean Handbook on Risk Information Management), which was managed by a consortium of five international institutions.

- University Twente, Faculty of Geo-Information Science and Earth Observation (UT-ITC), the Netherlands.
- The University of the West Indies, Faculty of Engineering (UWI) Trinidad and Tobago.
- Asian Institute of Technology (AIT), Thailand.
- SSBN – Flood Risk Solutions, United Kingdom.
- Envirosense, The Netherlands.

Through the CHARIM Project, flood hazard assessments at National scale were developed. The study considered three major types of flood hazard: river flooding (fluvial), surface water flooding from high intensity rainfall (pluvial), and coastal flooding from storm surges (coastal).

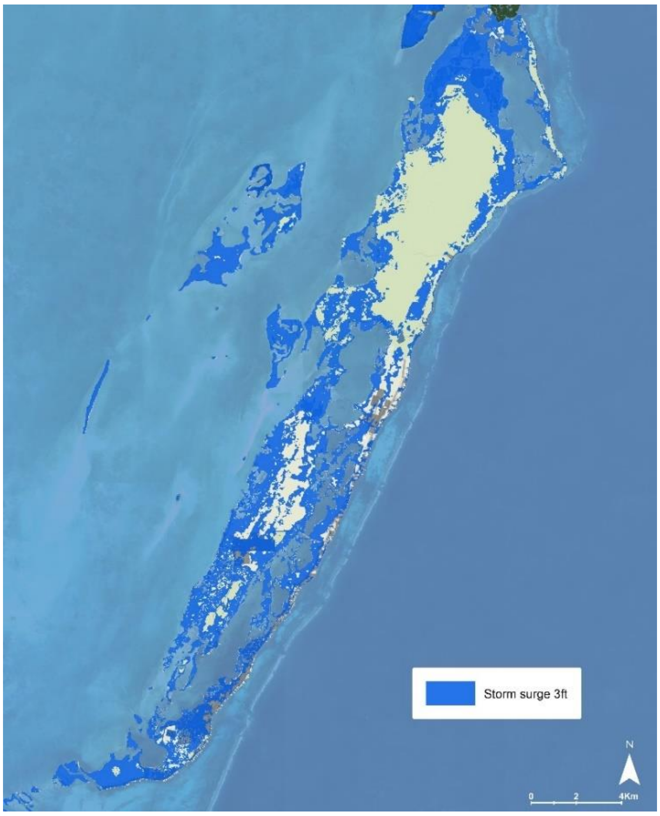
Figure 115 - 116 Coastal and pluvial flood susceptibility



Sources: Elaborated by CHARIM

Besides, this natural hazard has been analysed more deeply in the Vulnerability to natural risks diagnosis, focused on extreme meteorological events. Specifically, storm surge associated with category 5 hurricanes of the National Hurricane Center has been considered, with the edition of its extension by means of processes carried out by IDOM. For calculation purposes, has been analysed water depths greater than 3 ft.

Figure 117 - 118 Storm surge



% Caye affected
58.2%

Affected built footprint (acres)
942.5

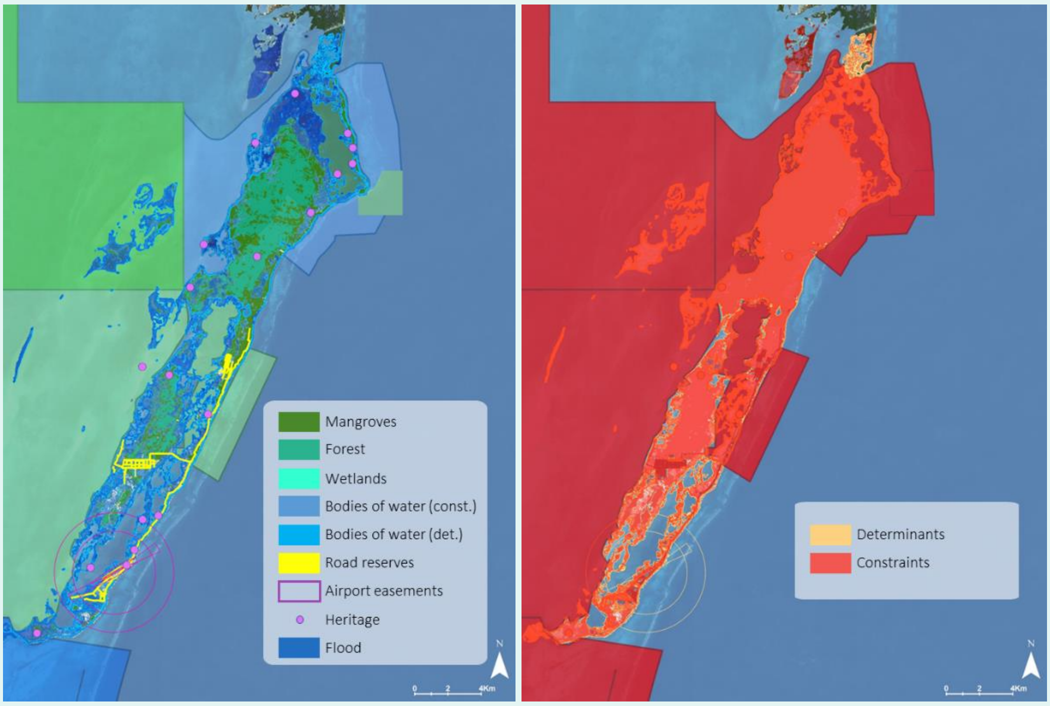
Affected vacational & residential footprint (acres)
793.5

Population
12.821

Source: IDOM, 2023.
NOAA

According with the previous analysis, 98.5 of the Caye is affected by conditioning or limiting factors to development, and up to 82% of the population lives in areas affected by limiting factors. This implies that urban development in the Caye should be adjusted to the inherent conditions of the territory, in such a way that interventions affect areas of high ecological value in the least possible way.

Figure 119 - Summary of determinants and limitations



	Typology	% Caye affected	Affected built footprint (acres)	Affected vacational & residential footprint (acres)	Inhab
Protected Areas	Nature Reserves	43,1%	46,7	44,1	0
	Mangroves	47,6%	236,7	226,1	695
Natural Areas	Forest	23,4%	11,9	11,4	26
	Wetlands	4,5%	23,9	8,2	30
Bodies of water	Bodies of water (constraints)	10,9%	160,2	129,6	2.857
	Bodies of water (Determinant)	26,0%	509,3	441,6	8.508
Infrastructures	Road reserves	1,2%	187,7	169,4	3.623
	Airport easements	0,2%	38,3	24,3	792
Strategic areas of interest	Heritage	-	-	-	-
Natural Hazards	Flood prone areas	58,2%	942,5	793,5	12.821
TOTAL DETERMINANTS AND LIMITATIONS TO DEVELOPMENT		**98,5%**	**1.244,7**	**1.073,8**	**16.086**
TOTAL LIMITATIONS TO DEVELOPMENT		**97,8%**	**1.166,2**	**1.003,0**	**14.979**

Source: IDOM, 2023

2.1.9. Analysis of Projects and Plans in Progress

The analysis of infrastructure projects, urban development and plans related to the environment and risk management is a key aspect of this consultancy, as they establish conditions and perspectives that have an impact on the development of the territory and the quality of life of the population.

For the purposes of the present study, the projects and plans have been grouped into three main groups: Urban Development and Tourism, Environment and Natural Hazards Management. A total of 15 projects have been identified and analyzed considering the following variables:

- **Type:** Projects are classified according to the specific development sector (mobility, urban facilities, public space, water management, etc.).
- **Involved stakeholders:** entities and authorities directly responsible for the planning or execution of the plans or projects.
- **Status:** Phase of implementation in which the project is (proposed or under development).
- **Year:** Execution period or development dates proposed for the plans and projects.

The following is a complete list of some of the most relevant plans, programs, and projects in Ambergris Caye. A more in-depth analysis of each of the identified projects is presented in Annex A of the present report:

Table 47 – List of Plans, Programs and Projects in Ambergris Caye

URBAN DEVELOPMENT AND TOURISM					
	Plan, Program or Project	Type	Involved Stakeholders	Status	Year
1	Design and construction of San Pedro General Hospital	Urban Facilities Health	Ministry of Health and Wellness, Republic of China (Taiwan), Ministry of Finance, Economic Development, and Investment	Under development	2022 - 2024
2	Urban roads upgrade	Mobility	San Pedro Town Council	Under development	2023
3	Assessing business environment considerations for the development of the Ambergris Caye in Belize	Economic Development	Ministry of Finance (MoF) of Belize Investment Climate Reform Facility	Under development	2022 - 2023
4	Develop adequate medical facilities in key tourist destinations such as Ambergris Caye and others	Urban Facilities Health Tourism	Ministry of Health and Wellness with Ministry of Tourism & Diaspora Relations, Public-Private Collaboration	Proposed	2022 - 2026
5	New Pre-primary, Primary and Secondary School Project	Urban Facilities Education	Ministry of Education, Culture, Science, and Technology, Caribbean Development Bank	Proposed	2019 -
6	San Pedro - Caribbean Queen Depot (By-passes and urban roads Program)	Mobility Logistics	Ministry of Infrastructure Development & Housing	Proposed	2019 - 2025

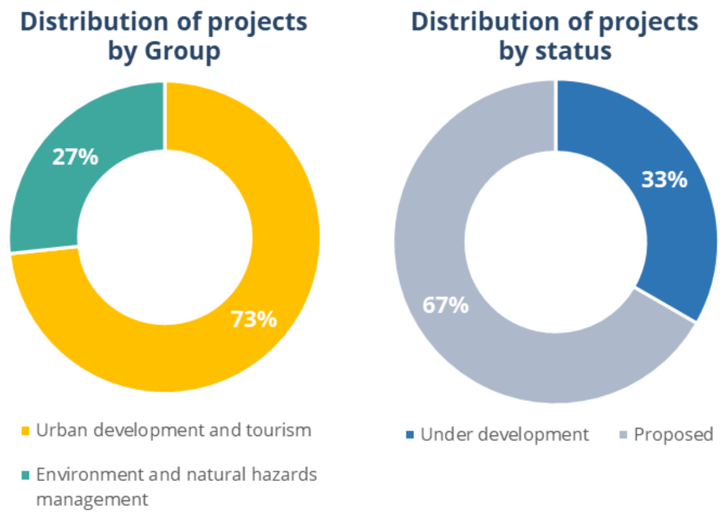
7	Water taxi services from Belize City International Airport and Bomba to San Pedro	Mobility Tourism Logistics	Belize Port Authority Ministry of Youth, Sports & Transport	Proposed	2019 - 2025
8	New San Pedro Airport	Mobility Logistics Tourism	Belize Airport Authority Belize Department of Civil Aviation	Proposed	2019 - 2025
9	Business Strip of San Pedro	Public Space Tourism Mobility Economic Development	San Pedro Town Council	Proposed	2023 -
10	Cargo Port in the North of Ambergris Caye	Logistics Mobility	San Pedro Town Council	Proposed	2023 -
11	Improvement of road infrastructure in the North	Mobility	San Pedro Town Council	Proposed	2023 -

ENVIRONMENT AND NATURAL HAZARDS MANAGEMENT					
	Plan, Program or Project	**Type**	**Involved Stakeholders**	**Status**	**Year**
1	Support to Integrated Water Resources Management	Water	IDB, Ministry of Natural Resources, Petroleum & Mining	Under development	2021
2	Development of innovative solutions to improve the resilience of homes in Belize to hurricane winds, considering the effect of climate change	Natural Hazards Management	IDB, Ministry of Sustainable Development, Climate Change & Disaster Risk Management	Under development	2021 -
3	North Ambergris Caye Expansion (water & wastewater); Caye Caulker South and Placencia Peninsula WWTP and collection System	Water Wastewater	Belize Water Services	Proposed	2022 - 2023
4	Water driven zoning mechanism	Water Wastewater	IDB, Ministry of Natural Resources, Petroleum & Mining	Proposed	2021 -

Source: IDOM, 2023

According to the table above, most of the plans and projects correspond to infrastructure interventions, with a greater impact on mobility, urban facilities, logistics and tourism development. On the other hand, it is noted that the majority of the projects are in the proposal phase, with only 5 plans and programs currently under implementation:

Figure 120 - Summary of determinants and limitations



Source: IDOM, 2023

The projects are aligned with some of the messages identified in the consultancy conducted by "Pacifico", here are some of the main messages and stakeholders:

- **General message:**

"To support that growth with a well-thought-out plan to create opportunities for everyone, build the necessary infrastructure, and ensure a sustainable future for our island".

- **Some of the main messages are:**

(For business-oriented groups) *"The sustainable development plan for Ambergris will help consolidate tourism growth and drive opportunities for our local businesses, tackling challenges like energy, services, and mobility.*

(For environmentalists) *"The sustainable development plan for Ambergris will foster sustainable tourism practices, support nature-based solutions and create necessary climate-resilient infrastructure."*

(For families) *"The sustainable development plan for Ambergris addresses the immediate challenges we are facing today and prioritizes the infrastructure we need for tomorrow, including schools, hospitals, roads, as well as water and waste management."*

(For People with less education) *"The sustainable development plan for Ambergris will help create new jobs. More schools and hospitals will improve access to health and education. And by supporting the development of a strong tourism sector, it will help create better jobs and improve transportation. "*

- **Some relevant groups or stakeholders:**
    - Business groups
    - Environmentalists
    - Families
    - Younger generations
    - Religious communities
    - Tourists
    - Hierarchises

2.1.9.1. Location of Projects

The map below illustrates the location of the projects identified above. It can be noted that the greatest concentration of developments is located in the urban center of San Pedro, while in the northern zone of Ambergris Caye are highlighted the sites proposed for the New Airport according to the National Transportation Master Plan, as well as the improvement of the road infrastructure:

Figure 121 – Location of Projects in Ambergris Caye

Source: IDOM, 2023

In conclusion, the plans, programs and projects identified in Ambergris Caye reflect that most of the investments proposed in the Island are oriented towards the improvement of road and transportation infrastructure, with a focus on mobility both within the Caye and between the Island and the mainland.

There are also projects aimed at improving water management through multilateral support programs. Meanwhile, no social housing or neighborhood improvement projects were identified, despite the fact that these are two important needs in Ambergris Caye.

Those projects support messages of creating opportunities and the need for infrastructure for the island, responding to different stakeholders.

General message is: "*To support that growth with a well-thought-out plan to create opportunities for everyone, build the necessary infrastructure, and ensure a sustainable future for our island*"

2.1.10. Analysis of Indicators and Comparison with other ICES

As part of the multisectoral analysis, numerical results are integrated, as a quantification of the observed territorial reality, which allows comparing the characteristics of each sector in a subjective manner.

For this purpose, the methodology designed by IDOM within the Emerging and Sustainable Cities Program includes some indicators, on which the necessary adaptations for Ambergris Caye are made.

These indicators are grouped into the following areas of interest:

- **Urban Boundary:** growth and morphology of the Urban Footprint

- **Urban Density:** population and housing density indicators.

- **Social Segregation:** distribution of the residential area of low and very low strata.

- **Public Space and Green Areas:** population access to recreational areas such as green areas and sports facilities.

Within these general themes, a battery of indicators is included that allow the sizing of the different sectors by means of a system of traffic lights based on the results. Each sector shown a color (red, yellow, green) for each of the indicators analysed, depending on whether its performance is better or worse. Values considered unfavourable are red, intermediate values yellow and optimal results green.

The assignment of a specific color to each indicator follows the standards described in the "Methodological Guide of the Emerging and Sustainable Cities Initiative (IDB)", a document that compiles up to 127 indicators on different topics, based on international standards, regional averages, contributions from sector specialists, comparisons of large and medium-sized cities in the region, as well as analysis of data collected for each sub-theme and municipality by experts.

In addition to this document, IDOM, in collaboration with the IDB, generated a new set of indicators focused mainly on issues related to urban growth. The publication "From Emerging Cities to Sustainable Cities" compiles these indicators.

2.1.10.1. Growth and Urban Boundary Indicators

This set of indicators analyses the current and recent situation of the urban boundary, defined according to an imaginary line that delimits the urban areas shown in Urban and Rural Transition Groups.

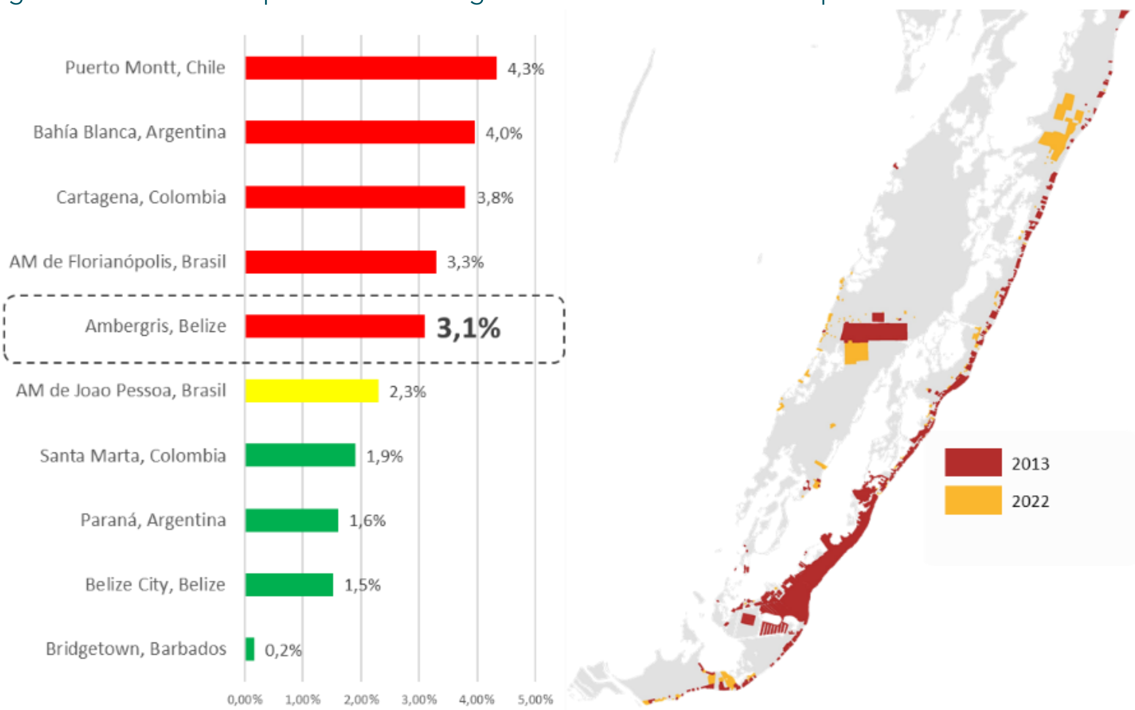
Figure 122 - Growth and Urban Boundary Indicators

INDICATOR	DESCRIPTION	UNITS	
Annual growth rate of the urban footprint	Average annual growth rate of urban footprint within official city limits (at least the last 5 years or the last period of time available)	% annual	**3,1%**
Annual growth rate of population/Annual growth rate of the urban footprint	Relationship between the average annual population growth and annual growth of urban footprint	Ratio	**1,13**

Existence and implementation of urban planning tools approved by law and updated in recent years (10 years)	Active existence and implementation of a comprehensive legally binding plan and developed or updated in the last ten years	Yes/No	**No**
Existence and implementation of urban plan; urban regulatory rules	Active existence and implementation of a comprehensive legally binding plan and developed or updated in the last ten years	Yes/No	**No**
Presence of unplanned periurban space **, generating lack of separation between urban and rural	Periurban area	Km^2	**5,10**
Presence of unplanned periurban space, generating lack of separation between urban and rural	Periurban area/ urban area	%	**236,1%**
Presence of a messy periurban space, generating lack of separation between urban and rural	Periurban area/ total area	%	**70,2%**
Urban population in the municipality or group of municipalities	urban population / total population	%	**81,5%**

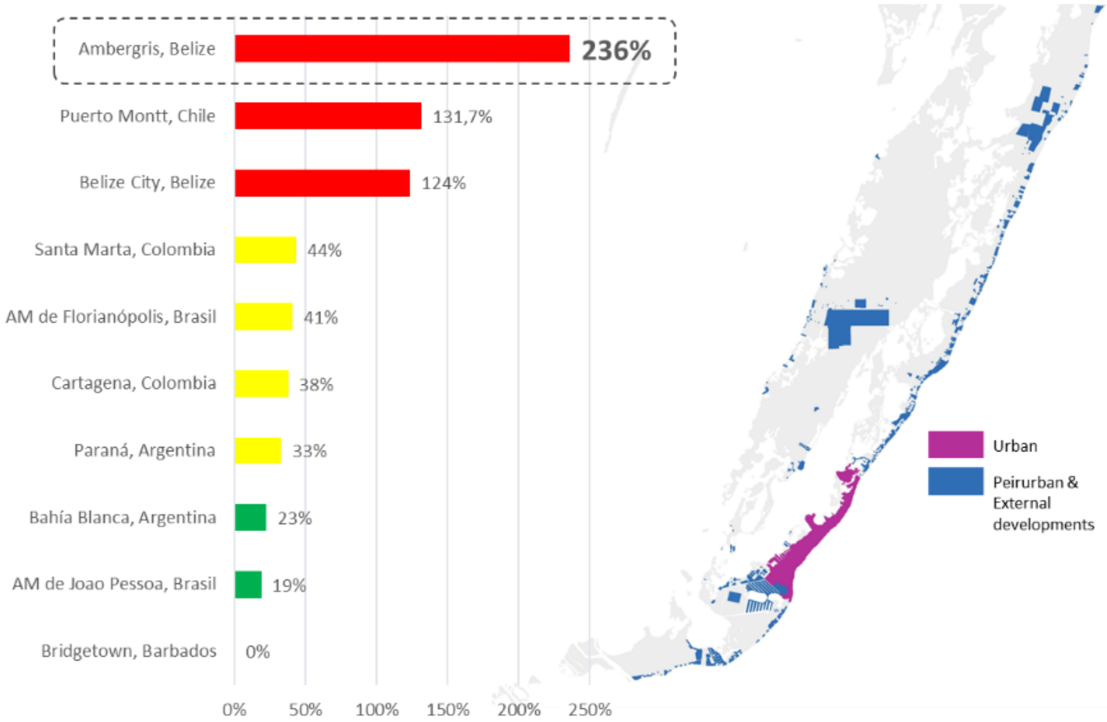
Source: IDOM, 2023

Figure 123 - ICES Comparative: Annual growth rate of the urban footprint



Source: IDOM, 2023

Figure 124 - ICES Comparative: Presence of unplanned periurban space



Source: IDOM, 2023

2.1.10.2. Density Indicators

The urban density indicators analyse the relationship between the physical space occupied by the Footprint in each sector and the presence of population and housing within them, offering very significant data on how the population of the Caye is spatially distributed.

Figure 125 - Growth and Urban Boundary Indicators

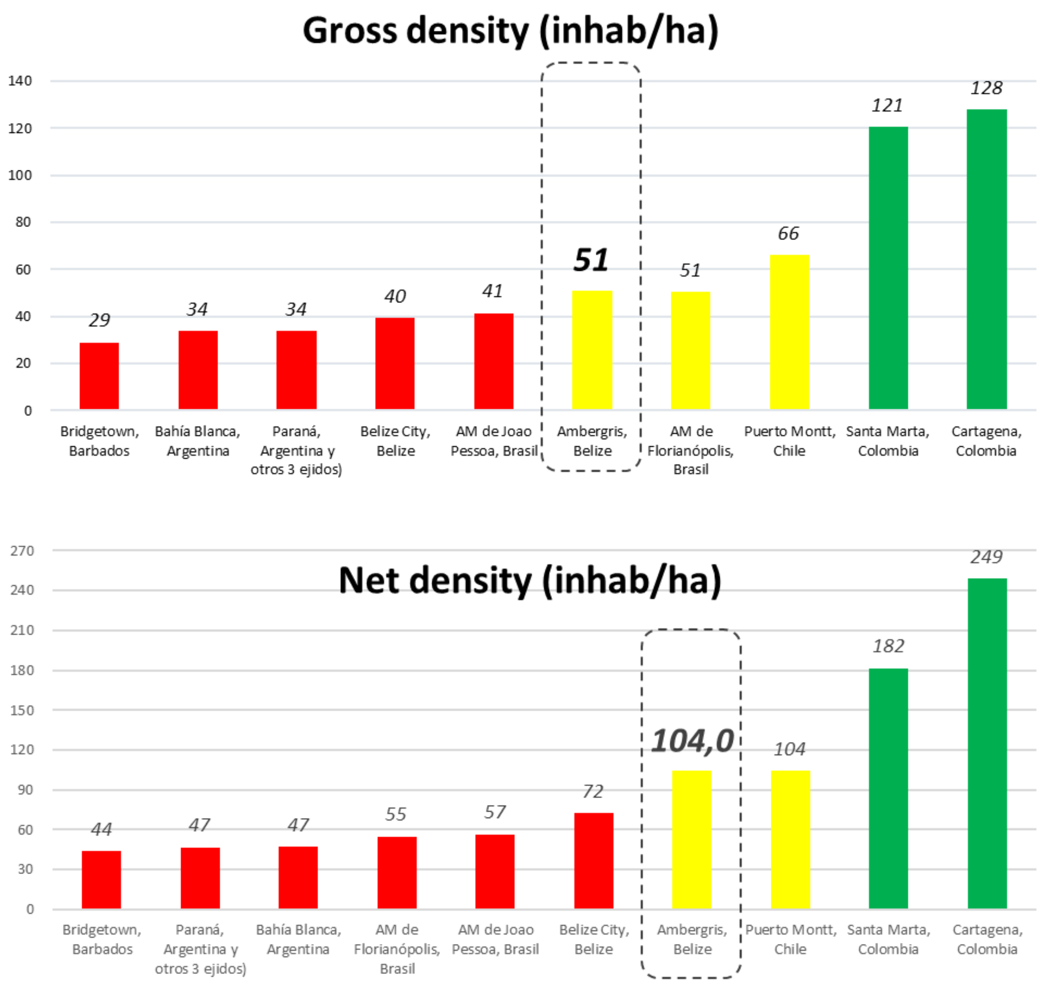
INDICATOR	DESCRIPTION	UNITS	
Net density of urban&periurban population	People living in urban residential area	Inh/Ha	**104,0**
Gross density of urban&periurban population	People living in total urban area, residential and non-residential	Inh/Ha	**51,1**
Net density built urban&periurban	Houses built in residential urban area	Dwe/Ha	**33,8**
Density distribution	Density distribution	Distribution of density	**Intermediate**
Urban spaces in the footprint	Empty spaces in total urban areas	% Vacant land/urban area	**38,3%**

Source: IDOM, 2023

Figure 126 - Net density built. Zoom urban & periurban

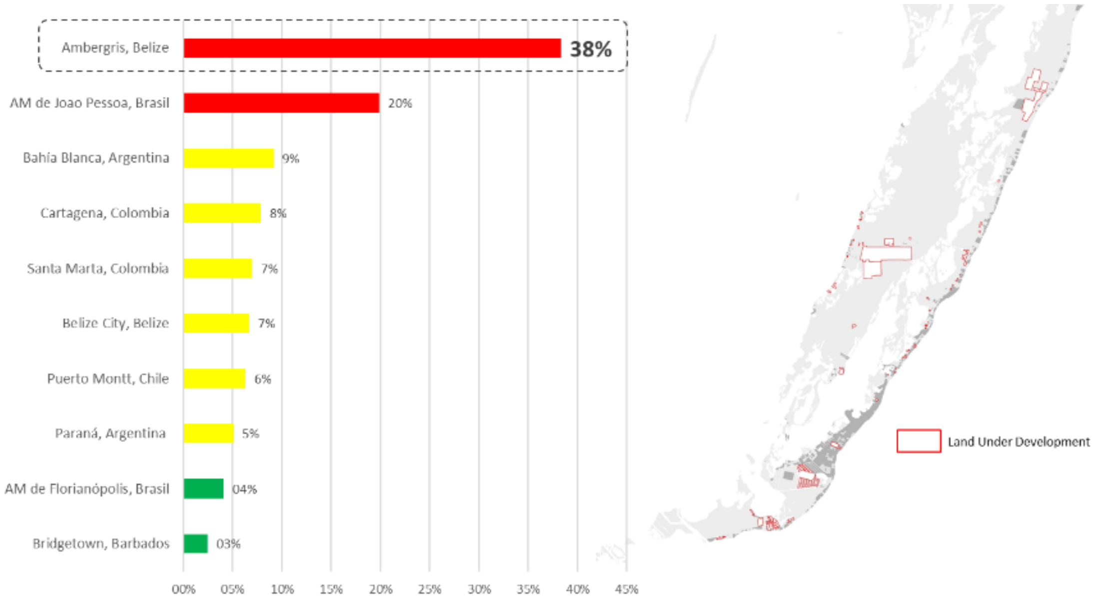
Source: IDOM, 2023

Figure 127 - ICES Comparative: Density indicators



Source: IDOM, 2023

Figure 128 - ICES Comparative: Vacant spaces in the footprint



Source: IDOM, 2023

2.1.10.3. Segregation and Social Injustice Indicators

These indicators tell us about the existence of inequalities in the residential areas of Ambergris Caye footprint. Among the aspects analyzed in this point are population strata, so because of a lack of information, the data is based on construction quality.

The indicator for "houses located in slums" was based on areas of poor building quality, where all housing is regarded as being of low quality. However, low- and medium-quality neighborhoods provide information for "lower social strata."

The number of "houses that do not meet habitability standards" in these low- and medium-quality neighborhoods has been estimated using the variable proportion of poor-quality housing in those areas.

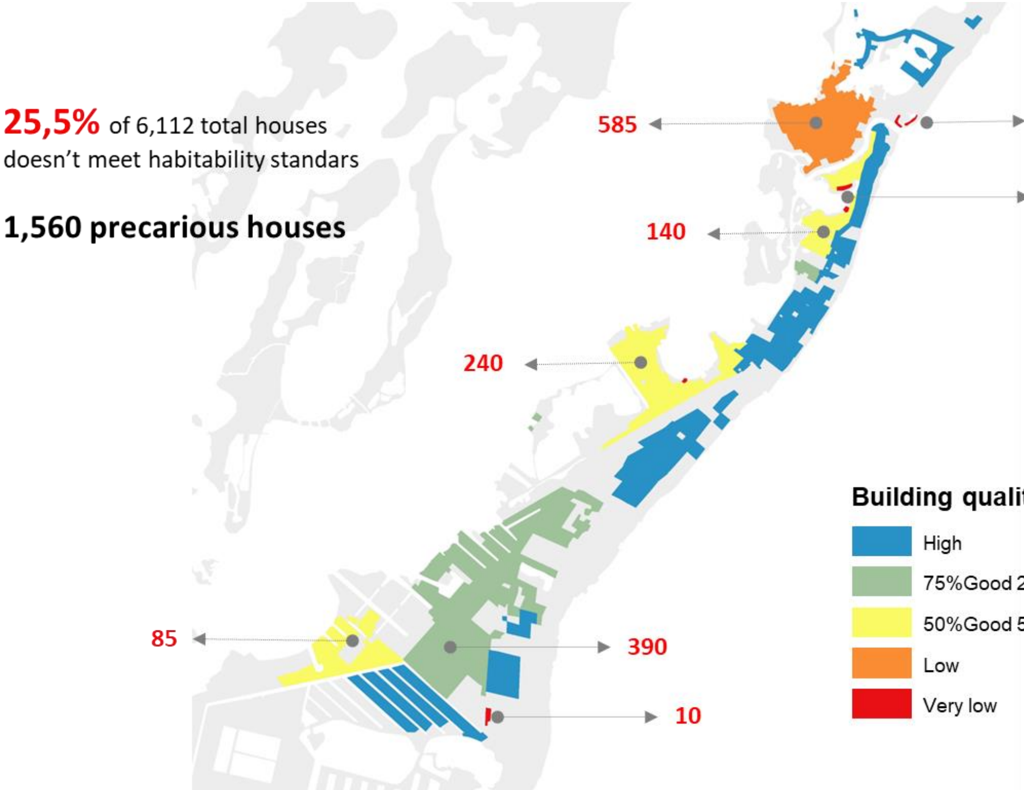
Figure 129 - Growth and Urban Boundary Indicators

INDICATOR	DESCRIPTION	UNITS	
Percentage of houses that do not meet habitability standards defined by the country*	Percentage of houses that do not meet habitability standards defined by the country	%	**25,5%**
Percentage of houses located in slums (surface) **	Percentage area of human settlements that occupy poor housing	%	**11,4%**
Percentage of houses located in slums (houses/dwellings) **	Poor housing percentage	%	**11,0%**
Percentage of houses located in slums (population) **	Percentage of population of human settlements that occupy poor housing	%	**11,7%**
Residential area occupied by lower social strata (urban habitat unskilled)***	Residential area occupied by lower social strata	%	**53%**

Source: IDOM, 2023

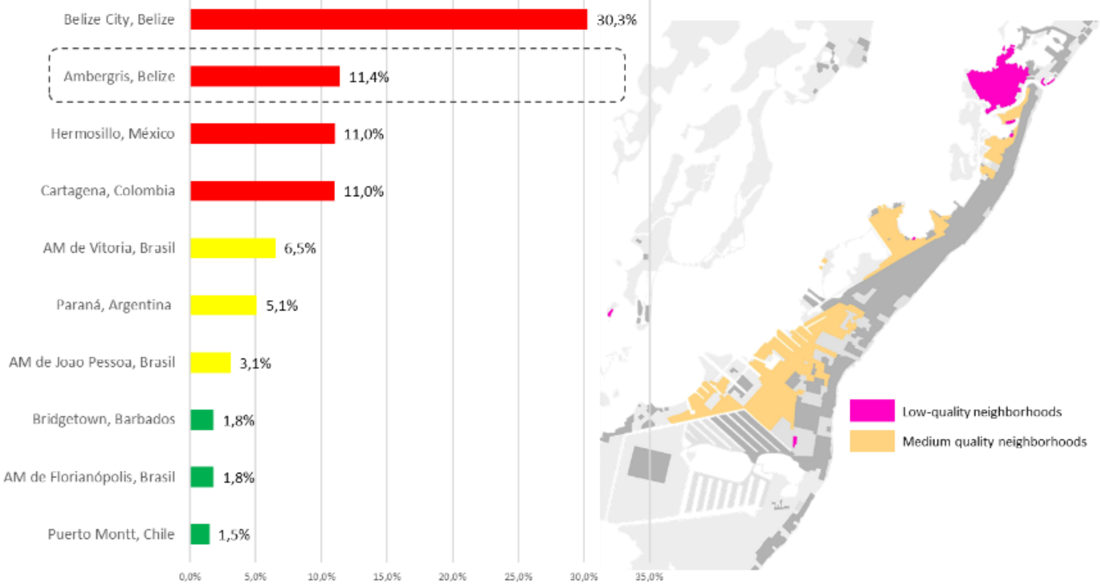
*Estimated precarious dwellings
** Low quality housing
*** Medium & low quality housing

Figure 130 - % houses that do not meet habitability standards defined by the country



Source: IDOM, 2023

Figure 131 - ICES Comparative% houses in low quality neighborhoods (left) and Low & medium quality neighborhoods map (right)



Source: IDOM, 2023

2.1.10.4. Green Areas and Public Space Indicators

The indicators of public space and green areas measure access to different types of green areas and recreational spaces based on the distribution of the population and these spaces. Both the proportion of this type of space in relation to the rest of the uses of the footprint and its density in terms of surface area per inhabitant have been analysed.

These public spaces are classified into:

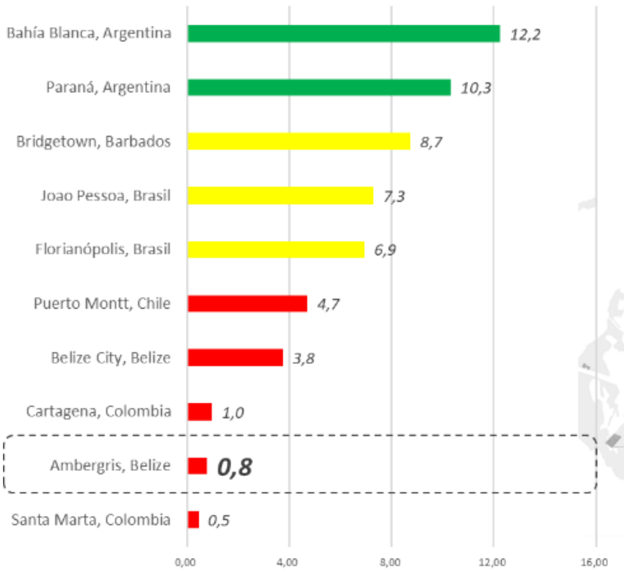
- **Qualified Green Areas:** These correspond to urban spaces that are predominantly occupied, have trees, and allow for recreation. They must be "qualified", i.e., have a certain degree of artificiality (landscaping, paving) and allow recreation.
- **General Green Areas:** These spaces, in addition to Qualified Green Areas, include Natural Areas: spaces that have remained within the Footprint due to the consolidation of the space around them.
- **Public Spaces:** The spaces identified as Public Spaces in this chapter correspond to places of free access for people: Qualified Green Areas, sports facilities, and public beaches.

Figure 132 - Growth and Urban Boundary Indicators

INDICATOR	DESCRIPTION	UNITS	
Qualified green areas (m2/hab)	Corresponding to the predominantly occupied urban spaces, with trees and a recreation areas.	m^2/inh	**0,8**
General green areas (m2/hab)	All green areas are considered	m^2/inh	**12,69**
Distribution of qualified green areas(% Population at less than ten minutes walking)	% Population at less than ten minutes walking distance, equivalent to about 500 meters radius of influence	%	**12,4%**
Public spaces (m2/hab)	It is the place where anyone has the right to move, where passing cannot be restricted by criteria of private property, and exceptionally by government reserve, including also green areas, roads , public buildings etc.	m^2/inh	**4,05**

Source: IDOM, 2023

Figure 133 - Qualified green areas (sqm/inhabit)and Green/Natural/Public space map



Source: IDOM, 2023

In conclusion, the analysis of indicators by topic provides a comparison of the dynamics of urban development in Ambergris Caye with respect to other cities in Latin America. In this sense, critical results were found, especially in areas such as the annual growth of the urban footprint, the standards of urban habitability and construction quality, and the rate of qualified green areas per inhabitant. This represents important challenges for the future development of the island, where the qualification of the territory should be a fundamental task.

2.1.11. General Benchmark Analysis

To identify success study cases, an analysis of 10 locations related to the subject of the study was carried out. Key aspects were examined such as: tourism as one of the most relevant pillars of the economy, geographic context, similar size and population among others. This assessment will help identify lessons learned and specific best practices that can be effectively applied in the island context. Finally, 4 case studies were selected for a detailed analysis, that will be develop in the next phase of the present consultancy.

2.1.11.1. Benchmark Methodology

2.1.11.1.1. Case Selection (General Criteria)

- **Geographic Context**
  In this initial stage of searching for successful cases to analyze and obtain information on their best practices, this consultancy is looking for locations or examples from the Latin American context as well as from other countries outside the Latin American region.

- **Size & Composition**
  To bring the cases analyzed into a real and similar context, the aim is to maintain a similar scale. Likewise, locations that do not necessarily have an island composition are analyzed: they may be related in other aspects like tourism value chain, active mobility, environmental axes, public space, among other topics related to the consultancy.

- **Population**
  Similarly, the locations to be analyzed should have similar population to Ambergris Caye's. These success cases should have in their dynamics the presence of visitors to ensure that tourists will be evaluated as a floating population.

- **Transport Infrastructure**
  The locations to be analyzed must have different methods of transportation infrastructure to ensure an adequate connection with different parts of the world. Major facilities such as airports, cargo ports, ferry terminals, among others, will be considered.

- **Tourism & Economy**
  Locations where tourism is the main source of income.

- **Protected Areas & Nature Reserves**
  Locations where the main characteristics and attractions are the natural areas.

2.1.11.2. Analysis of Study Cases

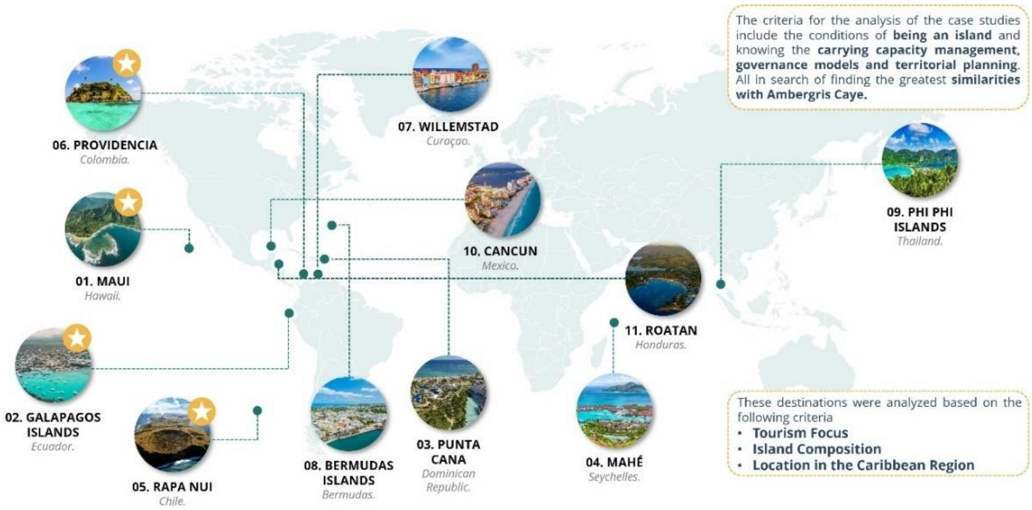
The ten initial case study cases have been selected from various geographical locations, covering Latin America (Chile, Ecuador, Colombia, Dominican Republic, Mexico, Honduras, Curaçao and Bermuda), Asia (Thailand) and Africa (Seychelles).

The choice of these locations in different regions of the world is intended to broaden the perspective and diversity of approaches that can be applied on the island. Each selected location has proven to be successful in its context and offers lessons learned that can be applicable to the specific case of Ambergris Caye. This geographic diversity in the case studies will ensure a comprehensive and enriching vision for the development consultancy.

In conclusion, the selection from Latin America, Asia and Africa offers a wide range of experiences and best practices that will serve as a valuable reference for the Ambergris Caye.

These case studies will provide important insights and contribute to the generation of sustainable alternatives for the island and its urban development.

Figure 134 Location Initial Study Cases



Source: IDOM, 2023

Considering the "Evaluation Matrix / Maximum and minimum score per evaluated criteria", it is possible to conclude the locations with higher scores and greater applicability for the present consultancy. These cities were selected using a numerical ranking methodology, in which each criterion has a value that depends on its hierarchy. Those locations that obtained a weighted average higher than 2,5 were selected for prioritization, as they offer greater contributions and lessons learned. Below is the list of cities with the highest scores that will be prioritized and analyzed in more detail.

- **Maui Island, Hawaii – United States**
- **Galapagos Islands – Ecuador**
- **Rapa Nui - Chile**
- **Providencia – Colombia**

A detailed explanation of each of the prioritized cases is provided below. A comprehensive description of each destination is included, as well as the differentiating factors that contribute to this consultancy. Finally, a series of lessons learned are presented that provide guidelines and key indicators that can be implemented in the consultancy's formulation strategies for Ambergris Caye.

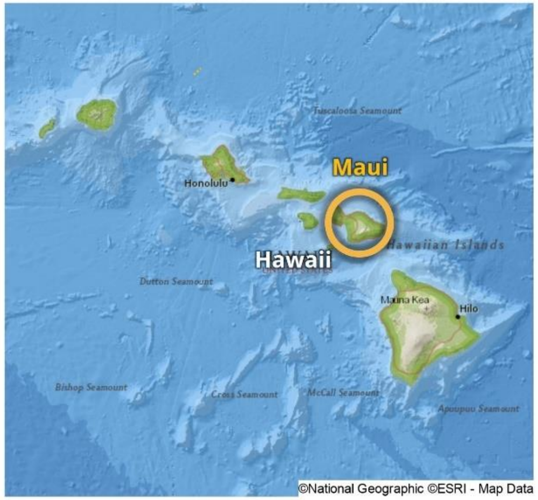
2.1.11.3. Prioritized Cases

2.1.11.3.1. Maui Island, Hawaii – United States

Figure 135 - Prioritized Case Study, Maui Island, Hawaii – United States

01. MAUI - HAWAII

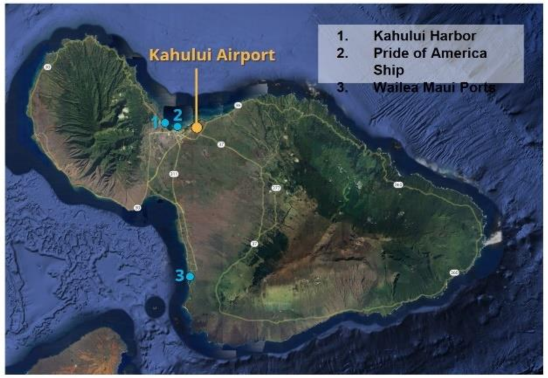
A. Location.



B. General Characteristics.

Region:	OCEANIA
Size:	728 mi2 (188,700 Ha)
Estimated Population:	164,221 INHABITANS
Main Economic Activity:	TOURISM
Airports & Ports:	YES
Environmental Value:	BEACHES

C. Infrastructure.



D. Positive Impacts by Component

Urban
- Livable human-scale urban communities, an efficient and sustainable land use pattern, and sufficient housing and services
- Maui's settlement patterns have become significantly more centralized

Environment
- Natural areas and wildlife are in designated state and National Parks.
- Natural Area Partnership Program (NAPP)
- Healthy watersheds, streams, and riparian environments.

Tourism

E. Tourist Attractors

Ecotourism | Adventure | Heritage | Beaches | Leisure

Some of the Main Attractions

F. Why to study Maui?

- Maui has a large number of environmental, tourism, land use and other **regulations.** These documents are **regularly updated** to ensure **optimal development of the island.**
- **Regenerative tourism** initiatives in process
- They have a high percentage of **repeat visitors and second homes** (short-term). Additionally, they are aware of the different **tourism targets**, honeymoons, leisure, and beaches, among others.

Key Institutions & Regulations

- ✓ Maui Nui Destination Management Action Plan, 2021 – 2023
- ✓ Maui Island Plan 2030
- ✓ Hawai'i's Housing Planning Study 2019
- ✓ Technical Studies and Best Practices Manual

Level of Applicability to the Caye

Figure 136 Prioritized Case Study, Maui Island, Hawaii – United States

01. MAUI - HAWAII

G. Management Tools

The island is equipped with an abundance of **management tools** that facilitate a **systematic approach to the execution of each developmental facet**. The **Maui Island Plan 2030** serves as a comprehensive blueprint, directing the island's growth, economic strategies, social endeavors, and environmental choices until 2030. This Plan sets forth a **visionary outlook** grounded in fundamental values, which are further delineated into goals, objectives, policies, and actionable steps. Furthermore, the Plan integrates insights gleaned from **historical experiences.**

Environment & Heritage Resources

Archaeological landscapes, ethnic diversity, historic structures, and rare ecosystems collectively define the island and make it unique. The combination of this elements tell the tale of a mix of cultures and their relationship with the surrounding natural environment

Economic Development

The first of the neighbor islands to attract largescale resort development as the islands transitioned from a plantation-based economy to one based on tourism. Maui's economy has thrived on tourism and it continues as Maui's primary engine.

Housing

Due to numerous factors, Maui's housing prices have escalated dramatically in the last decade. With some of the highest housing prices in the nation, many Maui residents are struggling to afford housing on the island.

Infrastructure & Public Facilities

The island's infrastructure systems are vital to the community, economic prosperity and quality of life. The categories to consider are Solid Waste, Wastewater, Water, Transportation, Transit, Parks, Public Facilities, Schools and Libraries, Sanitation, Energy, Ports and Airports.

Land Use

The State Land Use Law (Chapter 205, HRS) establishes an overall framework of land use management whereby all lands within the State are classified into one of four Districts: Urban, Rural, Agricultural, and Conservation.

Maui is known for implementing different management tools that allow for the adequate development of the territorial components for the sustainable growth of the island. Some of the management tools are:

- **Maui Island Plan, 2030**
- **Countywide Policy Plan, 2030**
- **Technical Studies and Best Practices Manual, 2003 - 2007**
- **Planning Director's Report, 2009**
- **Maui Nui Destination Management Action Plan, 2021 – 2023**
- **Environmental Protection & Sustainability Program, 2022**
- **County Quarterly Economic Indicators, 2023**

COUNTY OF MAUI · STATE OF HAWAII

HAWAI'I TOURISM AUTHORITY

Environmental Protection & Sustainability Division

H. Lessons Learned

- Maui's management tools emphasize a **holistic approach** that integrates various aspects of development, including **tourism, urban planning, environment, economy, among others.** This interconnected approach ensures a **balanced and sustainable growth trajectory.**
- **Community engagement**, involving local stakeholders in **decision-making processes**. This participatory approach fosters a sense of **ownership and accountability** among residents.
- In 2019, visitor arrivals to the island of Maui reached a **record 3.06 million visitors.**

Source: Maui Island Plan General Plan 2030, 2012

2.1.11.3.2. Galapagos Islands - Ecuador

Figure 137- Prioritized Case Study, Galapagos Islands - Ecuador

02. GALAPAGOS ISLANDS - ECUADOR

A. Location.

B. General Characteristics.

Region:	SOUTH AMERICA
Size:	3,000 mi2 (777,000 Ha)
Estimated Population:	33,042 INHABITANS
Main Economic Activity:	TOURISM
Airports & Ports:	YES
Environmental Value:	PROTECTED AREAS
Planning Instruments:	YES

C. Infrastructure.

D. Positive Impacts by Component

Urban

- Development and Land Use Plan for Each Island
- 22% of land in the urban area is undeveloped
- 90% of the territory has drinking water coverage

Environment

- One of the best-preserved oceanic archipelagos in terms of ecology
- Natural World Heritage Site UNESCO 1979
- The islands are part of the Galapagos National Park.

Tourism

- Concentration of Tourist Sites
- Constant Increase in Tourist Visits
- Tourism is the most important economic activity, accounting for more than 75% of the economy.

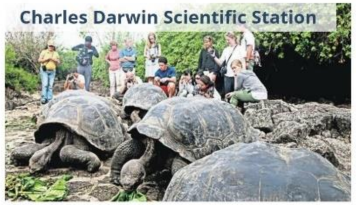
E. Tourist Attractors

Ecotourism ✓ | Adventure ✓ | Heritage | Beaches ✓ | Leisure ✓

Some of the Main Attractions

Tortuga Bay

Charles Darwin Scientific Station



F. Why to study Galapagos?

- It has **many planning instruments** for the different territorial components. **Urban, Environmental and Tourism.**
- **Land use plans** propose different **strategies to regulate, revalue and generate** new developments for **housing, public space and facilities,** among others.
- The **Environmental System** considers the need to **protect the territory** and **not affect the Galapagos National Park**, which encompasses all of the islands.

Key Institutions & Regulations

- ✓ Development and Land Use Plan for Each Island
- ✓ Organic Code of Territorial Organization (COOTAD)
- ✓ Strategic Plan Sustainable Tourism Development 2010 – 2014

Level of Applicability to the Caye

Figure 138 Prioritized Case Study, Galapagos Islands - Ecuador

02. GALAPAGOS ISLANDS - ECUADOR

G. Territorial Planning

Territorial planning in the Galapagos Islands is of vital importance due to its rich biodiversity, its role in scientific research and conservation. Over the years, **several land use plans** have been implemented to ensure sustainable and balanced development in the archipelago. In addition, since the archipelago is composed of several islands, regulations were developed **specifically for each of them. This makes it a powerful reference point for territorial planning.** Some of the key aspects of territorial planning in the Galapagos Islands include:

61 years since the creation of the Galapagos National Park

The Galapagos National Park is the first protected area in Ecuador and is the best-preserved volcanic archipelago in the world. 95% of its endemic flora and fauna remain in an excellent state of conservation.

23 years of special regime

Since 1997, the province has been administered under a special regime established in the Constitution of Ecuador.

Expansion of the Biosphere Reserve

Declared in 1984 by UNESCO, the Biosphere Reserve was expanded in 2019 to 56,371 square miles (14.6 million hectares).

Pioneers in the adoption of the 2030 Agenda.

In 2018, the implementation of the Sustainable Development Goals was adopted in the province, aligning with the Ecuadorian State's commitment to Agenda 2030.

Provincial Planning Assembly

The islands have the first provincial system of citizen participation, which promotes the construction of policies, monitoring and evaluation of the province's planning and regulations. The PPA has 44% citizen representation (14/32 members).

The most relevant regulations developed for the territorial planning of the islands are as follows:

- **Sustainable Development and Land Use Planning for the Special Regime of Galapagos 2030**
- **Development and Land Use Plan of Santa Cruz Canton 2012 - 2027**
- **Development and Land Use Plan of San Cristobal Canton 2012 – 2016**
- **Development and Land Use Plan of Isabela Canton 2012 – 2016**
- **Galapagos Agenda for Good Living 2010**

H. Lessons Learned

- Galapagos has a wide **variety of documents, studies and plans** for the appropriate **territorial planning for each of the islands.**
- **Public and private entities** work together with **citizen participation** to ensure the protection of their **unique biodiversity** and to **promote sustainable development.**
- **Limiting infrastructure and regulating tourism** has prevented overexploitation of resources and habitat degradation, thus protecting the integrity of ecosystems.
- **Land-use planning** in Galapagos is based on an **adaptive approach** that includes **constant monitoring** of ecosystems and development impacts.

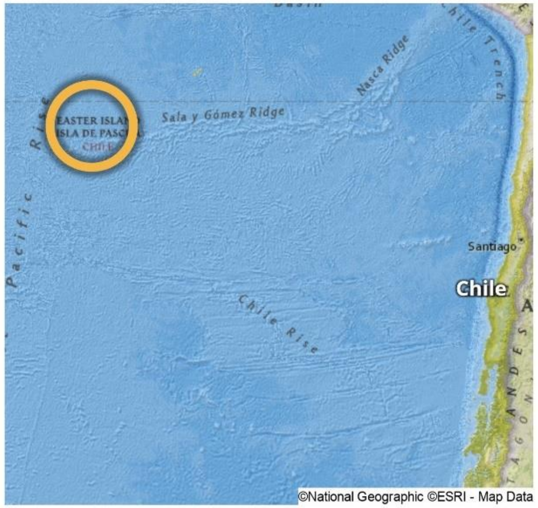
Source: Development and Land Use Plan, 2012-2017

2.1.11.3.3. Rapa Nui - Chile

Figure 139 Prioritized Case Study, Rapa Nui - Chile

03. RAPA NUI- CHILE

A. Location.



B. General Characteristics.

Region:	OCEANIA
Size:	40,320 ACRES (16,326 Ha)
Estimated Population:	7,800 INHABITANS
Main Economic Activity:	TOURISM
Airports & Ports:	YES
Environmental Value:	ARCHAEOLOGICAL SITES
Planning Instruments:	YES

C. Infrastructure.

D. Positive Impacts by Component


Urban

- Regional Insular Land Use Plan
- The proposal of the new Regulatory Plan establishes 755.5 ha for housing development.


Environment

- In 1995, UNESCO declares Rapa Nui National Park a "World Heritage Site".
- Is mainly made up of volcanic rocks and composed of three eruptive soils.


Tourism

- Tourism is the engine of the island's economy
- Constant Increase in Tourist Visits
- Tourism as an activity is developed practically throughout the island territory.

E. Tourist Attractors

Some of the Main Attractions

F. Why to study Rapa Nui?

- Adequately cared for **archaeological values** and appropriate **sustainable tourism management.**
- The island establishes a **limit on the number of visitors** that can access the island in a given period. Limiting the number of tourists helps **reduce pressure on natural and cultural resources.**
- **Continuous monitoring** to evaluate the **impact of tourism** and adjust **management measures** according to the results.

Key Institutions & Regulations

- ✓ Rapa Nui National Park Management Plan
- ✓ Demographic Carrying Capacity study for the Rapa Nui Territory, 2018

Level of Applicability to the Caye

Figure 140 Prioritized Case Study, Rapa Nui - Chile

03. RAPA NUI - CHILE

G. Carrying Capacity

Statistical data shows a **progressive increase in the population residing** on Easter Island or Rapa Nui (National Institute of Statistics, 1982; 1992; 2002; 2014). This has raised concerns within the community, which has expressed the need to address the potential **socio-cultural, environmental, and basic services-related impacts** resulting from or caused by this **population growth**. The community is particularly concerned about two aspects: firstly, the significant migration of individuals, mainly from mainland Chile, drawn by the **economic opportunities presented by tourism**, and secondly, the substantial **tourist population that visits Rapa Nui each year**. Some of the key aspects of the carrying capacity model are:

Drinkable Water

According to the study, by March 2023, the island's drinking water model will reach saturation point with 103,610m3/month.

Solid Waste

According to the study, by September 2024, the island's solid waste model will reach saturation point with 85,085 tons.

Electric Energy

According to the study, in March 2017 the island's energy model reached its saturation point with 842,602.5 kWh/month.

Tourism

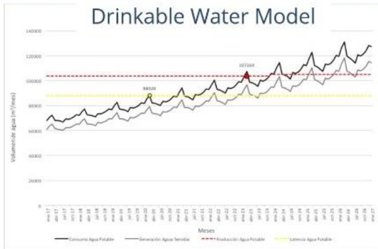
According to the study, by March 2024, the island's tourism model will reach saturation point with 2,779 tourists/month.

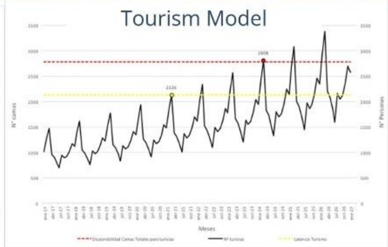
Housing and Occupancy

According to the study, the occupancy model is saturated since its development with an approximate of 4,555 km2 and housing with a total of 3,040 dwelling units in the urban area.

The demographic carrying capacity study was developed by the Universidad Católica de Chile and the Undersecretary of Regional and Administrative Development.

Rapa Nui's demographic carrying capacity is based on the need to balance population growth, tourism and development with the preservation of the island's unique natural and cultural resources. A careful and sustainable approach is essential to ensure a prosperous future for this unique community.





H. Lessons Learned

- **Community involvement** is vital for effective planning, especially in Rapa Nui where the community's **unique insights** and experiences about the territory are essential.
- Rapa Nui's **ongoing population growth** due to natural increase, new arrivals, and temporary residents has raised concerns about the **island's demographic capacity** to support this trend.
- The importance of **balancing tourism development with heritage conservation** and **long-term sustainability.**
- It is essential to have an **integrated management plan** that addresses both **cultural and environmental aspects.**

Source: Demographic Carrying Capacity study for the Rapa Nui Territory, 2018

2.1.11.3.4. Providencia - Colombia

Figure 141- Prioritized Case Study, Providencia - Colombia

04. PROVIDENCIA - COLOMBIA

A. Location.

B. General Characteristics.

Region:	SOUTH AMERICA
Size:	10,880 ACRES (4,402 Ha)
Estimated Population:	4,545 INHABITANS
Main Economic Activity:	TOURISM
Airports & Ports:	YES
Environmental Value:	BARRIER REEF
Planning Instruments:	YES

C. Infrastructure.

D. Positive Impacts by Component

Urban

- Low invasive urban intervention. Priority to environmental growth
- Restriction of construction to investors and independents. Only with OCCRE permits it is possible to build.

Environment

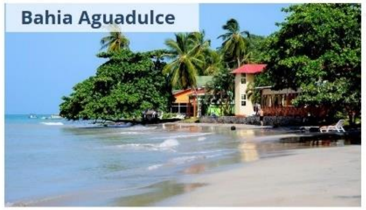
- Coral formations of Providencia and Santa Catalina have an extension of 32 km2.
- The degree of intervention on the island is very low, most of the soil is natural.
- Seaflower Natural Park was declared a Biosphere Reserve by UNESCO in 2021.

Tourism

- Central part of the archipelago's economy.
- Reached a 33.8% share of departmental GDP in 2019
- Providencia has 15 hotels, 314 rooms and 914 beds approximately

E. Tourist Attractors

Some of the Main Attractions



F. Why to study Providencia?

- **Limited growth** due to the fact that **housing construction** can only be **for natives** of the area.
- The island significantly **restricts independent people, investors, and even locals** (Raizales). This allows **urban development and massive growth to be controlled appropriately.**
- Providencia promotes a **wide range of types of tourism**, including **new tourism strategies** that allow for the **care and regeneration of nature** and a sense of local ownership.

Key Institutions & Regulations

- ✓ Departmental Development Plan 2020 – 2023
- ✓ Regional and Urban Economy, 2021
- ✓ San Andres, Providencia & Santa Catalina Islands Tourist Guide, 2022

Level of Applicability to the Caye

Figure 142 Prioritized Case Study, Providencia - Colombia

04. PROVIDENCIA - COLOMBIA

G. Tourism

Colombia, with **0.7% of the planet's continental surface, is home to 10% of the world's biodiversity**, occupying second place after Brazil. This archipelago is in the southwestern Caribbean, off the coast of Central America. It has the **most extensive barrier reefs in Colombia: 78 percent of the coral reef area of the country**. The Providencia barrier reef is one of the most extensive in the western hemisphere, protecting these fine sandy beaches. The **main source of the island's economy is tourism**, which offers many attractions such as nature, nautical, scientific, among others. Below, you can see the key points of tourism.

Nature Tourism

Providencia is a propitious scenario for the enjoyment of ecotourism, sighting of natural species, hiking and other natural activities.

Scientific Tourism

Sightings of turtle nesting, coral reef restoration, related research and environmental education, ecosystem restoration activities, among others, were identified.

Nautical Tourism

Great potential for nautical tourism, creation of marinas, diving, snorkeling, water sports, recovery of beaches for use as recreational areas, among others.

Ichthyo Tourism

Companies specialized in sport fishing consider that Providencia has adequate waters for the practice of ichthyotourism. It is a new method of tourism that has been developing more frequently.

Regenerative Tourism

Aims for deep connections between visitors, local communities, and nature, slowing down the pace of travel to align with sustainability and long-term socio-environmental growth.

As tourism is the main pillar of the island's economy, it must be developed in the most responsible and productive way.

Tourism in Providencia is in a restricted and limited development to maintain adequate control of the floating population. Likewise, different innovative methods allow tourism development to contribute to the regeneration and protection of the natural and cultural values found on the island.

MinCIT Ministerio de Comercio, Industria y Turismo | FONTUR COLOMBIA | viveCOLOMBIA | Gobernación del Archipiélago de San Andrés, Providencia y Santa Catalina | BANCO DE LA REPUBLICA BIBLIOTECA LUIS ANGEL ARANGO

H. Lessons Learned

- Providencia is an island that has been able to **regulate mass tourism** through **permits and restrictions** that only allow **urban developments to be built by local inhabitants.**
- The territory is developed through the **local community and private and public entities**, which has allowed an **active participation of the native inhabitants.**
- Tourism is the **island's main source of income**. For this reason, multiple **innovative strategies** have been developed to promote **new activities and attractions** to aim toward **sustainable and regenerative tourism.**
- One of Providencia's main goals is to **exploit sustainable tourism responsibly** to provide **scientific tourism, ichthyotourism** (fishing tourism), and **regenerative tourism** as tools to **recover** the island's natural environment.

Source: Re-thinking the Tourism Potential of the Department Archipelago of San Andres, Providencia, and Santa Catalina, 2022

2.1.11.4. Lessons Learned

Figure 143 - Lessons Learned from the Prioritized Cases

Source: IDOM, 2023

The following are strategies implemented by the prioritized cases that were successful in their implementation and management to solve problems similar to those of Ambergris Caye:

Figure 144 - Lessons Learned Chart

Source: IDOM, 2023

According to the cases analyzed. Management tools, territorial planning, adequate management of the carrying capacity and the promotion of sustainable tourism are pillars of great importance for the integral and adequate growth of a tourist island such as Ambergris Caye.

2.2. Vulnerability to natural risks

The document presented here corresponds to Module 2 Vulnerability and Natural Risks in Caye of Ambergris, Belize, related to Module 1 Climate Change and Module 3 Urban Growth.

It should be noted that the studies provide general guidelines for territorial planning, according to the scAAL of intervention addressed, as stipulated in the consultancy contract BL T/1150-p001 signed between International Interamerican Banc BIDand IDOM, taking into account the above, although the studies become a fundamental decision-making tool, it is recommended that the municipality advance studies at a more detailed scAAL in case it wishes to execute specific interventions in the risk areas delimited by this study.

2.2.1. Conceptual Framework

2.2.1.1. Methodology

The risk assessment or estimation process described below is based on the IDOM technical team's own criteria, which in turn are mainly based on the working methodologies developed in the document "multi-hazard risk assessment", 2011 version, of the United Nations University and the Dutch ITC School on Disaster Geoinformation Management of the University of Twente, The Netherlands, as well as on the methodological development proposed in the CAPRA platform.

Natural risk analysis is the systematic process of understanding the nature of risk and deducing various disastrous consequences, so that it forms the basis for planning management policies (emergency, prevention, mitigation)

In general terms, natural risk assessment is currently understood as a probabilistic analysis process based on the following sequence of stages:

2.2.1.1.1. Evaluation and calculation of the hazard.

This analysis should identify the causes of vulnerability associated with the prioritized hazards and related to infrastructure or institutional, social, or economic causes.

Due to the lack of information, a susceptibility analysis was carried out through the interpretation and development of maps where zoning can be identified according to their relative degree of susceptibility (high, medium, and low).

2.2.1.1.2. Analysis of exposed elements.

An inventory of critical infrastructure and residential and commercial areas that may be affected by hazards is developed. The information collected on drinking water supply, sanitation, drainage, solid waste collection, types of housing and roads, as well as residential areas was used, considering the predominant constructive and structural typologies in each area.

2.2.1.1.3. Vulnerability estimation.

Vulnerability is the predisposition of a system, element, component, human group or any biological or non-biological group to be affected by a specific hazard. The way in which the studied hazard impacts the exposed elements will be analyzed.

2.2.1.1.4. Risk assessment.

Based on the information on hazards, exposure values and vulnerability functions, a quantitative probabilistic risk analysis is developed in terms of monetary losses and affectations. This calculation includes the maximum probable losses and expected annual losses from the prioritized hazards.

Quantitatively, the hazard can be defined as $P(mi)$ equivalent to the frequency or probability of occurrence of an event (i), expressed as $\%/year$, of a magnitude (mi), defined by parameters such as depth, velocity, volume, energy, etc.

Vulnerability determines the level of exposure and predisposition to damage and loss in the face of a specific hazard. It consists of the identification and evaluation of vulnerable elements and the estimation of the percentage of losses resulting from a hazard or dangerous phenomenon. It can be identified as $V(mi)$ or percentage of the monetary value exposed, in currency (w), that would be lost due to the impact of an event i of magnitude m.

Finally, **risk calculation** consists of estimating the probable losses for the different possible hazardous events, through a process of relating identified hazards to estimated vulnerabilities to determine the social, economic, and environmental consequences. In this case, the monetary value of the damage suffered by the element or system, which means group of elements, under analysis is being incorporated. If the value of the system is defined as $W(\$)$, the mathematical expression of risk that we have been developing would take the following form:

Equation 1 Risk calculation

$$Ri = P(mi) * V(mi) * W \ messure \ in \ \$/year$$

Where:

- Ri: Risk
- $P(mi)$: Probability of Frequency
- $V(mi)$: Vulnerability
- W: Present value of the property

Figure 145 Risk Methodology Evaluation

SOURCE: IDOM 2023

2.2.1.1.5. Utilities

The usefulness of risk studies for municipalities is diverse, it could start from a cost/benefit analysis of mitigation measures to analyze the recovery of the investment or financial protection strategies through insurance, knowing what the premium to be paid should be, or urban development and land use plans that consider natural hazards and prevent the construction of risk. Finally, it is an input for emergency services for the development of their risk management plans.

Within this methodology, being able to carry out the three parts that make up the base studies simultaneously, allows to build the growth scenarios of the study and to consider the studied hazards, as well as the mitigable and non-mitigable risk zones.

Likewise, the methodology makes it possible to analyze the risk situation of the municipalities in a trend scenario of urban growth in the horizon year of the studies.

2.2.1.2. Territorial Framework

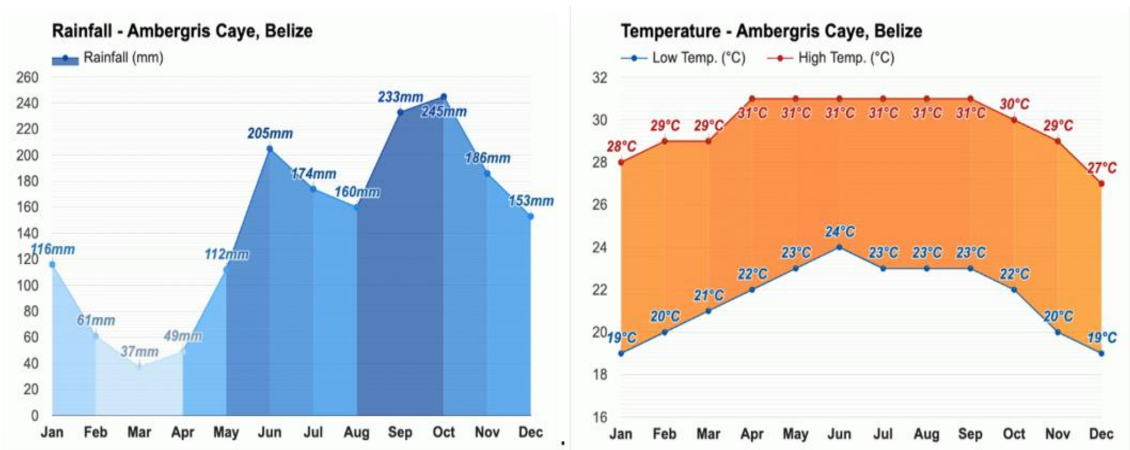
Ambergris Caye, is situated on the Caribbean coast of Central America with Mexico to the North and Guatemala to the west and south. It lies between 15° 45' and 18° 30' N and 87° 30' and 89° 15' W, its terrain is low and flat along coastal areas formed by an accumulation of coral fragments and silt from the Río Hondo as it emptied from what is now northern Belize. The Caye is made up of mangrove swamps, 12 lagoons, a plateau in the north called Basil Jones, and a series of low sand ridges. The largest lagoon, fed by 15 creeks, is the 2.5-mile-long Laguna de San Pedro on the western side of the island." 2 The eastern side of the island is bordered by a low-lying sand ridge that is only a few feet high and approximately 500 ft wide. On the southern part of the island, this sand ridge, along with the lagoons on the west, are underlain by a flat limestone formation.

The island is a 25 mile long, flat, coral sand island, protected on the east by a living reef that extends 185 miles down the coast of Belize. Ambergris is the southernmost extension of the Yucatan Peninsula, a unique Peninsula of porous limestone, also it is a peninsula that runs parallel to the mainland and bordered by the Caribbean Sea to the east and a lagoon to the west

Ambergris Caye was formed by an accumulation of coral fragments and silt from the Río Hondo as it emptied from what is now northern Belize. The Caye is made up of mangrove swamps, 12 lagoons, a plateau in the north called Basil Jones, and a series of low sand ridges. The largest lagoon, fed by 15 creeks, is the 2.5-mile-long Laguna de San Pedro on the western side of the island Ambergris Caye has two climatic seasons, the first one from January to May with an average monthly rainfall between 37mm and 116mm, and the second season with an average monthly rainfall between 153mm and 245mm. This shows that the Caye has a unimodal behavior, in which throughout the year there is only one season with more rainfall and one season with less rainfall.

Likewise, with the information collected, it can be observed that in the rainy season there are between 5 and 10 days of rain during the months, and for the rainiest season, between 12 and 15 rainy days are recorded during the months.

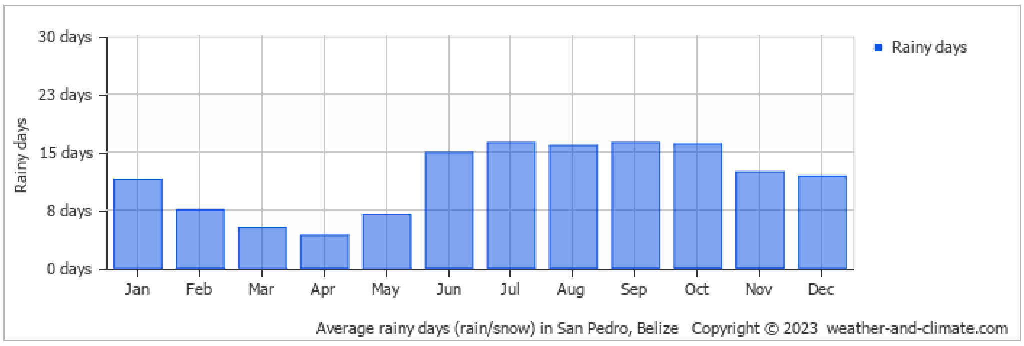
Figure 146 Average Rainfall and temperature in Ambergris Caye since 2005 to 2020



Source: National Meteorological Services of Belize (July 2023)

Being a tropical climate, the Caye has average minimum temperatures of 19°C in the months of December and January. Likewise, there are average maximum temperatures of 31°C between the months of April and October.

Figure 147 Average Rainy days



Source: National Meteorological Services of Belize (July 2023)

The beaches on Ambergris Caye are unlike many Caribbean countries. They are very narrow stretches of white sand dotted with many coconut palms and other native flora. Most of the mangroves have been cleared on the stretch of beach from the San Pedro River down to The Victoria House Resort. The beaches are located only on the eastern coast of the island where the water at the shore is shallow, and the seabed dominated by heavy seagrass, making swimming not particularly enjoyable.

In Caye there is also a very important ecosystem, The Mangroves. Three (3) mangrove species exist in Belize, and include the Red Mangrove, the Black Mangrove and the White Mangrove. All three (3) species of mangroves are found on Ambergris Caye. In terms of ecology-related ecosystems services, mangroves are a major provider of fish biomass that pay dividends in terms of issues of food security, foreign exchange earnings and income. They perform an important nursery function for a wide range of finfishes and invertebrates that inhabit the reef system, seagrass beds and open ocean during the latter stages of their life cycle.

The rapid spread of urbanization and general resort development on the southern portion of Ambergris Caye has resulted in major land-clearing and reclamation activities that have greatly decreased the number of mangroves in the area. Mangrove clearance on both southern and northern Ambergris Caye continues to be a growing problem.

2.2.1.3. Background information

In Ambergris Caye there have been some researches and works based on climate change, with their recommendations for adaptation and mitigation of the effects produced by these changes in the historical climatology of the region. These have served as the basis for the present studies and therefore the most important conclusions of each one will be presented.

In 2008, the Worldwide Life Fund developed a study to determine how climate change and other natural hazards affect the coastal inhabitants of the Mesoamerican Reef (MAR) in order to include their perspectives in conservation and management strategies to increase their adaptive capacity. (World Wildlife Fund, 2008)

The Ambergris Caye community identified the loss of mangroves as one of the main problems at this time.They consider that this loss supports the development of other major problems such as erosion, increased sedimentation, loss of natural buffering, loss of nursery habitats and loss of the natural filtration system, among others.

As a result of this and through the methodology used by WWF, which includes three phases (Problem Tree, Timeline and Mapping) the community also identifies hurricanes as the main natural threat that leads to the destruction of coral reefs, major flooding on the island, evacuations, and economic losses among other problems. (World Wildlife Fund, 2008)

Currently the community propose some initiatives to reduce the degree of vulnerability such as a proper planning for future developments, identification, and enforcements of critical areas for species protection and recreation, an update of San Pedro master plan, action to protect the remaining wetland areas and mangrove restauration where possible.

Because of these initiatives one year later was release a revised master development plan for Ambergris Caye, where it was identified by experts the community profile, the existing conditions of population, tourism, land use, infrastructure, and natural resources also it was developing a statement of issues, goals, and recommendation within an action plan. However, some of the recommendations made on it, were not followed so the problems identified in 2008 continued to develop until the current state of the natural ecosystems and the island's vulnerability to natural hazards.

Following this some experts start to develop their own investigation with available tools and information on the internet. Therefore in 2010 the university of Oxford and Alabama Huntsville with a 30-year satellite imagery available analyzed the forest cover of Belize at national level. Based on multi-temporal, automated classification of satellite imagery of Belize, it was determined that Belize's forest cover has declined over the thirty years between 1980 and 2010. Forest cover in mid-November 1980 was estimated at 4.2 million acres, or 75.9% of Belize's land territory, while that cover had fallen to 3.4 million acres in late February 2010, or 62.7% of the country's land territory. While the highest rate of deforestation registered was the over 70,000 acres cut annually in the period 2000-2004, between 1980 and 2010, on average almost 25,000 acres of forest have been cut annually. This amounted to a loss of 0.6% of Belize's forest cover annually, or a loss of 17.4% of Belize's 1980 forest cover in the past thirty years. (Emil A. Cherrington, 2010)

In addition to this initiatives in 2016, the Coastal Zone Management Authority & Institute with the Ministry of Agriculture, Forestry, Fisheries, The Environment & Sustainable Development release the Belize Integrated Coastal Zone Management Plan where it was identify the coastal area of Belize,and its value, it was also identify the coastal issues and propose an initiative for sustainable coast beside a propose of implementation and coordination plan in which it was contemplate building alliances to benefit Belizeans and a implementation of strategies to adapting to climate change were it was prioritize the ecosystem based adaptation. Following these actions, it was also developing a socio-economic adaptation capacity where it was defining the responsibilities of each ministry.

In 2018, some Academic experts of Alabama University measure the land-use and land-cover change in biodiverse, tropical countries as critical for conservation management. This project used Landsat satellite imagery to document vegetation cover change on Ambergris Caye, Belize, from 2000 to 2017. The results of this study indicate a 10.85% decrease in vegetation and a 39% increase in urban and barren land during the seventeen-year study period with an annual forest loss rate of 0.67% per year using a compound interest rate formula. (Brenna M. Sweetman, Jordan R. Cissell, Sandra Rhine, Michael K. Steinberg, 2018)

Following this, in 2020, the University of Alabama also release and article base on remote sensing in which they use public earth observation data for tracking progress in sustainable management of coastal forest ecosystems in Belize, Central America. This paper examines historic and recent changes in mangrove cover across all of Belize, applying statistical adjustments to rates of change derived from Landsat satellite data. The Belize Barrier Reef Reserve System (BBRRS), where mangrove clearing was prohibited since the site's designation in December 1996. The data indicate that within the BBRRS, approximately 89 ha of mangroves were lost from 1996 to 2017, compared to the estimated loss of 2703 ha outside the BBRRS during the same period, and nationwide loss of almost 4100 ha from 1980 to 2017. Thus, compared to the mangroves outside of the BBRRS, the annual rate of mangrove loss within the BBRRS over the period 1996–2017 was merely 4.24 ha per year, versus 129.11 ha per year outside the BBRRS. Furthermore, almost 75% of the 1996–2017 mangrove loss outside the BBRRS were concentrated in three geographic zones associated with tourism infrastructure. (Emil A. Cherringtona, Robert E. Griffin, Eric R. Andersona, et all., 2020)

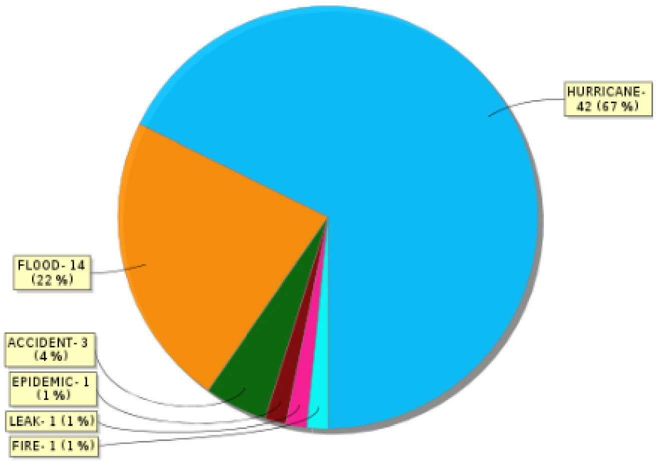
Therefore, in 2021, again the World Wildlife Fund starts a project called "The Smart Coasts Project" which is aiming to increase the capacity of National Governments, Marine Protected Areas (MPAs), and coastal communities in the Mesoamerican Reef (MAR) region to be able to adapt to the ever-increasing threat posed by global climate change. In Belize, three regions have been identified by the project -the Northern Regional Planning zone, the Ambergris Caye Regional Planning zone, and the Southern Regional Planning zone. The sites identified by the ongoing project were chosen due to the importance of biodiversity in the region, the vulnerability of the local populations to climate change, and the lack of capacity in those communities to be able to adopt adaptation strategies. (World Wildlife Fund, 2008)

One of the last projects in the Caye was coordinated by scientists from Grassroot Biodiversity of Belize, which was based on shoreline management, especially for Boca del Rio, where a restoration of the shoreline based on natural solutions was considered and special areas were identified for the red mangroves and natural vegetation of the island. vegetation Also the necessity of LIAR Dems, orthophoto-mosaic, and sediment pathway data was enunciated.

2.2.1.4. Past events

In Ambergris Caye there have been approximately 62 events considered as natural hazards, of which 67% have been classified as hurricanes, 22% as floods and the remaining 11% as epidemics and fires.

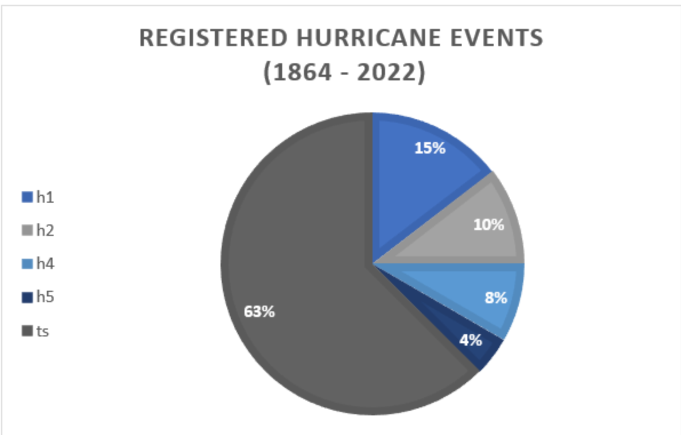
Figure 148 Number of hazards events registered in Ambergris Caye



SOURCE: DESINVETAR SENDAI DEVELOPED BY UNDRR (JULY 2023)

Following this it is going to be presented the historical record of hurricanes that had influence on the Caye between 1864 and 2022. In Figure 3 it is shown events between 1864 until 2022. Among these years there was registered 7 events classified as Hurricane h1 with average winds between 75 and 92 Km/h, 5 hurricanes classify as h2 with average winds between 98 and 109 km/h, also there was registered 4 hurricanes as H4 with wind between 132 and 155 km/h and there was registered 2 events as hurricane H5 with average wind of 173 km/h.

Figure 149 Registered Hurricane Events



Category	# Events
h1	7
h2	5
h4	4
h5	2
ts	30

SOURCE: IDOM 2023

In addition to this data, there is also 30 tropical storms registered between 1864 and 2022 with an average winds of 40 and 69 km/h.

In 2016, Hurricane Earl, a category one hurricane, battered the coastal areas of Belize on Thursday, August 4th, leaving a massive trail of destruction along its path. The final damage assessment by the National Emergency Management Organization (NEMO) for both Ambergris Caye and Caulker, amounts to millions of dollars in material losses. A total of 94 families on both islands were severely affected by the storm. (National Meteorological Service, 2023)

NEMO reports around $30,000 in damages to households in both Ambergris Caye and Caye Caulker were incurred. Along the eastern coast of Ambergris Caye, from the 252 docks that line the coast, 227 were affected, while 135 were destroyed. The assessment also includes several dive shops which were partially or destroyed due to the strong winds and surges caused by the hurricane. The grand total in damages is estimated at $11 million dollars. According to the report from NEMO, each dock is estimated to cost between $80,000 and $95,000 without any additional structures on them. (The San Pedro Sun, The Island Paper, 2016)

Photo 22Damage caused by Earls Hurricane

SOURCE: (The San Pedro Sun, The Island Paper, 2016)

2.2.2. Objectives

Given the above context, HUD requires services from a consultancy firm to develop multisectoral diagnosis assessments, a vulnerability to natural risk study, an urban footprint and demographics prospective analysis, an estimation of the current and future carrying capacity of the Island, a set of project proposals for the short, medium and long term, a financial plan, a zoning plan, and the elaboration of pre-feasibility designs for two prioritized projects.

2.2.2.1. Specific Objectives

- Vulnerable areas identification and characterization: Identify and provide specific sectoral information of at least two informal or vulnerable urban areas, which will have specific integral proposals in the following phase of the consultancy.
- Vulnerability to natural risks and GHG emissions inventory:
    - The objective of the Vulnerability study is to get a better understanding of the risks the Caye faces from natural hazards, including increasing hazardous risk due to climate change, and to facilitate adequate planning. Consider at least three prioritized hazards, as coastal flooding/storm surge (under consideration of different levels of sea level rise), inland flooding, hurricanes and tropical storm-strength winds, seismic activity and its effects, wildfires, heat waves, or coastal erosion (also considering sea-level rise), among others. Consider effects of changes in minimum or maximum temperatures, precipitation, insolation, and in seasonal climatic patterns (i.e., food and water shortages). Identify public and private key actors on the local and national levels. Institutional capacities and opportunities regarding risk reduction shall be assessed and current relevant initiatives identified (i.e., in the areas of urban planning, definition of land use regulations, development planning and institutional budgets). Identify infrastructure-related, institutional, social, and economic causes of vulnerability associated with the prioritized hazards.
    - For inland flooding, coastal flooding, seismic activity and its effects, and hurricane strength winds develop a probabilistic disaster risk analysis including:
        - Past, current, and future hazard trends (under consideration of climate change scenarios and hazards' interplay if applicable).
        - Exposure value calculation including an inventory of critical infrastructure and residential and commercial areas that may be affected by those hazards (i.e. health infrastructure, potable water supply, sanitation, drainage, electricity supply, solid waste collection, housing, and roads).
        - Define the physical vulnerability function of each type of construction and infrastructure for the considered hazards.
        - Based on the information of hazards, exposure values and vulnerability functions, develop a quantitative probabilistic risk analysis in terms of physical and human losses.
        - Develop maps to illustrate the results of the probabilistic disaster risk analysis. Climate change projections for Ambergris Caye shall be applied to the analysis. Calibrate risk and susceptibility maps and risk calculations using information on historical losses. The risk and susceptibility assessments shall be conducted for the urban growth scenarios to determine how these will influence future vulnerability.

2.2.3. General Framework

2.2.3.1. Hazards prioritization

According to the terms of reference associated with this study, the vulnerability to climate risks must consider at least three prioritized hazards. It is also noted that the Caye may face threats such as coastal flooding/storm surge, inland flooding, hurricanes and tropical storm-strength winds, seismic activity and its effects, wildfires, heat waves, and coastal erosion.

To prioritize three different climate threats, the decision needed to be supported by various factors that could determine the threats with the greatest impact and repercussion within the study area. These factors should also provide significant input, either due to limited study, a change in calculation methodology to improve the robustness of results, or in alignment with the consultancy's objective of developing a zoning plan and prioritizing two feasibility studies. Furthermore, the technical analysis, in line with the consultancy's objective, should emphasize the Northern area of the island, where the exposure is lowest. Therefore, the threats must be well-defined during the hazard definition stage, both to enhance risk assessment in the exposed zones and to facilitate zoning in the Northern area.

The factors considered, considering economic conditions and time availability, include reviewing past, ongoing, or future studies on different threats to gather qualitative information that could serve as a basis for threat prioritization, utilizing available and useful data from other organizations or institutions if available, and collecting inputs from stakeholders interviewed during the initial mission.

After conducting a qualitative review of secondary information, it has been identified that the most significant and prominent threat to the island is coastal erosion and degradation of natural systems, especially mangroves. The "Revised Master Development Plan for Ambergris Caye" mentions, for example, dredging, beach erosion, the condition of mangroves and the barrier reef, and ecologically sensitive systems. Among these identified environmental threats, the one most relevant to this study, according to our understanding of climate risk, is beach erosion. Regarding this threat, the study does not reflect quantitative data but qualitatively indicates that this threat, "although a natural phenomenon, has accelerated in recent time and is attributable to numerous causes mainly those of man's activities in various kinds of beach engineering such as the clearance of mangroves, the reclamation of land from the sea, the construction of piers, and the dredging of sand offshore, all of which affect the littoral drift and the consequent shift and deposition of sand" (Cardona, M. & Cardona, K, 2009, p.35).

On the other hand, the "NATIONAL SUSTAINABLE TOURISM MASTERPLAN FOR BELIZE 2030" from 2011 speaks in much more general terms about climate change and its associated threats, without emphasizing any threat. Additionally, the SMART COASTS project on Climate-Smarting Marine Protected Areas and Coastal Management in the Mesoamerican Reef Region, led by WWF in collaboration with various institutions, prioritized a Coral Reef Restoration Program without referring to or defining any other specific threat within the territory. This same program identifies Ambergris Caye as an area of high mangrove and coral protection and restoration.

Therefore, the secondary information pointed to hurricanes and coastal erosion as the main threats. Thus, it is necessary to focus specifically on these threats and examine the level of analysis available for both within the study area. More specific information will be developed in the storm surge section, but for this hurricane-related threat, public information from the NHC was found that allows for a comprehensive risk assessment, with a focus on critical exposure and vulnerability of systems.

For the other threats that have been identified from the initial analysis, no qualitative data, maps, or zoning associated with these threats have been found. Therefore, the prioritization should be based on the perception of the island's residents and stakeholders.

2.2.3.2. Physical Environment Description

2.2.3.2.1. Geology and Morphology

The Basil Jones well, drilled on Ambergris Caye, includes nearly 8500 feet of rocks that tell the geologic story of the caye. Its foundation is made up of Cretaceous and Tertiary limestones which were formed from the accumulation of shells and reef debris.

Glaciers alternately advanced and retreated across the continents during the Pleistocene Period, and as they advanced and ice built up, global sea levels dropped and exposed the limestones on the caye to rainwater, which resulted in the formation of many caves and sinkholes (cenotes) on the caye. These features are known as "karst". As the glaciers retreated, global sea levels rose, and new limestones were formed. Four sea level falls and rises are recorded by the Pleistocene limestones on and under Ambergris Caye. It is important to note that many of the limestone rocks underlying the island may have been subjected to karstification at some time in their history and that these systems of cavities may be interlinked. Above the limestone, the island is bordered on the east by a low, unstable beach ridge, only a few feet high and about five hundred (500) feet, which runs parallel to the barrier reef. It has been reported that the beach at San Pedro has retreated substantially in the last twenty (20) years, as the beach has a steepness indicative of erosion and strong winds capable of aeolian transport blowing directly onshore for a significant number of hours in each year. (Malikah Cardona; Kamilah Cardona, 2009)

2.2.3.2.2. Hydrogeology

Fresh groundwater on Ambergris Caye is limited and is found within the beach ridge which runs for most of the length of the island. There is also a small volume of freshwater that can be pumped out of the several interconnected cenotes on the island. As majority of the beach ridge has been and continues to be developed, high levels of contaminants are present in the groundwater. (Malikah Cardona and Kamilah Cardona,, 2009)

2.2.3.2.3. Mangroves

There are three species of mangroves growing on Ambergris Caye and throughout Belize, the red, the black and the white. Since the soils on Ambergris Caye are poor in nutrients many of the mangroves are relatively small. Some of the mangroves that are growing on the southern part of the island in richer soil attain heights of up to fifty (50) feet. 39 Mangroves can be considered as one of the most important ecosystems on Ambergris Caye for several reasons. They help add dry land to the island, protect the shoreline, provide shelter for juvenile marine life and are the beginnings of a food chain for some marine life. Despite the significant importance that mangroves have on the environment, they are rapidly being cleared to make way for new mega - developments. Sea walls are often put up in their absence, to prevent erosion but, as was explained earlier, may have adverse effects. (Malikah Cardona and Kamilah Cardona,, 2009)

2.2.3.2.4. The Barrier Reef

The most important threats to the reefs in Belize arise from natural disturbances, such as hurricanes, coral diseases, Diadema (sea urchin) mortality, coral bleaching, and sea level rise, as well as from anthropogenic threats like nutrient enrichment, sedimentation, over-fishing, direct damage (from boat and diving activities), and oil spills. Protection and management of coral reefs in Belize is achieved through a network of Marine Protected Areas that include areas within the offshore atolls, areas in the Northern Province (Bacalar Chico, Cay Caulker), the central province (South Water Cay), and the southern province (Sapodilla Cays). (Malikah Cardona; Kamilah Cardona, 2009).

2.2.4. Trip Field May 2023

The field visit, which forms the basis of this analysis, took place from May 8 to 20, 2023. Its primary purpose was to kick off the project by engaging with key stakeholders and establishing a common starting point for data collection and methodology presentation. Specifically focusing on disaster risk management, climate change, and adaptation to climate hazards, the methodology was shared with interviewed stakeholders, who were asked various questions to gather valuable local knowledge and technical insights for prioritizing actions.

During the field visit, technicians involved in coastal protection measures for the GrassRoots project were interviewed. They highlighted **coastal erosion** as the main threat to the island, along with recent issues of water scarcity and rising water tables combined with saltwater intrusion. Insights from the tourism association revealed the significant environmental impact of sargassum and its influence on tourism, as well as the impacts of storms that "wash everything away."

A meeting with Valentine Rosado, the science advisor of the city council, provided evidence supporting the reports available to date and reaffirmed that coastal erosion is the primary threat. Rosado emphasized the importance of beach restoration projects and emphasized that a considerable portion of the erosion is attributed to poorly planned human adaptation and ineffective temporary solutions. The meeting with Mr. Victoriano Pascual, CEO of the Ministry of Agriculture, held in Belmopan, did not yield any specific outcomes concerning the main threats to the island. However, discussions with NEMO (National Emergency Management Organization) highlighted that household fires and hurricanes, particularly the strong winds they bring, cause significant damage on the island. The reports from the Damage Assessment Needs reflect the most affected areas of the island.

In summary, coastal erosion emerged as the most concerning threat to the inhabitants and leaders of San Pedro and the island as a whole. Hurricanes, with their powerful winds, also pose considerable devastation, while flooding affects houses despite the community's ability to manage the impact based on the duration of water exposure.

2.2.5. Storm Surge Flooding

Storm surge flooding is a critical climatic hazard that poses a significant threat to coastal regions worldwide. In the specific context of Ambergris Caye, Belize, understanding storm surge flooding is crucial for developing effective guidelines for territorial planning and mitigating the risks associated with this hazard.

Storm surge occurs when strong winds associated with a tropical cyclone or severe storm push large volumes of water toward the coastline, resulting in a rapid increase in sea level above the normal tidal range. In the case of Ambergris Caye, the combination of these factors can lead to severe flooding, impacting both the natural environment and human settlements.

The severity of storm surge flooding depends on various factors. The intensity and size of the storm, the angle of approach, and the local bathymetry play crucial roles in determining the extent of the flooding. Additionally, the presence of coral reefs, coastal vegetation, and barrier islands can influence the degree of protection and wave attenuation experienced by the island.

The consequences of storm surge flooding in Ambergris Caye can be substantial. The sudden rise in sea level can lead to the inundation of low-lying areas, causing damage to infrastructure, disruption to essential services, and potential threats to human safety. Coastal erosion and the destruction of critical habitats are among the long-term impacts that can significantly affect the island's social, economic, and ecological systems.

Photo 23 Example of storm surge flooding in Ambergris Caye, caused by Hurricane Julia (2022)

Source: ambergriscaye.com (July 2023)

By recognizing the risks associated with storm surge flooding in Ambergris Caye and implementing proactive measures, it is possible to enhance the island's resilience and reduce the impacts of this climatic hazard. Territorial planning that takes into account the dynamics of storm surge flooding can contribute to the protection of both human communities and the valuable ecosystems that make Ambergris Caye a remarkable and cherished destination.

The following sections expose the process carried out in the analysis of storm surge flooding risk assessment in Ambergris Caye

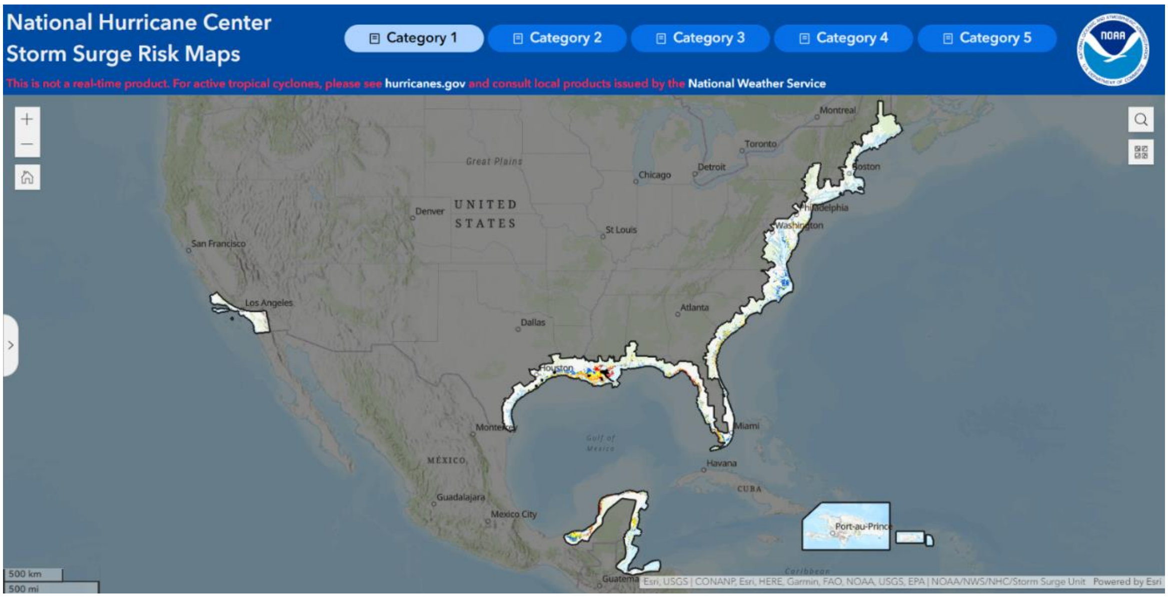
2.2.5.1. Hazard definition

Defining the hazard is a crucial step in understanding the risks associated with cyclonic storm surges. This process involves identifying the specific zones that are susceptible to the impacts of these events. By accurately defining the hazard, policymakers, urban planners, and communities can develop appropriate strategies and guidelines to mitigate the potential consequences. In the context of Ambergris Caye, Belize, where the vulnerability to cyclonic storm surges is significant, a comprehensive understanding of the hazard is essential for effective territorial planning and risk management. This section aims to provide an overview of the hazard definition process and its significance in assessing storm surge flooding risks in Ambergris Caye.

For the definition of the hazard, the modeling procedure conducted by the National Hurricane Center (NHC) of the National Oceanic and Atmospheric Administration of the US (NOAA) has been employed. The NHC utilizes sophisticated modeling techniques to simulate and forecast the behavior of hurricanes, including their associated storm surges. Through the collection and analysis of various meteorological data, such as wind speed, pressure, and storm track information, the NHC develops computer models that can accurately predict the potential impact of hurricanes on coastal areas. These models take into account factors such as the storm's intensity, size, forward speed, and the specific coastal topography of the region under consideration. By utilizing the NHC's modeling procedure, stakeholders in Ambergris Caye can gain valuable insights into the potential threat of storm surges.

The NHC provides Storm Surge Risk Maps for the U.S. Gulf and East Coasts, Hawaii, Southern California, U.S. territories - Puerto Rico, U.S. Virgin Islands, Guam, and American Samoa. Additional international areas that are mapped include Hispaniola and parts of the Yucatan Peninsula, like Belize and its cayes, is its shown in the illustration below.

Figure 150 NHC Storm Surge Risk Maps Portal



Source: National Hurricane Center and Central Pacific Hurricane Center

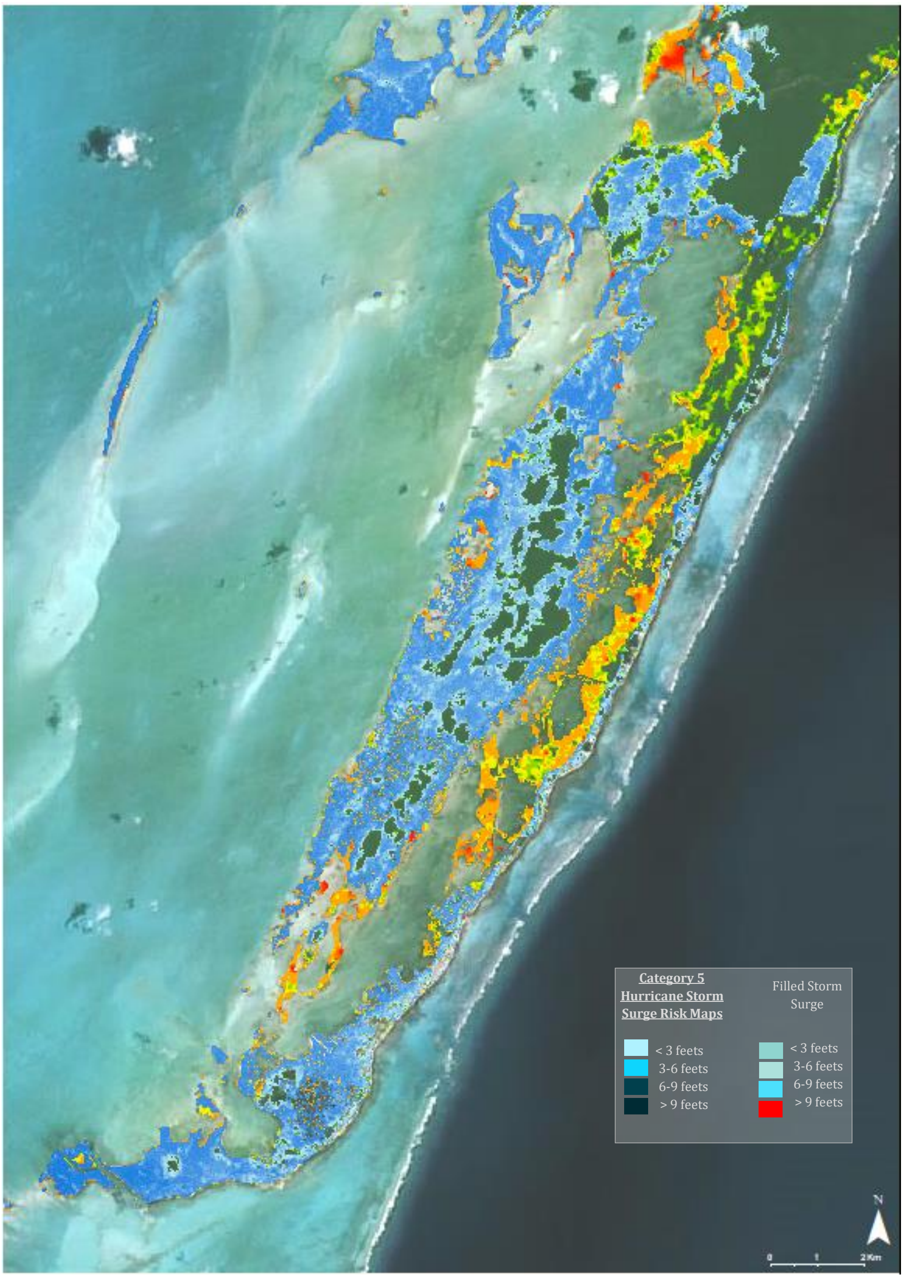
As mentioned, the National Oceanic and Atmospheric Administration (NOAA), particularly the National Weather Service's (NWS) National Hurricane Center (NHC), employs the hydrodynamic Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model to simulate storm surge caused by tropical cyclones. The SLOSH model generates simulations of tens of thousands of hypothetical tropical cyclones based on climatology within each SLOSH basin or grid, allowing the calculation of potential storm surges. To assess and visualize storm surge risk under varying conditions, storm surge composites such as Maximum Envelopes of Water (MEOWs) and Maximum of MEOWs (MOMs) are created.

Regarding de Digital Elevation Model (DEM), during the modelling process for international areas outside of the U.S., like Belize, the analysis of the NHC uses TanDEM-X (TDX) DEM data provided by German Aerospace Center (DLR). The resolution of this DEM is 0.4 arc seconds in latitudinal direction and varies in longitudinal direction between 0.4 arc seconds (equator) and 4 arc seconds (85 degrees N/S) (Wessel, 2016).

This modelling process has been taken as a reference, and it is a perfect base for a risk analysis in the island, that helps real state and sustainable development. However, the Storm Surge Risk Map of the NHC referring to Ambergris Caye have been processed in order to adapt its information to the purpose of the study. Firstly, it has been noted that there is a certain lack of information on flood depth. This leads to the appearance of holes between the coast area and inland zones. Missing information on flooding water depth can create a significant gap in our understanding of the potential impacts of flooding events. Specifically, when there is a lack of data or knowledge regarding water depth, a crucial hole emerges between the coastal areas and the inland zones. This gap hampers our ability to accurately assess the extent of flooding and its associated risks. To solve these problems, the flooding has been expanded as it interplays with the topography, and outliers' values have been removed, obtaining a definitive version of the Storm Surge Risk Maps in Ambergris Caye. In addition, some spatial incoherence has been observed, with pixels of 8-9 feet depth data, not corresponding to the caye's topography. To complete the information and generate a robust model of the hazard spatial distribution, topography and flooding areas have been completed using digital elevation model ALOS PALSAR 12,5m.

In this manner, the hazard has been defined, allowing to identify the zones potentially affected by storm surges in the island. The different maps for each hurricane category are showed in annex B0. Hurricane Category 5 storm surge map is showed below as a matter of exemplification:

Figure 151: Category 5 Hurricane Storm Surge Risk Map



Source: IDOM, 2023.

2.2.5.2. Climate Change

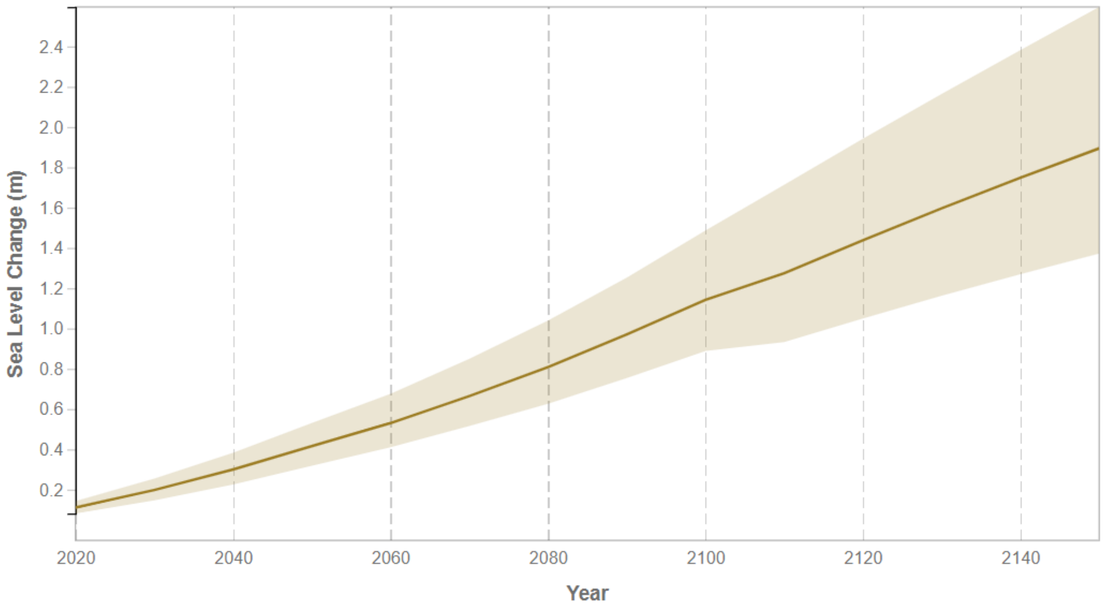
Once the storm surge hazard has been defined, this chapter proceeds to explain the expected variation of this threat due to the effects of climate change. In particular, the effect of sea-level rise will be analysed, as global temperature increases will result in rising ocean levels, multiplying the risks of the analysed inland flooding.

To calculate this rise in sea levels on the island, the sixth report from the IPCC (Intergovernmental Panel on Climate Change) has been consulted, which includes applied models for global and regional sea-level rise under different emission scenarios and timeframes. The IPCC's sixth report dispose of a tool[1] to navigate through the data and generate several insights.

Sea level change for Shared Socio-Economic Pathways (SSPs) resulting from processes in whose projection there is enough confidence according to the IPCC criteria, and the projections are relative to a 1995-2014 baseline.

Within the study area that affects this research, the available data on the IPCC platform indicate a sea-level rise of 1.38 feet by 2050, based on the SSP5-8.5 scenario. The following plot represent this sea level rise projection in meters, with a shaded range which shows the 17th-83rd percentile ranges.

Figure 152:Projection of sea level change in a SSP5-8.5 scenario in the spatial scope of the caye.



Source: IPCC AR6

With this projected sea-level rise by the IPCC for the study area, the hazard maps for the island have been recalculated, increasing the flood values considering the new globally increased sea level of 1.38 feet[1], and serving as a new hazard defined value to calculate risk and its associated quantitative measures.

2.2.5.3. Exposure

Once the hazard has been defined, we now proceed to analyze the exposure to this hazard. This section will present an assessment of the equipment, infrastructure, and buildings that are subject to the risk of flooding. Understanding the exposure to flood risk is essential for evaluating the vulnerability and potential impacts on critical assets and structures within the study area. By identifying and assessing the elements at risk, including key facilities, transportation networks, residential areas, and essential services, we can gain insights into the potential consequences of flooding events.

[1] IPCC AR6 Sea Level Projection Tool: https://seAALvel.nasa.gov/ipcc-ar6-sea-level-projection-tool

In order to analyze the exposure, a digitization process was conducted to map the buildings on the island. This digital representation allows for the integration and cross-referencing of the buildings with our hazard maps. This process has resulted in the generation of **5,242 digitized infrastructure.** Since the detection has been made using an orthophoto of satellite imagery, the type of building, infrastructure of construction has not been defined. Once the building layer has been generated, exposure maps can be derived, providing insights into the extent to which different flood scenarios affect these structures. The following figure presents the results of this exposure analysis, highlighting the potential impact on the buildings in the study area.

Figure 153: Example of digitalized infrastructure for exposure analysis. Details of scales 1:25000 (left) and 1:7000 (right)

Source: IDOM, 2023.

A cartographic cross-referencing of the flood layers and the digitized buildings layer allows us to identify the number of buildings affected by each event, depending on their return period. The overall number of buildings affected in each flood is presented in the following table

Table 48: Buildings affected in each storm surge flood.

Number of affected infrastructures				
Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**
3,910	3,910	3,927	3,332	4,232

Source: IDOM, 2023.

2.2.5.4. Vulnerability

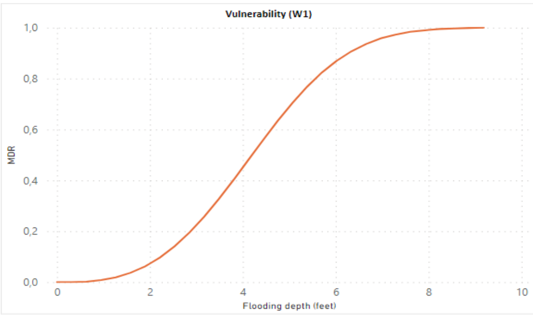
The vulnerability analysis focuses on understanding how susceptible the buildings are to flood-induced damage and the potential consequences of flooding events on their structural integrity. In this analysis, the materiality of the buildings has been examined, based on field data collected regarding the walls materials and observed construction quality. By considering these factors, it is possible to assign a level of damage to each building, depending on the depth of inundation it experiences.

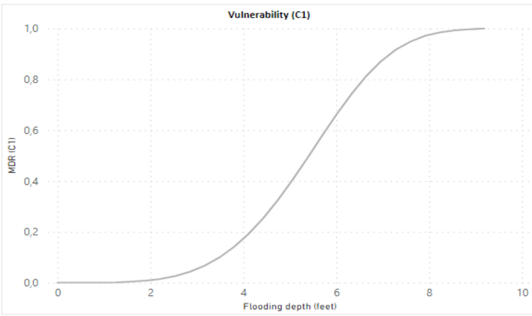
Understanding the vulnerability of buildings provides valuable insights for decision-making processes related to disaster preparedness, response planning, and targeted interventions. It helps prioritize resources and identify areas where mitigation efforts should be focused to minimize the potential impacts of flooding and enhance the resilience of the built environment. Factors such as the type of walls (e.g., masonry, wood, or reinforced concrete) and observed quality of construction play a vital role in determining vulnerability to storm surge floodings. Buildings with weaker construction and less flood-resistant features are generally more vulnerable to damage when exposed to higher water levels.

In order to calculate the external damages caused by each event, the ERN-Vulnerability curves stablished by CAPRA methodology have been consulted. These curves define a percentage of damage associated with the value of the property. The Mean Damage Ratio (MDR) curves determine the average damage based on the flooding depth and construction materials. These curves provide us with information about the vulnerability of buildings, indicating to what extent they will be affected for each event value.

Regarding the construction materials for the walls characterized in the study, three types of wall materials have been differentiated based on their vulnerability to floods: concrete, wood and mixed buildings (as mix structures combining concrete and wood, and the curve derived from the other two). The ERN-Vulnerability curves for these materials are illustrated on the figures below.

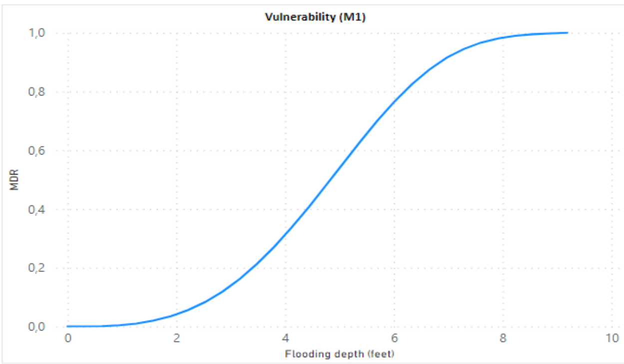
Figure 154: ERN-Vulnerability curve for wood buildings & Figure 155: ERN-Vulnerability curve for concrete buildings





Source: IDOM, 2023.

Figure 156: ERN-Vulnerability curve for mixed buildings



Source: IDOM, 2023.

It should be noted that the construction of certain buildings on piles, as shown in the following images taken in the field, has also been taken into consideration. Based on the field visits and insights gained from the island's residents, it has been observed that a significant majority of the infrastructures are elevated. This elevation is achieved through various means, such as the inclusion of steps, fences, raised platforms or piles. Notably, the implementation of piles is particularly evident in the neighborhoods of San Mateo and San Pedrito. Therefore, iwt has been considered that the risk in these elements would begin to be counted as of a certain height, displacing the curve so the MDR would start from 3.28 feet for the whole island buildings, and 5 feet in the case of San Mateo and San Pedrito.

Photo 24 ERN-Vulnerability curve for mixed buildings

Source: IDOM, 2023.

2.2.5.5. Risk definition

By combining the hazard, exposure, and vulnerability analyses, a comprehensive understanding of the risks associated with flooding events can be achieved. Once the hazard and its exposure on the island, as well as the vulnerability of the exposed buildings, have been analyzed, we can proceed to evaluate the risk. By considering the potential damages caused to the buildings by each flooding event, along with the probability of occurrence for each event, it is possible to generate a risk map that categorizes and prioritizes areas of action on the island.

Risk on the island has been statistically calculated through the determination of Average Annual Loss (AAL). AAL is a measure used in risk assessment to estimate the average annual economic losses that a society or organization could expect to experience due to hazardous events or phenomena such as earthquakes, floods, or fires. To calculate the AAL, the annual probability of occurrence of the hazardous event is multiplied by the expected economic losses in the event of its occurrence. It is important to note that the AAL does not indicate the expected losses in a particular event but rather the average annual losses expected over time.

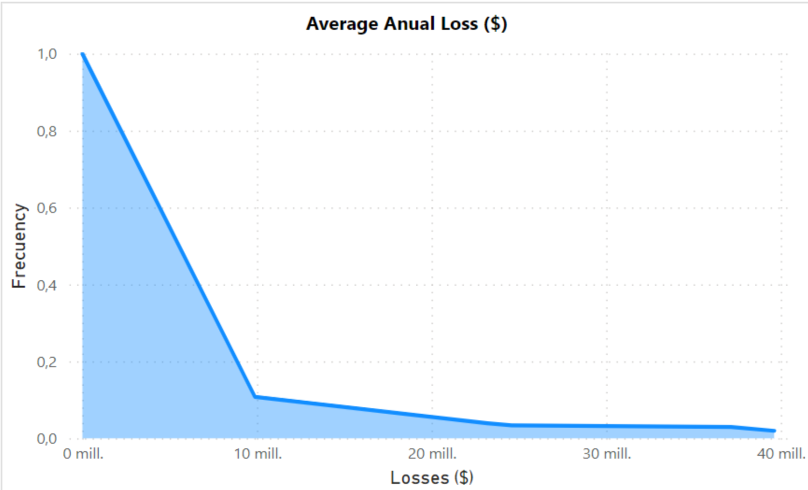
The AAL also serves as a valuable planning and decision-making tool for organizations and governments. It allows them to estimate the necessary resources for risk management and plan responses to hazardous events. By integrating the total costs and their associated frequency, the AAL provides a comprehensive understanding of the risk landscape. The AAL is defined by the previously developed costs, evaluated with respect to different return periods and their associated frequency of occurrence. Thus, the AAL is the integral of the curve defined by the total costs and the frequency of those costs.

In summary, AAL provides a quantitative measure of the average annual economic losses expected from hazardous events. It is an essential component in risk management, aiding in decision-making, resource allocation, and the development of effective risk reduction strategies.

By identifying and prioritizing zones of action, the risk map serves as a valuable tool for decision-makers and stakeholders involved in territorial planning, disaster management, and resource allocation. It guides the development and implementation of appropriate strategies, such as land-use planning, building codes and resilient construction practices, early warning systems, and emergency response plans, to effectively reduce the risks associated with flooding events on the caye.

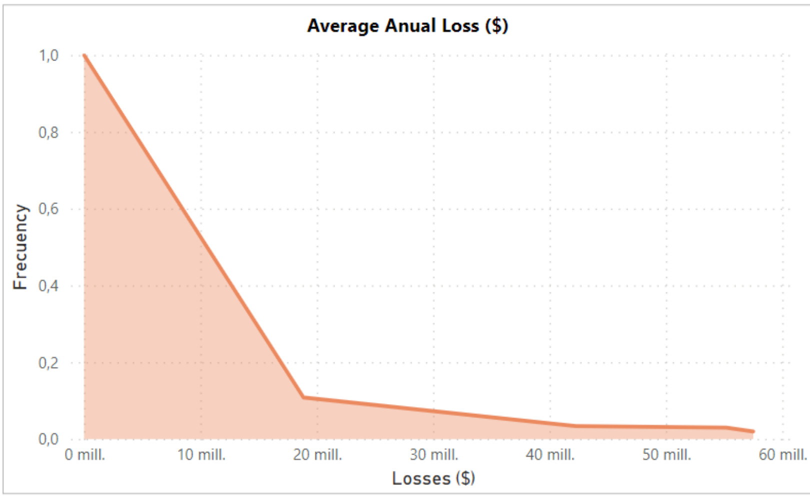
The graphs obtained from the AALs, as a result of the analyses previously described, are shown below.

Figure 157: Average Annual Loss curve associated to storm surge flooding in the current climate scenario.



Source: IDOM, 2023.

Figure 158: Average Annual Loss curve associated to storm surge flooding in climate change scenario.



Source: IDOM, 2023.

In summary, the results of the damages associated with each event depending on its return period, as well as the ° estimation of the frequency linked to each hurricane category. The historical record utilized for this analysis is derived from the the International Best Track Archive for Climate Stewardship (IBTrACS) (see 2.2.6.1 below for more info).

Table 49: Hurricanes categories and return periods calculated to risk definition

	Mean velocity (knots)	Tr (Return Period)
Category 1	73,4	9.27
Category 2	89,5	25.5
Category 3	104,5	29.75
Category 4	124.00	34
Category 5	140.00	51

Source: IDOM, 2023

Table 50: AAL table associated to storm surge flooding in the current climatic scenario.

	Losses in digitalized infrastructure	
Return Period	Associated Cost	**AAL**
H0	0	**$6,959,591**
H1	$9,881,960.46	
H2	$23,187,960.28	
H3	$24,581,179.83	
H4	$37,152,688.74	
H5	$39,620,387.67	

Source: IDOM, 2023

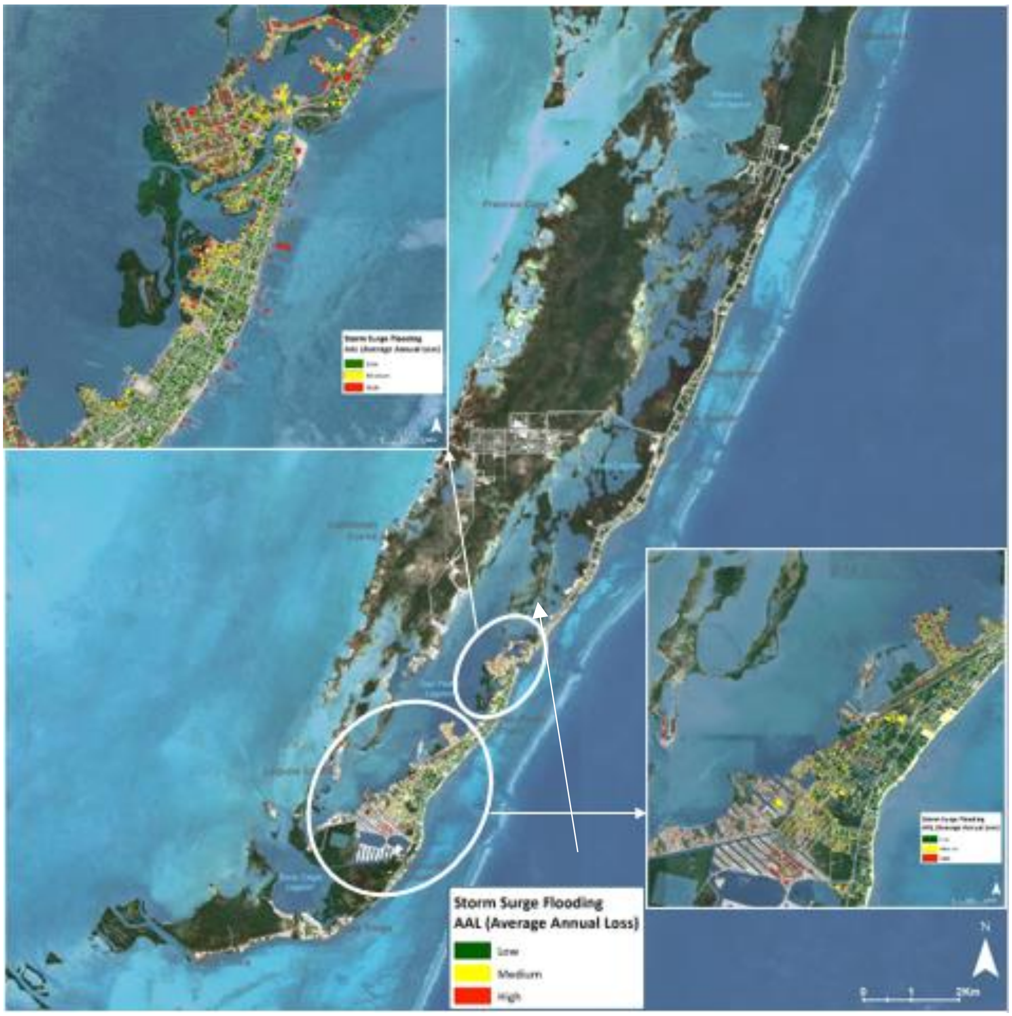
Each hurricane, characterized by its category and frequency, engenders a range of impacts that manifest as damages if the event occurs. Consequently, higher categories inflict more significant impacts but take place less frequently. The presented Annual Average Loss (AAL) value corresponds to the cumulative area under the probability curve, representing the expected average losses associated with hurricane events over a given period. The same calculation has been carried out for the threat posed by climate change, with the resulting damage being greater.

Table 51: AAL table associated to storm surge flooding in the climate change scenario.

	Losses in digitalized infrastructure	
Return Period	Associated Cost	**AAL**
H0	0	**$12,569,626**
H1	$18,864,766.81	
H2	$40,532,222.58	
H3	$42,266,764.79	
H4	$55,185,261.12	
H5	$57,493,359.30	

Source: IDOM, 2023

Figure 159: AAL map associated to storm surges in Ambergris Caye.



Source: IDOM, 2023.

As previously mentioned, the annual losses encompass the costs associated with damage incurred on an annual basis. The upper figure illustrates the Annual Average Loss (AAL) categorized by infrastructure batches. This representation quantifies the cost attributed to each infrastructure for every return period, determined by its frequency and normalized by its area. In this context, the low, medium, and high values correspond to infrastructures incurring losses of $0.50, $1.50, and up to $6.5 per square foot annually.

Climate change causes this AAL to increase as shown in the previous tables, but in terms of the distribution per lot, climatic change supposes a 6% more cost per square foot, and supposes up to 55% more expenses in the most extreme cases.

2.2.5.6. Conclusion

The field results revealed that the population and institutions do not perceive a high flood risk, as the houses are adapted, and the water recedes within three days of the event. However, based on the conditions established in the analysis, the conclusions of this storm surge risk study aid in determining the areas most affected by such events and identify elements susceptible to impact in both the present and future scenarios. Furthermore, considering the effects of climate change highlights the significance of wetlands in mitigating sea-level rise and facilitating flood drainage.

According to Pacifico's surveys the perception of risk evaluated from the perspective of how much the natural ecosystem of the Cayo and the lives of the people who live there could be affected by climate change, it can be said that on a scale of 1 to 5, the people surveyed perceive the impact of climate change on their lifestyles to be above 4.

Following this, the primary determining factor influencing the vulnerability of these systems is the material composition of the walls. Additionally, the size of the dwelling plays a decisive role, as the associated costs escalate with the extent of the affected infrastructure requiring replacement.

As it was anticipated in the terms of reference, the northern area of the island merits special attention. Buildings in this region demonstrate notable resilience, primarily due to the implementation of concrete walls and elevated designs to mitigate the impact of flooding. Consequently, the costs incurred in this area are generally lower, except for certain infrastructures such as small kitchens or bars within resorts that may employ inferior construction materials, resulting in higher costs for their replacement.

Therefore, the younger people of the Caye, surveyed in the Pacifico's survey, feel that they are the most affected by climate change because these types of structures have been built on the Caye and until now they did not have a zoning plan that can regulatethe quality and location of construction and also the mangrove protection zones which can protect the cay from storm flooding and can also regulate the quality and location of construction.

2.2.6. Strong Winds

This section will analyse winds as an intrinsic risk of hurricanes. The wind speeds are used to categorize hurricanes and their destructive capacity. As wind speed increases, the destructive capacity is considered to be multiplied by the square. Thus, a tripling of wind speed increases destructive power by a factor of nine. Wind speed is affected by topography, increasing in exposed areas and on hills crests, and decreasing in sheltered areas. The height of the hurricane's column is another factor that enhances its voracity, generating a greater force with greater vertical extensions.

Photo 25 Destruction caused by strong winds in Ambergris Caye during hurricane Earl events (2016)

Source: San Pedro Sun

The destructive potential of strong winds during hurricane events in the island poses a significant threat. Devastation can arise from either the direct impact of the powerful wind itself or the hazardous projectiles carried by the wind. The relentless forces exerted by the wind can uproot trees, leading to the flattening of entire forests. Hurricanes wreak severe havoc on coastal marine ecosystems, destroying coral reefs, mixing the water column, and redistributing bottom sediments. Similarly, water pollution is increased by storm water runoff. These factors are detrimental to the ecosystems, as well as to the socioeconomic resources of coastal island territories such as Ambergris Caye.

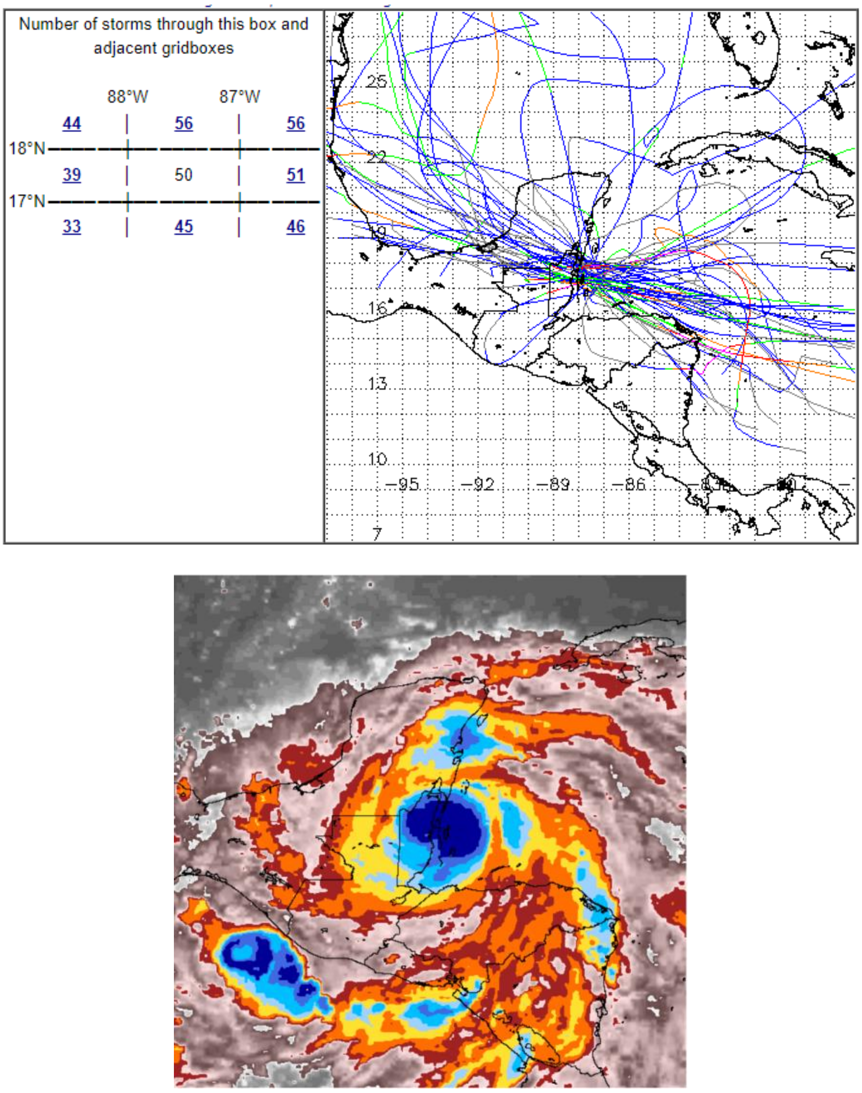
Human-made structures are not immune, as buildings may sway precariously or even collapse under the intense wind pressure. Depending on the materials and construction techniques, roofs can be uplifted, multiplying the vulnerability of homes to winds and other effects of the hurricane, such as flooding. The extreme pressure fluctuations within a hurricane can cause well-enclosed structures to rupture explosively. However, most of the destruction, loss of life, and injuries resulting from strong winds are predominantly caused by the airborne debris propelled at high speeds. The impact force of these projectiles depends on their mass and the square of their velocity. Examples of common projectiles include poorly secured roofing materials, tiles, antennas, telephone poles, trees, and various detached building components.

2.2.6.1. Hazard definition

To define the wind threat, **historical event series** were consulted to establish wind speeds over specific time periods, which served as return periods associated with the frequency of this specific threat. The National Meteorological Service of Belize provided wind data for the San Pedro station at 5-minute intervals. However, the received data was not suitable for statistical adjustment, prompting the use of the historical hurricane-generated wind series. The data on past events has been also extracted from the National Meteorological Service of Belize and additionally, to increase the available data and cross-reference and adjust values, the International Best Track Archive for Climate Stewardship (IBTrACS) was consulted.

IBTrACS contains global tropical cyclone best-track data, collected from agencies in every ocean basin. The project has been endorsed by the World Meteorological Organization as the official archiving and distribution resource for best-track data. The data were collected and processed by the IBTrACS group at the NOAA National Centers for Environmental Information (NCEI) in Asheville, NC.

Figure 160:Regional map of storms and Number of storms through this box and adjacent grid boxes (left) and example of summary information provided for every storm in the portal (Hurricane EARL 2016) (right)



Source: IBTrACS Website (https://ncics.org/ibtracs/)

Figure 161 List of Historical Storms by the NMS of Belize (left) & List of all storms within the grid box presented above IBTrACS (right)

NAME	DATE	INTENSITY (knots)
NOT NAMED	1920	85
NOT NAMED	1921	80
NOT NAMED	1924	40
NOT NAMED	1931	115
NOT NAMED	1932	60
NOT NAMED	1933	95
NOT NAMED	1934	85
NOT NAMED	1938	50
NOT NAMED	1939	50
NOT NAMED	1940	40
NOT NAMED	1942	95
NOT NAMED	1943	40
NOT NAMED	1945	60
GERDA	1958	50
HATTIE	1961	145
AL12	1964	60
Chloe	1971	55
Edith	1971	140
Laura	1971	60
Al16	1975	60
Frieda	1977	50
AL17	1979	30
Hermine	1980	60
AL07	1986	30
Keith	2000	120
Chantal	2001	60
Arthur	2008	40
Alex	2010	95
Richard	2010	85
Earl	2016	75
ETA	2020	130
Lisa	2022	80

NAME	DATE	INTENSITY (knots)
UNAMED	1864	69.51808
UNAMED	1866	60.82832
UNAMED	1870	69.51808
UNAMED	1874	52.13856
UNAMED	1879	69.51808
UNAMED	1889	73.86296
UNAMED	1892	86.8976
UNAMED	1893	86.8976
UNAMED	1898	39.10392
UNAMED	1916	39.10392
UNAMED	1916	95.58736
UNAMED	1918	69.51808
UNAMED	1921	34.75904
UNAMED	1924	34.75904
UNAMED	1931	39.10392
UNAMED	1931	39.10392
UNAMED	1931	108.622
UNAMED	1931	60.82832
UNAMED	1932	39.10392
UNAMED	1932	39.10392
UNAMED	1933	69.51808
UNAMED	1933	34.75904
UNAMED	1934	39.10392
UNAMED	1936	34.75904
UNAMED	1938	39.10392
UNAMED	1939	30.41416
UNAMED	1940	39.10392
UNAMED	1941	78.20784
UNAMED	1942	34.75904
UNAMED	1942	86.8976
UNAMED	1943	34.75904
UNAMED	1945	34.75904
UNAMED	1945	86.8976
UNAMED	1946	30.41416
GILDA	1954	52.13856
JANET	1955	147.72592
ABBY	1960	69.51808
ANNA	1961	69.51808
HATTIE	1961	121.65664
FRANCELIA	1969	85.159648
EDITH	1971	60.82832
LAURA	1971	60.82832
CARMEN	1974	119.918688
FIFI	1974	91.24248
GRETA	1978	95.58736
HERMINE	1980	56.48344
GERT	1993	34.75904
KYLE	1996	43.4488
MITCH	1998	147.72592
KEITH	2000	108.622
CHANTAL	2001	52.13856
IRIS	2001	121.65664
DEAN	2007	147.72592
ARTHUR	2008	39.10392
ALEX	2010	52.13856
KARL	2010	52.13856
MATTHEW	2010	34.75904
RICHARD	2010	85.159648
HARVEY	2011	52.13856
RINA	2011	78.20784
ERNESTO	2012	73.86296
EARL	2016	73.86296
FRANKLIN	2017	47.79368
NATE	2017	39.103921

Source: Tables prepared by IDOM 2023. Data from National Meteorological Service of Belize (left) and IBTrACS (right)

Finally, it is worth mentioning that the Saffir-Simpson Scale has been used to characterize the hazard, so that hurricanes can be categorized through different wind speeds, and, through the analysis of past events, the different return periods can be defined.

Table 52 List of Hurricanes and its impacts

Hurricane Category	From Wind V (knots)	To Wind V (knots	Impacts
Category 1	63.71	83	Minimal damage, mainly to trees, vegetation, and poorly secured mobile homes or trailers. Total or partial destruction of electrical lines or poorly installed signs. Minor damage to piers and docks.
Category 2	83	96	Considerable damage to trees and vegetation. **Major damage to mobile homes**, signs, and exposed electrical lines. Partial destruction of roofs, doors, and windows, but few damages to structures and buildings. Considerable damage to piers and docks. Marinas experience flooding, and smaller boats break moorings in open areas. Evacuation of residents from low-lying areas in coastal zones.
Category 3	96	113	Extensive damage: large trees knocked down, as well as loosely installed signs and billboards. Damage to building roofs, doors, windows, and small structures. **Destruction of mobile homes** and caravans. Large structures near the coasts are severely damaged by wave impact and floating debris. Evacuation of all residents along coastal zones.
Category 4	113	135	**Extreme damage:** trees and shrubs are flattened by the wind, and signs and billboards are torn down or destroyed. Extensive damage to roofs, doors, and windows. **Total roof collapse** in small residences. Most mobile homes are destroyed or severely damaged. Massive evacuation of all residents within an area of approximately 500 meters from the coast, as well as low-lying areas up to three kilometres inland.
Category 5	135	>135	**Catastrophic damage**: trees and shrubs are completely flattened and uprooted by the wind. Significant damage to building roofs. Total collapse of roofs and walls in small residences. Most mobile homes are destroyed or severely damaged.

Source: IDOM, 2023 based on Saffir- Simpson classification

To assess the threat of strong winds associated with different return periods and establish the hazard level based on specific frequencies and corresponding wind velocities, the data series depicted in Table 53has been utilized. This series, sourced from the IBTracs portal, provides a historical record of 32 storms specifically within our study area. The maximum recorded wind speed in this series stands at 145 knots, while the lowest recorded speed is 30 knots.

To determine return periods or winds associated with various time frequencies (such as 2.33, 10, 25, 50, 100, or 500 years), a statistical regression analysis has been applied to the dataset. By extending the list to include a larger number of values, irrespective of the regression method employed, a more robust statistical analysis can be achieved. In this case, a conservative approach has been adopted to ensure safety and generate inputs that err on the side of caution. To accomplish this, the series has been supplemented with the minimum recorded storm wind speed of 30 knots. Consequently, the statistical adjustment has been performed on a complete data list spanning from 1920 to 2022, combining storm data from the portal database with the lowest wind speeds for years without available information. By incorporating data from exceptional storms rather than relying solely on typical annual wind values, the results associated with higher frequencies become more reliable and aligned with real-world conditions. The average of the statistical adjustments applied, including the Gumbel method and the lognormal adjustment pairs 2 and logarithm Person III, to the data series defines the threat level as follows:

Table 53:Strong Winds hazard defined by return periods and velocity

Strong Winds	**Frequency**	***TR2.33***	***TR10***	***TR25***	***TR50***	***TR100***	***TR500***
	Velocity (knots)	38.89	66.31	136.41	153.23	169.91	208.52

Source: IDOM, 2023

2.2.6.2. Exposure

Understanding the exposure to flood risk is crucial for evaluating the potential consequences and impacts on critical assets and structures within the designated study area. By identifying and evaluating the elements at risk, including essential facilities, transportation networks, residential zones, and vital services, we can gain valuable insights into strong winds events.

To analyze the exposure, as it was mentioned in previous sections, a digitization process was undertaken to accurately map the buildings across the island. Exposure to the risk of strong winds on the island can be generalized, so the exposure map represents the digitized buildings, equipment, and infrastructure. The digital geoprocessing of the buildings has resulted in the generation of 5,242 digitized buildings, generating information on residential/housing buildings, commercial buildings, decks, and accommodation infrastructure, such as hotels, resorts, or apartments.

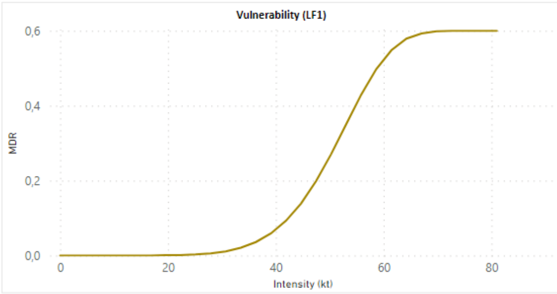
2.2.6.3. Vulnerability

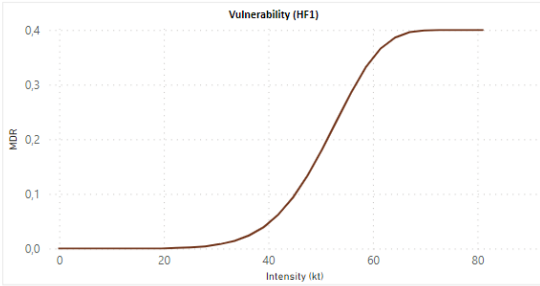
This section will analyze the vulnerability of the digitized buildings to the threat of strong winds on the island. Roof covering failure is one of the most widespread types of damage observed during strong wind events. Roof coverings which are not adequately attached, and corner and eaves regions of roofs are frequently damaged. Once roofs are breached, house interiors are exposed to further damage from wind and water, consequently multiplying the risks. If the roof is eliminated, walls are subject to collapse even when exposed to lesser winds. Therefore, in order to select the key factors to determine the weakness of each of the digitized buildings, the materials and construction qualities of the roofs on the island have been considered as a key differentiating element of vulnerability to strong winds.

The vulnerability analyses in this section focus on understanding the susceptibility of the mapped buildings to damage from high winds. For the analysis, as mentioned above, the materiality of the roofs of these buildings and their qualities have been examined. By considering these factors, it is possible to assign a level of damage to each building, depending on the speed of wind it experiences. According to the field visits and available images, different types of roofs have been identified, such as concrete roofs, metal sheets, thatched roofs, and polymer tiles.

As in the storm surge hazard, MDR curves have been used to indicate the percentage of damage to the house depending on the value of wind intensity affecting the building. In this way, a percentage value of damage can be generated for each return period in each of the digitized buildings, depending on the roof materials and qualities. Three different curves have been considered: Lightweight roofs with flexible masonry, where are included sheet metal and thatch roofs; heavy roofs with flexible masonry, where are included rubber rye roofs; and concrete roofs.

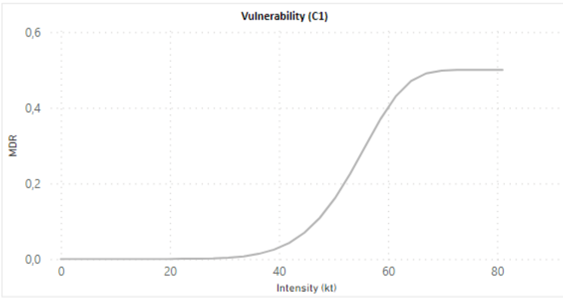
Figure 162: ERN-Vulnerability curve for lightweight roofs with flexible masonry & Figure 163: ERN-Vulnerability curve for heavy roofs with flexible masonry





Source: IDOM, 2023.

Figure 164: ERN-Vulnerability curve for concrete roofs



Source: IDOM, 2023.

2.2.6.4. Risk definition

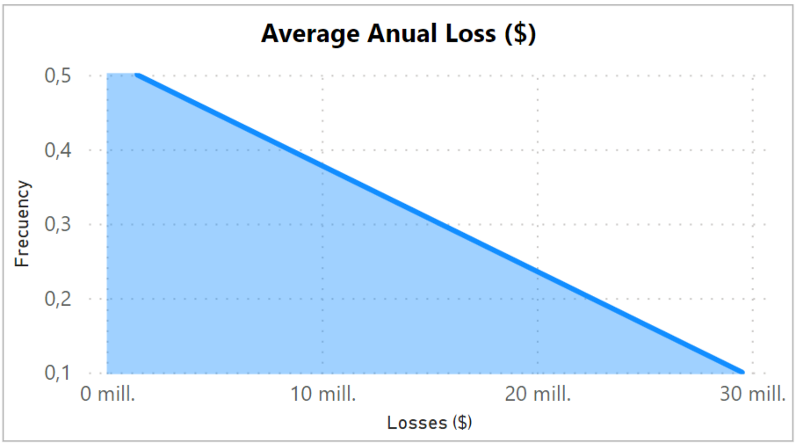
As shown in previous chapters, the intersection between the exposure and its vulnerability with the hazard and the probability of occurrence of each event generates a modeling of the risk itself.

Once we have analysed the hazard and its impact on the island, as well as assessed the vulnerability of exposed buildings, the next step is to evaluate the level of risk. This involves considering the potential damages that each strong wind event can cause to the buildings, along with the probability of occurrence for each event. By integrating these factors, we can generate a risk map that categorizes and prioritizes areas of action on the island.

In this case, to calculate the AAL, the Average Annual Loss of each strong wind event has been multiplied by its expected economic losses. It is important to note that the AAL represents average annual losses over time, rather than specific losses in a particular event. As mentioned before, the AAL serves as a crucial tool for planning and decision-making for organizations and governments. It helps estimate the necessary resources for risk management and facilitates the planning of responses to hazardous events. By integrating total costs and their associated frequency, the AAL provides a comprehensive understanding of the risk landscape.

Finally, the aggregate data of the annual losses expected as a result of the process described above are shown below.

Figure 165: Average Annual Loss curve associated to strong winds.



Source: IDOM, 2023.

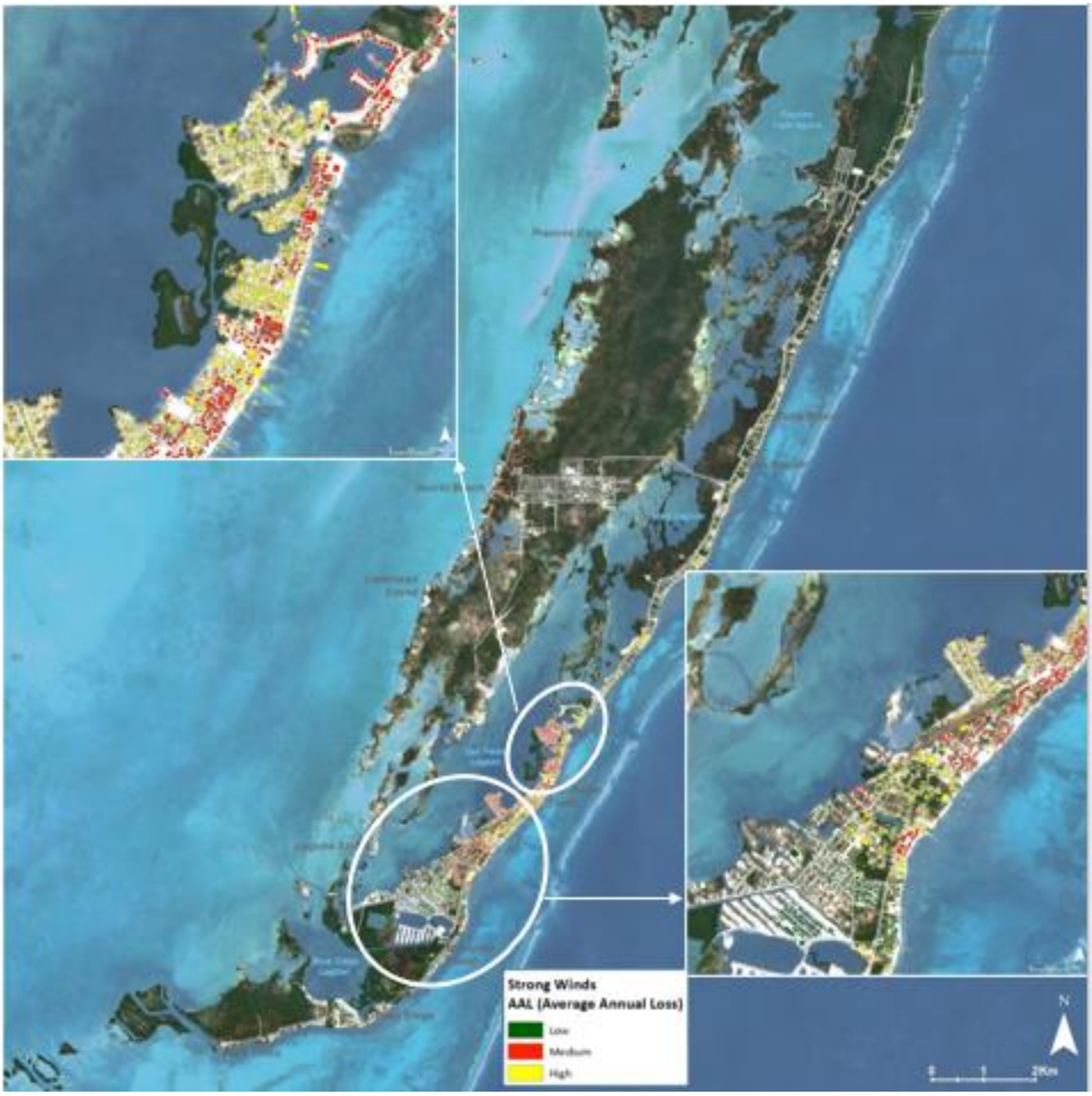
Each hurricane, characterized by its category and frequency (defined in the hazard definition section) causes a range of impacts. In the same manner as for the flooding risk, higher categories inflict more significant impacts but take place less frequently. The presented Annual Average Loss (AAL) value corresponds to the cumulative area under the probability curve, representing the expected average losses associated with hurricane events over a given period.

Table 54: AAL table associated to strong winds risks.

	Losses in digitalized infrastructure	
Return Period	Associated Cost	**AAL**
H0	0	**$9,509,454.31**
TR2	$1,426,473.97	
TR10	$29,558,470.09	

Source: IDOM, 2023.

Figure 166: AAL map associated to Strong Winds in Ambergris Caye.



Source: IDOM, 2023.

The distribution of wind threat is consistent across the entire island, with the intensity of the wind speed serving as the defining factor. Specifically, the vulnerability of systems lies in the materiality of the roofs. This exposure, which subsequently determines the risk expressed as the Annual Average Loss (AAL) in this chapter, applies to all digitized infrastructures.

2.2.6.5. Conclusion

The risk maps and economic estimation of risk concerning high winds associated with hurricanes serve as valuable tools for prioritizing geographical interventions and for the zoning and location of investments in adaptation, mitigation, or response measures by risk management institutions.

It is highly important to mention that he costs presented in the analysis are exclusively associated with the replacement costs of roofs for each roof type examined, namely light roofs, heavy roofs, and concrete roofs. Among these, roofs made of aluminium metal sheets and those with thatched roofs are the most affected areas. While concrete roofs entail higher replacement costs, they are less likely to sustain severe damage. On the other hand, roofs constructed from aluminium metal sheets and thatched roofs are more susceptible to substantial damage.

2.2.7. Coastal Erosion

Coastal erosion is a pressing environmental concern that poses significant risks to the natural and human systems of coastal regions around the world. It refers to the gradual wearing away and removal of land, sediments, and natural features along a coastline due to the relentless action of waves, tides, currents, and wind. It is an intricate process shaped by a delicate balance between natural forces and the vulnerability of coastal landforms. The consequences of erosion can range from subtle changes in coastal landscapes to severe impacts such as the loss of valuable ecosystems, infrastructure, and human settlements.

The risk of coastal erosion is driven by a multitude of interconnected factors, both natural and human-induced, which contribute to the relentless wearing down of the shoreline. One of the primary natural causes is the energy of waves generated by wind, storms, and ocean currents. The relentless pounding of waves against the coastline, particularly during storm events, gradually weakens and erodes the land. Another significant factor contributing to coastal erosion is the rise in sea levels, which exacerbate erosion by amplifying the force and reach of waves.

In addition to natural causes, human activities have also played a role in exacerbating coastal erosion. Construction of coastal infrastructure, such as harbours, piers, and groins, can disrupt natural sediment transport processes and impede the natural buffering capacity of coastal ecosystems. The removal of sand and other sediments from beaches for construction and other purposes further depletes the natural sediment supply, leaving the coastline more susceptible to erosion.

Photo 26 Coconut trees root system exposed due to coastal erosion.

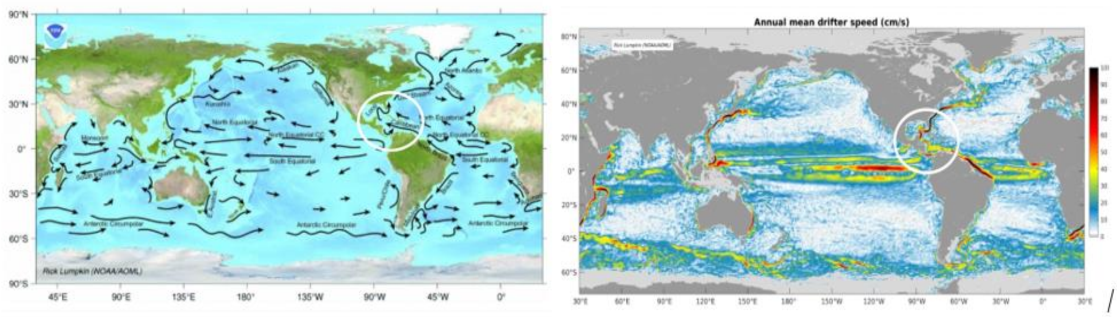
Source: San Pedro Town Council.

Understanding the definition and causes of coastal erosion is crucial for developing effective strategies to manage and mitigate the associated risks in the caye. By recognizing the complexity and interplay of natural and human factors driving erosion, appropriate measures to protect vulnerable areas can be identified ensuring the long-term sustainability of the island's coastal communities.

2.2.7.1. Hazard definition

This section will display the characterization and morphodynamical dynamics of the beaches conferred in Ambergris Caye.

Figure 167: Ocean streams and global wind dynamics



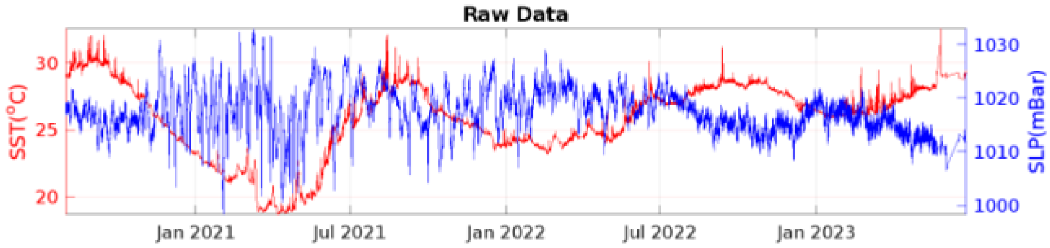
Source: National Oceanic and Atmospheric Administration (July 2023)

In accordance with the terms of reference and in alignment with the primary objective of the consultancy, a comprehensive analysis and study of the entire Caye are imperative. Due to the extensive coastline and the intricate nature of the coastal ecosystem, approaching the definition of hazards from a singular perspective poses challenges. The elongated shoreline, coupled with diverse coastal typologies, complicates the establishment of a distinct dune line that can serve as a reference for historical shoreline comparisons.

Consequently, the hazard definition for the coastal erosion threat necessitates the utilization of diverse methodologies to enhance our understanding of this issue faced by the Caye. These multifaceted approaches to hazard definition encompass the identification of erosion and sedimentation processes resulting from shoreline variations over a specified time frame. Moreover, qualitative explanations and comprehensive investigations of coastal processes influenced by gray infrastructure measures, such as cement walls, will be conducted to delve deeper into their impact on adjacent coastal sections.

It is vital to highlight that Ambergris Caye in Belize is subject to the influence of the Caribbean and Loop oceanic depressions. It experiences an annual mean drifter speed ranging from 30 centimeters per second to 45 centimeters per second. Additionally, the nearby buoy records an average sea surface temperature (SST) of approximately 25°C, exhibiting an increasing trend, alongside an average sea level pressure (SLP) of 1010 mBar, which demonstrates a decreasing trend.

Figure 168: Sea Surface Temperature (SST) and Sea Level Pressure (SLP)



Source: SEALITE (July 2023)

It is also important to note the role the mangroves on the island play in land retention. The mangroves are the most natural protection from erosion of land. The mangroves are also a key element in maintaining sea levels and preventing erosion of the island. There is a reason so much of Belize's environmental policy is around the protection of mangroves.

According to the master development plan for Ambergris Caye, beach erosion, although is a natural phenomena, has accelerated in recent time and is attributable to numerous causes mainly those of man's activities in various kinds of beach engineering such as the clearance of mangroves, the reclamation of land from the sea, the construction of piers and the dredging of sand offshore, all of which affect the littoral drift and the consequent shift and deposition of sand.

Retaining walls are often built along the coast to prevent further erosion of the shoreline. However, not only do these structures prevent erosion of sand at that location, but they may also contribute to changes in erosion and buildup patterns near the structure. "For example, if alongshore movement of sand is suspected to be from north to south along San Pedro, it is likely that just south of a sea wall may be deprived of sand. North of the structure, sand may build up and lead to accretion of the shoreline. As a result of this, owners of properties south of structures who are adversely affected by their neighbor's sea wall may have to build a similar stabilization structure to prevent further erosion of the shoreline directly in front of their property

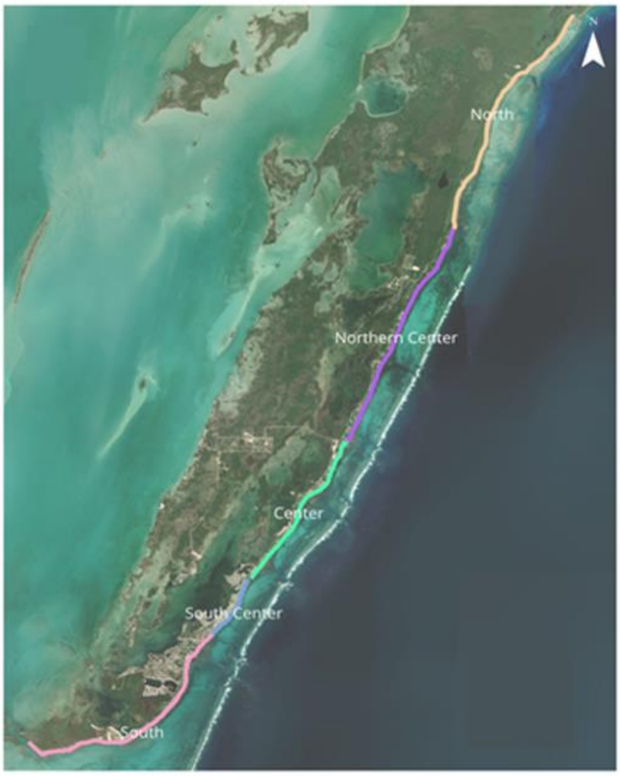
Another cause of beach erosion is the undue proliferation of piers. They reduce the effective use of beach areas and are potential sources of pollution. The latter arises from the concentration of boats and activities in localized areas which will inevitably generate refuse, petroleum spills, aerial pollution, and noise. Strict controls should be imposed on their frequency to minimize these problems.

2.2.7.1.1. Segment division for coastal shoreline analysis

To undertake a comprehensive study of the coastal erosion phenomena on the island, an essential preliminary step entails dividing the island into distinct sections based on specific shared characteristics. These characteristics encompass various factors, including the extent of construction activities along the coastlines, the level of inland development, and the implementation of concrete walls as infrastructure measures by both private resorts and public entities. This division has resulted in the identification of five defined zones along the beach, namely the north, center north, center, south center, and south zones.

Each zone exhibits unique morpho dynamics shaped by anthropogenic activities on the island. In-depth analyses of each zone will shed light on the interplay between human interventions and natural coastal processes. These investigations will provide valuable insights into the factors influencing coastal erosion dynamics within each zone, facilitating a comprehensive understanding of the overall coastal erosion phenomena on the island.

Figure 169: Sections used to divide the coastline for coastal erosion processes



North: Low human intervention.

Northern center: Few urbanizations and private resorts

Center and South center: Higher population density.

South: Hydro-morphological modification nstruction in private land

Segment	Area (acres)	Length (mill)
Center	18.12	3.18
North Center	17.89	5.26
South Center	9.08	1.5
South	17.40	5.34
North	16.15	5.53

Source: IDOM, 2023.

The growth population is situated along the coast, where most of the tourism's infrastructure is placed, which is calculated in approximately 23% of the homogeneous units.

The south center zone which has good and medium quality buildings mainly residential along the coast with almost 45% of the homogeneous units, and it has been classified as urban perimeter with a density of 15.4 dwelling per acre. Also, this segment as shown in Table 1 has a length of 3.18 miles and an area of 18.12 acres.

The center and north center zones were classified as Urban linear peri urban and the south zone as external development mostly, these three zones have a density of 20.5 dwellings per acre and is located approximately the 23% of the development of the tourist sector with building classify as high (4 or more floors) and low density (less than 4 floors) accommodations. In Addition, as it is shown in table 1, the south zone has a length of 5.34 miles and an area of 17.40 acres, in this same way the center zone has a length of 3.18 miles and an area of 18.12 acres and finally the north center zone has a length of 5.26 miles and 17.89 acres

The last zone defined through the analysis is the north zone, where the human intervention is very low, the natural process can be identified easily also, this zone does not have high rate of population growth. Because of these characteristics the analysis is presented in an independent way.

2.2.7.1.2. Automized identification – Python tool

Considering the scale and ultimate objectives of the generated outputs, the utilization of an automated algorithm was deemed the initial approach to define the associated shorelines changes and dynamics within a specified time frame. This decision was primarily driven by the considerable length of the coast, rendering manual digitalization impractical, and the vast area, making it challenging to procure satellite images for all years and different sections uniformly. Thus, an automated software tool was employed to assess the robustness and accuracy of shoreline analysis, with **CoastSat** being the selected code. CoastSat is an open-source software toolkit developed in Python, leveraging the capabilities of Google Earth Engine to efficiently retrieve Landsat and Sentinel-2 satellite imagery spanning over 30 years (and continually expanding).

The code acquired satellite images undergo pre-processing procedures to mitigate the impact of cloudy pixels and enhance spatial resolution. Subsequently, a robust and generic shoreline detection algorithm is employed, combining supervised image classification and sub-pixel resolution border segmentation techniques. This innovative shoreline detection approach achieves an accuracy level of approximately 10 meters, effectively mapping the shoreline's position. Detailed information on this technique can be found in the reference section, specifically the publication by Voi, K. et al. (2019). Many other factors such as along-shore distance for computing intersection, minimum number of shoreline points to calculate intersection, maximum range for points around transects or distance the distance around the clouds where shoreline can't be mapped, are parameters that need to be manually defined:

Figure 170: Example of parameters needed to define code specifications

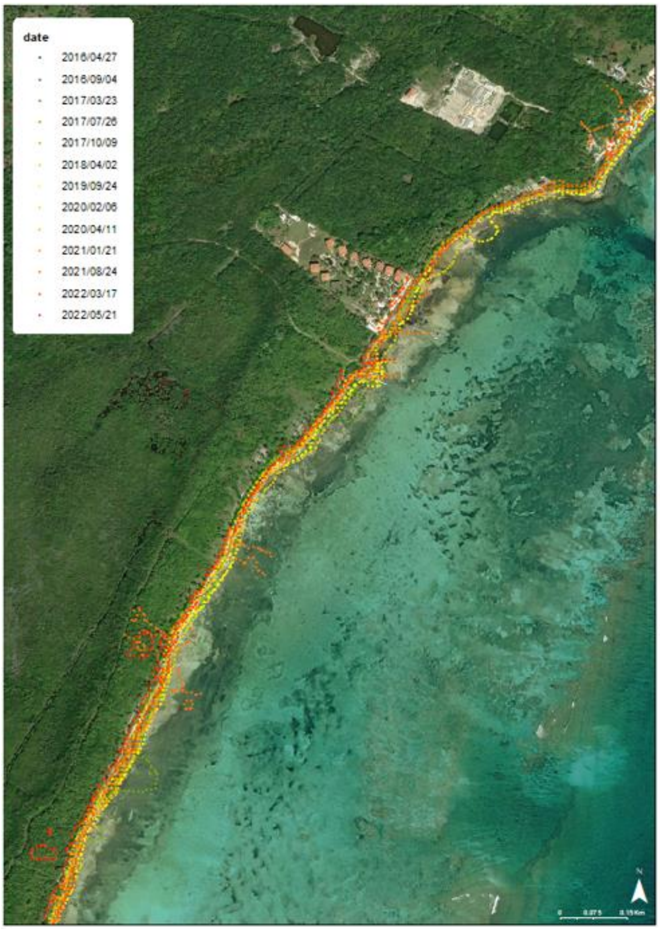
```
settings = {
    # general parameters:
    'cloud_thresh': 0.5,        # threshold on maximum cloud cover
    'dist_clouds': 300,         # ditance around clouds where shoreline can't be mapped
    'output_epsg': 28356,       # epsg code of spatial reference system desired for the output
    # quality control:
    'check_detection': True,    # if True, shows each shoreline detection to the user for validation
    'adjust_detection': False,  # if True, allows user to adjust the postion of each shoreline by changing the threhold
    'save_figure': True,        # if True, saves a figure showing the mapped shoreline for each image
    # [ONLY FOR ADVANCED USERS] shoreline detection parameters:
    'min_beach_area': 1000,     # minimum area (in metres^2) for an object to be labelled as a beach
    'min_length_sl': 500,       # minimum length (in metres) of shoreline perimeter to be valid
    'cloud_mask_issue': False,  # switch this parameter to True if sand pixels are masked (in black) on many images
    'sand_color': 'default',    # 'default', 'latest', 'dark' (for grey/black sand beaches) or 'bright' (for white sand beaches)
    'pan_off': False,           # True to switch pansharpening off for Landsat 7/8/9 imagery
    # add the inputs defined previously
    'inputs': inputs,
}
```

Source : https://github.com/kvos/CoastSat

Furthermore, modifications were made to the primary code to enable the collection of images from a wider range of time periods without excessively burdening the processing speed. Specifically, for the Sentinel-2 images, which provide a multispectral resolution of 10 meters and a panchromatic resolution of 20 meters, the selected timeframe spans from December 1, 2015, to January 1, 2023. The objective is to tailor the tool to the unique characteristics of the Belize coast and analyze the results to ensure its applicability across all transects.

This approach aims to enhance efficiency in shoreline analysis, thereby enabling comprehensive assessments of shoreline changes and dynamics. By adapting the tool to suit the intricacies of the Belize coast, the findings derived from this analysis will contribute to informed decision-making in managing coastal erosion risks.

Figure 171: Result of CoastSat automized digitalized shorelines from th valid satellite images from 2016-2022



The digitized shorelines obtained through the automated process exhibit a maximum distance of **25 meters between them**. It is important to note that this distance is considered negligible in the context of coastal erosion processes. Given its relatively small magnitude, it does not significantly impact the analysis and understanding of coastal erosion dynamics.

Source: IDOM, 2023.

As each satellite image is captured at a distinct **tidal stage**, it becomes imperative to apply a tidal correction to eliminate apparent shoreline changes resulting from tidal fluctuations. In the present case, the identified 25-meter variation is attributed to differences in tide levels during the photograph acquisition. Consequently, precise sea level data corresponding to the specific moments of photograph capture would be required to accurately adjust for this deviation. The algorithm employed incorporates the necessary functions to facilitate this correction process.

Note: although the results of this analysis may not be definitive, the application of this methodology presents a valid proposition for future scenarios where precise sea level data is available. Such data would enable calibration of the model and expedite the analysis, thereby enhancing efficiency and providing a valuable tool for studying coastal erosion in smaller-scale locations or beaches.

2.2.7.1.3. Manual Shoreline digitalization of representative, special cases for each section

As it was not feasible to achieve automated digitization of the entire coastal length of the island, a manual approach has been employed to digitize the coastlines of the most significant sections within each area outlined in the section "Segment division for coastal shoreline analysis". These representative sections have been carefully selected based on the presence of exposure elements of special interest, such as critical infrastructure, areas in close proximity to the coast, locations featuring adaptation elements like concrete protection walls, and areas where the reference dune line is distinctly visible, providing a reliable baseline for analysis.

For each representative section, historical images from the Google Earth portal have been acquired and georeferenced within the ArcGIS geographic information system, specifically ArcMap. This georeferencing process enables accurate spatial referencing of the images. Subsequently, the coastline changes have been digitized based on clear identification of the dune line, which delineates the variations and positioning of tides at the time the images were captured. The resulting digitized coastlines provide valuable insights into the coastal dynamics and erosion patterns specific to each representative section.

The image below demonstrates the overlapping of images created for each representative section within their respective areas, further enhancing the visualization and understanding of the coastal changes occurring in these significant locations:

Figure 172: Example of georeferencing images from Google Earth images in section North of the Island.

Source: IDOM, 2023.

Once every representative section has been selected, the images available from Google Earth downloaded and georeferenced in ArcMap, an digitalization of the shoreline associated to each data has been expertly drawn and the different dynamics of erosion and sedimentation calculated as explained for each section below.

2.2.7.1.3.1. North Section

Figure 173: Digitalized shorelines for the presentative selected section for North Section

For this representative section, 8 images are available in 21 years. A clear erosion can be seen in the period 2003-2010, associated with a period of 7 years, where hurricanes Arthur and Alex may have eroded the coast. However, the dynamics mean that in 2016 and 2019 there is a sediment recovery of 25 feet. In recent years it has eroded as well.

The areas with the greatest erosion are those that do not have vegetation on the ground, which is why its protective function is evident.

Sedimentation Erosion

Table 55: Shorelines changes of erosion and sedimentation for the North section

T1 - North							
Measures in feet							
2002	2003	2010	2014	2016	2019	2021	2023
-	4.30	23.82	0.00	14.76	10.96	9.84	7.22

Source: IDOM, 2023.

2.2.7.1.3.2. Northern Center Section

Figure 174: Digitalized shorelines for the presentative selected section for North-Centre Section

Sedimentation Erosion

This analysis encompasses a collection of eight images spanning the period from 2010 to 2022. Notably, the most substantial erosion rates occur between 2014 and 2016, coinciding with the impact of Hurricane Earl. In the subsequent two years, there is a sedimentation process resulting in an accumulation of approximately 18 feet, effectively offsetting the erosion experienced in preceding years. Furthermore, it is evident that the most significant erosion processes transpire south of the protective wall situated along the northern boundary. Consequently, the endpoint where the protective measure terminates experiences more pronounced erosion phenomena. Nevertheless, the erosion and sedimentation process range from 1 to 4 feet which are not very dense

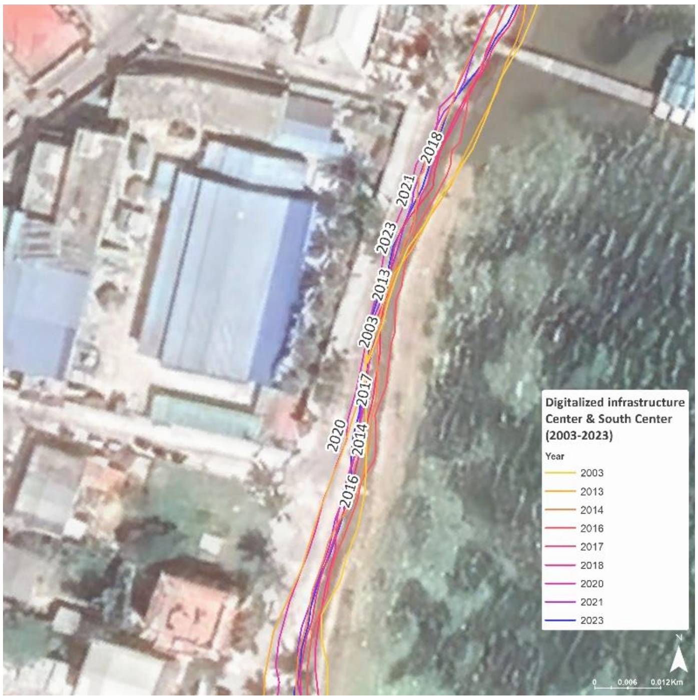
Table 56: Shorelines changes of erosion and sedimentation for the North-Centre section

T2 - Northern Centre							
Measures in feet							
2010	2011	2014	2016	2018	2019	2021	2022
-	2.30	1.08	19.59	17.91	3.15	3.61	4.72

Source: IDOM, 2023.

2.2.7.1.3.3. Center & South Center Section

Figure 175: Digitalized shorelines for the presentative selected section for Centre and South-Centre Sections



Sedimentation Erosion

This section includes the coast near the school, where revegetation adaptation measures already exist in specific places on the coast. It is observed in the 10 images available in the last 20 years that the greatest erosion occurred in 2016, when Hurricane Earl. In the year 2020 there is also a great erosion process that may be linked to Hurricane ETA.

Despite the establishment of measures, last year an erosion of 4 feet was observed, but it is associated with normal coastal dynamics. It is reflected in the analysis that the greatest changes occur where there is greater availability of erosive soil. The presence of elements on the coast reduces erosion due to the effect they have on

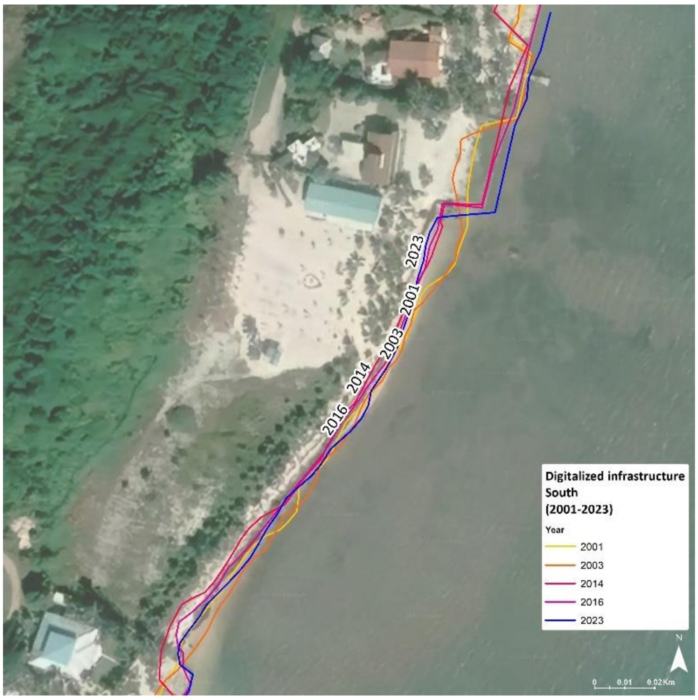
Table 57: Shorelines changes of erosion and sedimentation for the Centre & South Centre section

T3 - Centre & South Centre: School								
Measures in feet								
2003	2013	2014	2016	2017	2018	2020	2021	2023
-	4.92	1.48	16.73	24.61	7.87	24.21	15.75	4.63

Source: IDOM, 2023.

2.2.7.1.3.4. South Section

Figure 176: Digitalized shorelines for the presentative selected section for South Section



Sedimentation Erosion

The section of the southern zone presents only 5 images in 22 years. Large erosion is evident in the 11 years from 2003 to 2014 but cannot be attributed to any specific type of event, since the time range is very wide. However, when a sedimentation of the same dimensions occurs in the following two years, it can be derived that it is an area susceptible to great coastal dynamics and that the variation of the same can be around 25 feet.

The presence of the protection wall causes erosion of up to 45 feet in the surrounding areas to the south

Table 58: Shorelines changes of erosion and sedimentation for the South section

T4- South				
Measures in feet				
2001	2003	2014	2016	2023
-	5.91	25.36	24.84	0.00

Source: IDOM, 2023.

2.2.7.1.4. Discussion of the results

Based on this comprehensive analysis, which identifies the coastline and defines its variations, it can be inferred that there is no significant coastal erosion threat for the whole island, since the erosion and sedimentation processes are essentially costal dynamics. Primarily, the observed changes are attributed to the accumulation of beach sand and coastal dynamics influenced by the hurricane season, as well as the impacts and effects of hurricanes along the coastline. The subsequent section will focus on analyzing the evidence that can be extrapolated regarding the impact of adaptation measures, particularly the concrete protection walls, on the adjacent coast. Additionally, the preceding analyses suggest that the presence of vegetation and the anchoring effect of roots in the soil may serve as protective measures against noticeable erosion. This evidence will be further examined and explored in the following section.

2.2.7.2. Exposure

As demonstrated in the preceding sections pertaining to hazard definition, the susceptibility to coastal erosion poses a threat to the entire coastline of the island, rendering the elements situated along this coastline vulnerable. However, due to the lack of definitive patterns or specific erosion processes, it is challenging to identify specific elements that are explicitly exposed to the established threat. Consequently, any element located in close proximity to the coast becomes a **potential system exposed** to the previously characterized coastal erosion processes. This underscores the need for careful consideration of the buildings and structures established along the coastline, as their proximity to the dynamic coastal environment heightens the risk associated with coastal erosion for every specific coastal erosion study that need to be performed.

2.2.7.3. Vulnerability

A beach is commonly known by the accumulation of sediment such as sands or gravels, which are located between the line of maximum reach of the temporary waves and the depth that corresponds to the zone where there is no active movement of sediments by the waves. (Hurtado Reátegui, 2013)

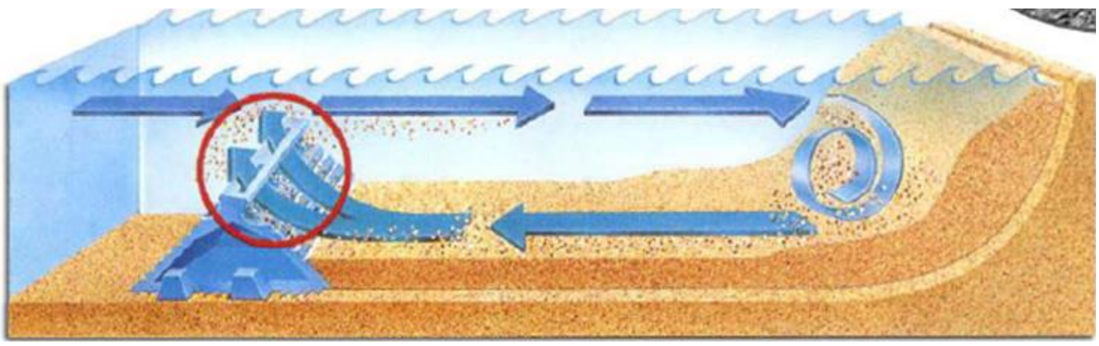
Thus, all hydrodynamic processes respond immediately to morphological changes and generate topo-bathymetric changes under the action of waves, streams and winds, which require sediment redistribution. (Rodriguez, 2019).

Therefore, the topo-bathymetric profile represents the dynamic equilibrium between the erosion and the accumulation of sediment which means the beach does not have the same extension during the year, however the structures presented (Protective walls) on Ambergris Caye interfere with this natural process.

In this way, we have been working on defining the influence of these protective walls on the normal beach's dynamics and how it has been affected the natural erosion process. For this reason, we will now begin a characterization of each typical beach profile beach present on the island and the influence that these structures have generated.

There is a high presence of protective walls in the island. These kinds of structures are usually used for protection against wave action. They could be emergent, semi-submerged or submerged depending on the design and the average sea level to which have been calculated. (Paolo Gyssels, 2013)

Figure 177 Wallseffects on beaches



Source: (Hurtado Reátegui, 2013)

These structures have five principal objectives: first defense against erosion, second coastal protection due to ecological reasons, third seaport protection, fourth shoreline modification and prevent the sandy material lost from the beach. (Paolo Gyssels, 2013)

Hence it is pertinent to define the predominant profiles of the topo-batrimetry of the shoreline in Ambergris Caye, to be able to analysis the dynamic changes due to the protective structures.

2.2.7.3.1. Typical profiles at Ambergris Caye.BEACH

2.2.7.3.1.1. South Zone.

In the southern region, a dissipative beach characterized by low slopes and a gentle littoral gradient is prevalent, accompanied by the presence of longitudinal barriers. This topo-bathymetric profile can be observed in the figure below.

Within these zones, the majority of protective walls are situated, playing a crucial role in safeguarding the area against erosion. Nevertheless, the presence of these protective wall has also posed challenges in areas where such structures are absent, creating certain vulnerabilities.

Figure 178 Typical beach profile South Zone

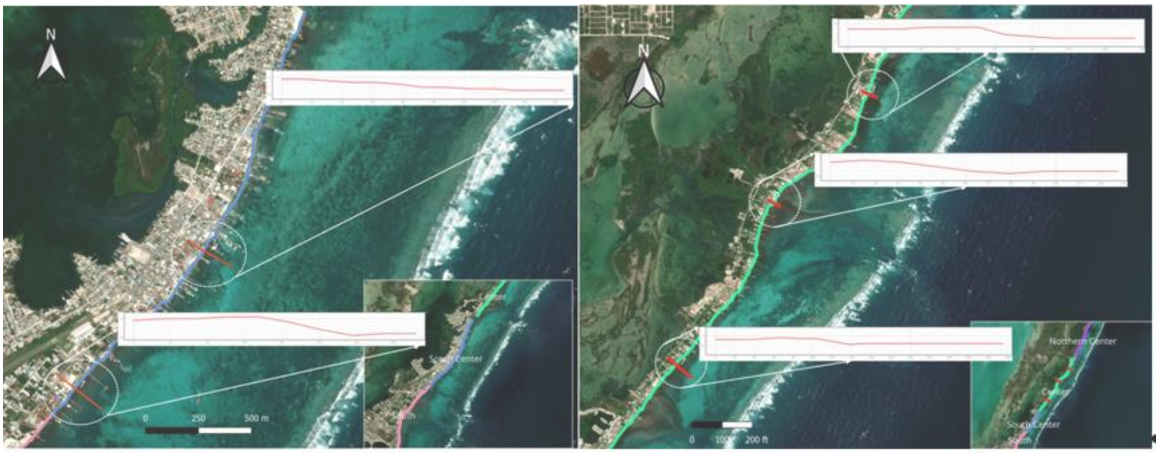
Source: IDOM, 2023.

2.2.7.3.1.2. Central South and Central Zone.

These two zones exhibit distinct characteristics, representing the most densely populated area within the Caye. Moreover, a significant portion of urban dwellings is concentrated along these shorelines, resulting in the substantial presence of protective structures defining nearly the entire coastal line in these regions.

Furthermore, these areas display a typical dissipative beach profile. The terrain profiles showcase low slopes, while the accumulation process within the longitudinal barriers becomes evident. Notably, the presence of loading dock structures induces a differential process of sediment accumulation, promoting the formation of sandbanks through sediment deposition.

Figure 179 Typical beach profile at Central South and Central Zone



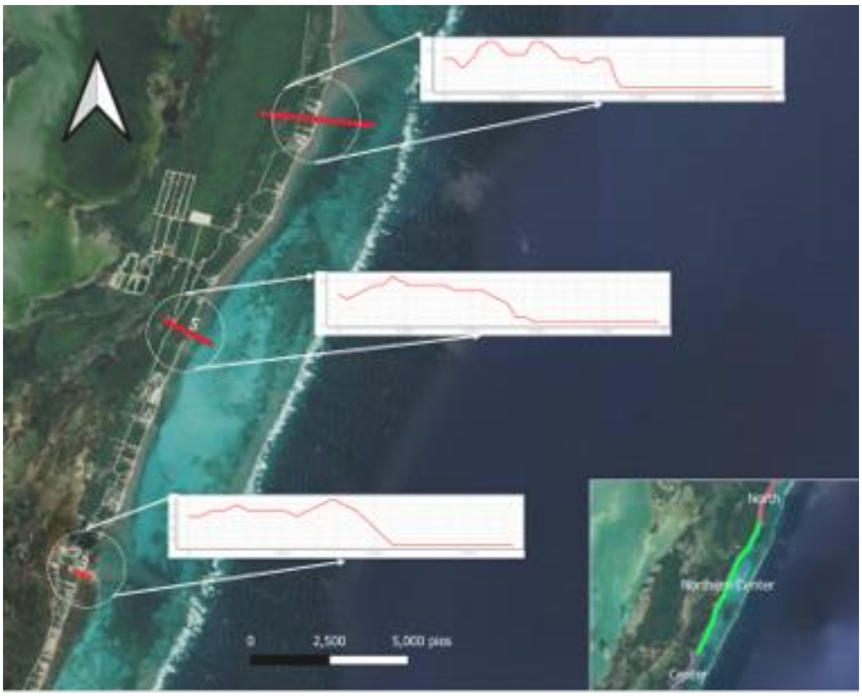
Source: IDOM 2023

2.2.7.3.1.3. North central zone

In the North Central Zone, where human intervention is relatively limited, a reflective beach is predominant. This type of beach exhibits a steeper slope, allowing it to reflect wave energy and form distinct steps along its profile.

The dynamics observed in this zone have remained stable over time. Unlike other areas, there is a lesser presence of protective structures. Consequently, the natural processes and cyclical behavior of the beach have remained relatively consistent throughout the years.

Figure 180: Typical beach profile at North Central Zone



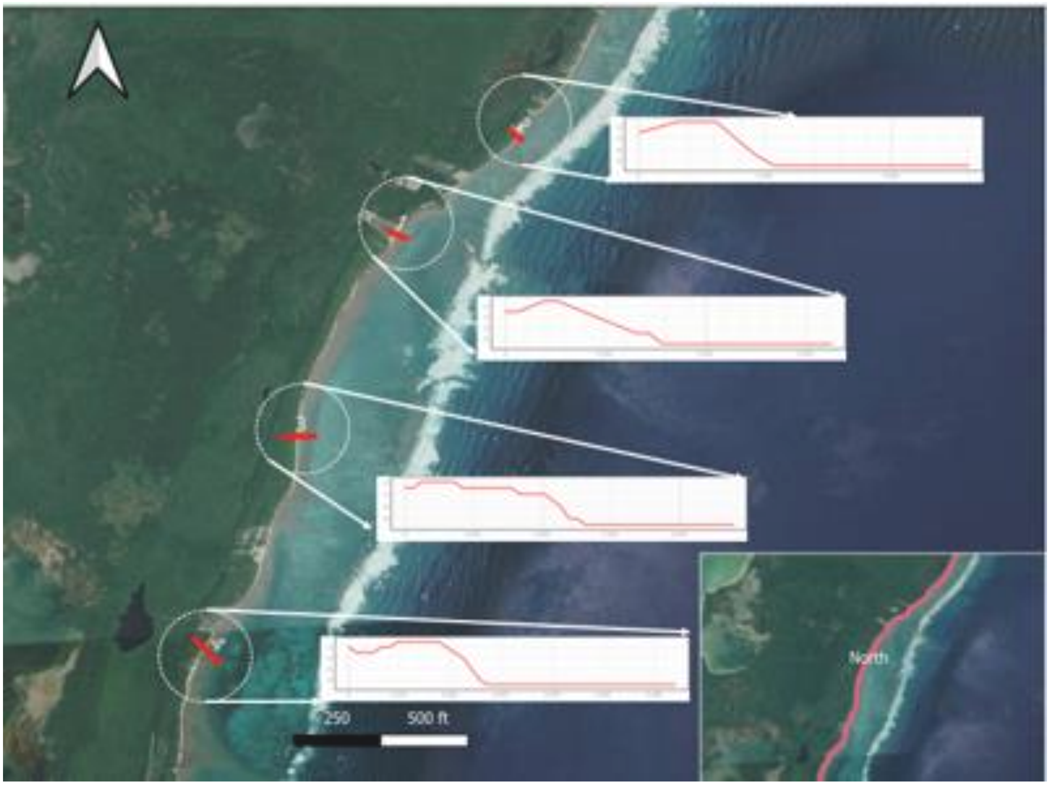
Source: IDOM 2023

2.2.7.3.1.4. North Zone

In the North Zone, being the part of the key with less population growth, it presents a typical beach with reflective behavior, where the slope of the beach is steeper, reflects the wave energy and forms a kind of sand steps along the profile.

The dynamics observed so far is stable, since in this area there is not the same number of protective structures, therefore, the natural process along with the normal cycle of the beach have remained stable over the year

Figure 181: Typical beach profile at North Zone



Source: IDOM 2023

2.2.7.3.2. Analysis of the interaction between protectives walls and shorelines

As depicted in *Figure 182*, the circles indicate the presence of an accelerated erosion process resulting from changes in velocity profiles caused by inadequately finished structures. In this regard, it can be established that the velocities at the edges of these structures have amplified the water velocity. While it is true that these structures have effectively reduced flow energy and dissipated wave force upon reaching the coastline, the unfinished state of these structures has inadvertently become a contributing factor favoring erosion in the adjacent beaches.

Figure 182: South Central Zone – Protection wall interaction with erosion process

Source: IDOM 2023

Figure 183: Central Zone – Protection walls interaction with erosion process

Source: IDOM 2023

These zones present a dissipative profile beach. Being the most natural profile the middle one (number 2), it is possible to identify that profiles 1 and 3 have undergone a change in their natural behavior that has been induced by the protective structures located to the right and left of the natural profile.

The structure associated with profiles 1 and 3 has been dissipating the energy of the wave colliding with it. However, this structure has caused an increase in the capacity of marine drag located on the edge of the structure towards the natural beach, which has caused accelerated erosive processes with an increase in the capacity of bottom drag.

The structure associated with profile No. 2, the geotextile, has a function of preventing marine drag during times of high swells. However, it cannot resist itself the accelerated erosion process that occurs in this area of the shoreline.

In the **northern part** of the island, careful analysis reveals that the natural processes of coastal erosion have been consistently and sustainably maintained over the years. This can be attributed to the minimal anthropogenic intervention in terms of construction activities. The limited human interference allows the natural processes of erosion and sedimentation to persist in a stable manner.

On the contrary, in **the southern zone** where protective constructions have been implemented to mitigate coastal erosion, two distinct scenarios have emerged. Firstly, in areas where these protection walls have been constructed, land reclamation has taken place, resulting in the restoration and maintenance of wider beaches than would occur naturally. Secondly, due to the fragmented nature of these protective structures, which have been independently built on individual properties, a lack of continuity in the coastal protection efforts can be observed along the southern coastline of the island.

Within this area, there is evidence of accelerated erosion processes attributed to an increase in kinetic energy at the moment of wave breakage. This phenomenon occurs because the wave direction and continuity are disrupted by the presence of the protective wall structures.

Therefore, the interaction between the altered natural processes and the functionality of the coastal protection walls becomes complex. It is essential to acknowledge that the island does not face a significant threat of coastal erosion, as long as the natural processes of the beaches in Ambergris Caye remain undisturbed and not integrated with artificial interventions.

2.2.7.4. Conclusions

The application of various methodologies helps to comprehend the coastal dynamics from diverse perspectives and establish a series of baseline data and inputs. These insights can be utilized both for broader coastal management and to assist smaller properties in understanding the dynamics of the coast near their infrastructure and exposed systems. The algorithm's application has demonstrated that coastal erosion can be swiftly and automatically defined using wave data, providing a snapshot of the island's coastal processes in the coming years. Having access to this data proves crucial in enhancing our understanding of coastal dynamics.

Through manual digitization and qualitative analysis of adaptation measures' influence on coastal erosion processes, the study reveals the complexity and variability of coastal dynamics. Specific erosion or sedimentation processes are not evident, as they fluctuate in response to extreme climatological events. However, it is apparent that protective seawalls do have a pronounced impact on subsequent sections, accelerating the erosion of the coastline.

Following this, in the Pacifico’s Survey, people scored 3.7 on "how much they think the development of Ambergris will affect their daily lives", according to the field trip and workshops, these protective dikes have been built under the perception of the existence of coastal erosion. However, these studies have shown that there is just a natural process of sedimentation and erosion on the coast of Ambergris, but the seawalls have affected this natural process affecting the seagrass and favoring the erosion processes, so if these types of structures continue to be built, the degradation of the seagrasses that protect the coastal areas will continue and could continue to favor the loss of beaches. Therefore, it is very important to implement a zoning plan and mitigation projects that can slow down these processes and provide time to recover the natural coastal defenses.

2.2.8. General Conclusions

The inputs provided in this report serve as valuable guidelines, although they are not decisive due to the limited scale of analysis, which hinders making lot-level decisions. Further risk studies with greater detail will be necessary for specific interventions. Nevertheless, essential insights can be extracted to aid in the island's zoning and prioritize areas for intervention, as well as identify constraints on growth.

Notably, vulnerable neighborhoods like San Mateo and San Pedrito present higher risks due to socio-economic factors that determine their vulnerability. The materiality of these areas largely contributes to their high-risk status, as the perceived threat level remains high across the entire island. In the northern zone, which holds potential for future development on Ambergris Caye, it is evident that vegetation serves as a natural barrier against coastal erosion, and flood-prone areas are located near mangrove and wetland zones. Construction near these natural wetland ecosystems should be maintained to preserve their benefits, as adaptation measures in such areas would incur substantial costs and disrupt ecosystem dynamics, while also being susceptible to water accumulation.

To reduce risk, investing in improving the materiality of specific areas proves to be an effective measure for mitigating both flood and high-wind risks. Essential factors for comprehensive understanding of this concerning threat are coastal erosion monitoring and obtaining tidal level data. These efforts are pivotal in addressing the concerns of the island's population regarding this pressing issue.

The implementation of a zoning plan that regulates mangrove protection zones and mitigation actions for seagrass seeding and restoration is essential according to the results obtained in this natural risk vulnerability diagnosis which also agree with the risk perception results obtained in the Pacifico’s survey.

GHG INVENTORY AND MITIGATION ROADMAP

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2.3. GHG Inventory and mitigation roadmap

2.3.1. Conceptual Framework - Climate change

Climate change is a highly complex phenomenon that has gained importance in recent times due to the increase in the earth's surface temperature (between 0.75 and 0.99 °C approx.), which entails impacts of different orders, such impacts can be irreversible and their permanence critically affects the development of human life on earth (IPCC, 2018). Essentially, the balance established over millennia has been lost due to human activity. In this sense, basic concepts to understand climate change as a phenomenon, some of the impacts associated with global warming and the call for action by the scientific community are presented below.

Climate change refers to changes in the properties of the Earth's atmosphere, ocean, cryosphere and biosphere. Climate change is a consequence of the alteration of the Earth's energy balance due to changes in the amount of greenhouse gases (GHG) present in the Earth's atmosphere (NASA, 2022).

GHGs are compounds of natural and anthropogenic origin present in the Earth's atmosphere, whose main characteristic is their capacity to absorb and emit radiation. The gases of natural origin are water vapor (H2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and ozone (O_3). While anthropogenic GHGs, derived from activities related to energy and material consumption are CO_2, CH_4, N_2O and halocarbons. The Kyoto Protocol includes the gases shown in **¡Error! No se encuentra el origen de la referencia.**.

Table 59. Kyoto protocol recognized greenhouse gases.

Symbol	Name	Common sources	Atmospheric lifetime (years)
CO_2	Carbon dioxide	Fossil fuel consumption (61%), forest clearing, organic decay, and peat thaw (14%).	50-200
CH_4	Methane	Landfills, production and distribution of natural gas and petroleum, fermentation from the digestive system of livestock, rice cultivation, fossil fuel combustion, etc.	12
N_2O	Nitrous oxide	Fossil fuel combustion, fertilizers, nylon production, manure, etc.	150
HFCs	Hydrofluorocarbons	Refrigeration gases, aluminum smelting, semiconductor manufacturing, etc.	264
PFCs	Perfluorocarbons	Aluminum production, semiconductor manufacturing, etc.	10,000
SF_6	Sulphur hexafluoride	Electrical transmission and distribution systems, circuit brakers, magnesium, etc.	3,200

Source: (IPCC, 2021a)

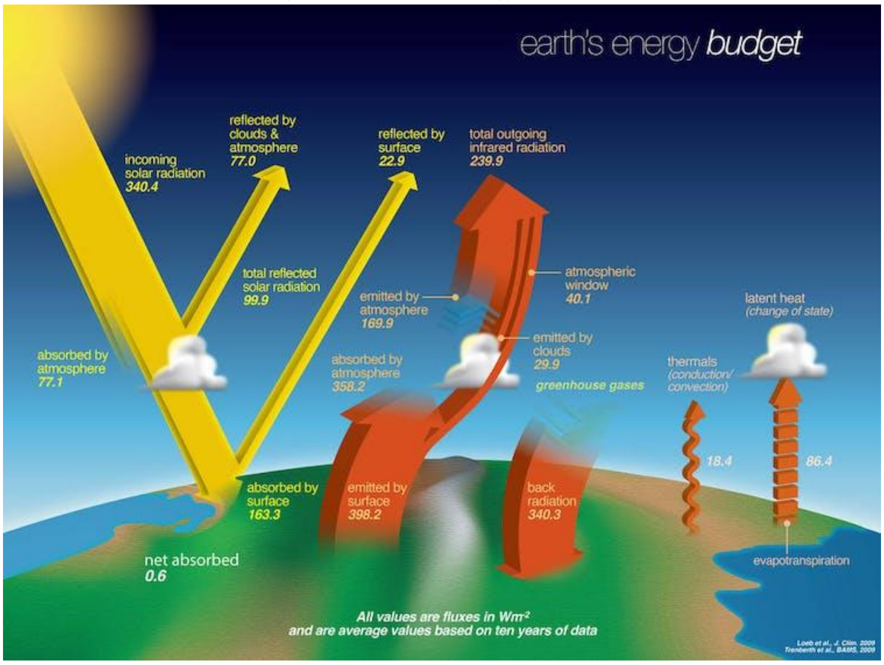
Water vapor is responsible for two-thirds of natural climate change. In the atmosphere, water molecules trap heat radiated by the Earth and emit it in turn in all directions, heating the Earth's surface and promoting other climatic phenomena, before returning it back to space.

However, human activities do not add water vapor to the atmosphere, so the major contributor to anthropogenic climate change is CO_2 (NASA, 2022).

Overall, CO_2 has increased by 48% since the industrial revolution. Methane (CH_4), nitrous oxide (N_2O) and other anthropogenic gases have also increased their concentration in the atmosphere.Contrary to water vapor, the gases: CO_2, CH_4 and N_2O are long-lived GHGs, i.e., they are chemically stable and persist in the atmosphere on time scales ranging from decades to centuries; moreover, they have a high capacity to absorb infrared radiation, so their emissions have a long-term influence on climate (US EPA, 2016). In such a way, the radiation emitted by the earth in the form of infrared radiation, in balance with the energy received in the form of solar radiation, is absorbed by these GHGs increasing the Earth's temperature (ACS Climate Science Toolkit, 2009). See

Figure 1.

Figure 1. Earth´s energy balance.



Source: (NASA, 2017)

The addition of more anthropogenic GHGs to the atmosphere increases global warming and thus intensifies climate change, where the degree of warming depends on several feedback mechanisms. For example, as the atmosphere warms due to increasing levels of anthropogenic GHGs, the concentration of water vapor increases, further intensifying the greenhouse effect, this in turn causes further warming, which brings about a further increase in water vapor, creating a self-reinforcing cycle. This water vapor feedback can be strong enough to nearly double the increase in the greenhouse effect, solely due to added anthropogenic GHGs (IPCC, 2014).

Global warming being a phenomenon of worldwide relevance, over the last 3 decades, the scientific community has tried to answer two main questions: Does climate change exist, the existence of climate change is posed, this is what is known as "detection"; What does climate change attribute, which alludes to what the main cause of climate change is, in case it exists, this question is called "attribution".

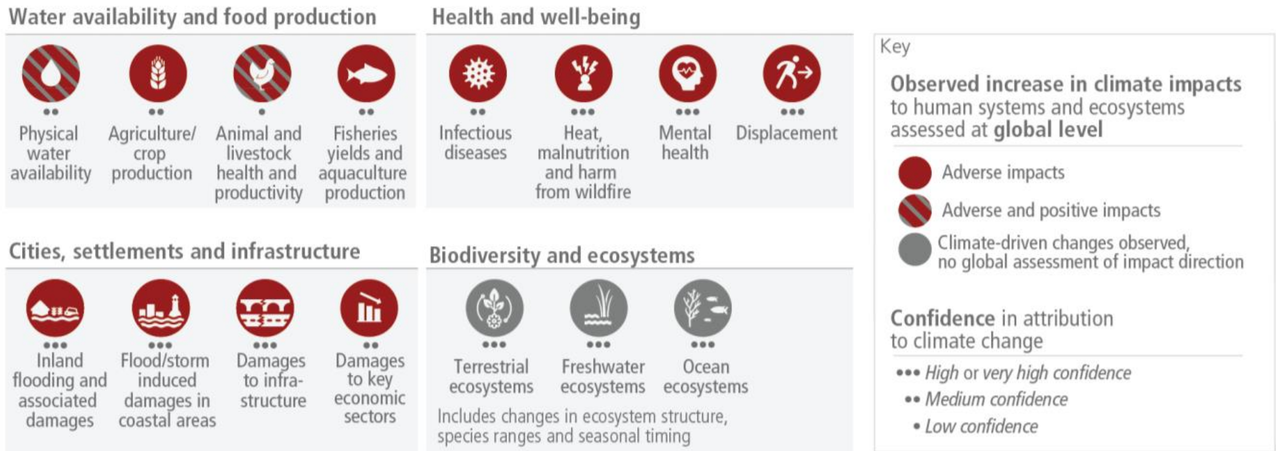
In this regard, the Intergovernmental Panel on Climate Change (IPCC) periodically publishes, through its Assessment Reports, the consensus between the work carried out by the scientific community on the study of climate change, including the opportunity fronts.

The conclusions of the Sixth Assessment Report (AR6) indicate that global warming is unequivocal and that it is extremely likely that since the middle of the 20th century it has been due to GHG emissions and changes in land use associated with human activity; and that mitigation actions must be taken to reduce future impacts, for which reason it must be taken into consideration that daily activities such as commuting to work or school, or using air conditioning, have an impact on the climate.

It has also been pointed out that there are three characteristics of climate change that make it a problem of hitherto unknown dimensions. First, it is a problem of global scale where responsibility is shared (albeit differentiated). Second, the impacts are local, long-term and distributed very differently around the globe, regardless of the location of the emission; and third, due to the complexity of the global climate system, the uncertainty surrounding the predicted impacts is significant. We are all responsible for impacts of uncertain magnitude, which, in any case, will affect the most vulnerable groups the most (IPCC, 2021b).

For this reason, it is imperative to act to avoid the impacts of climate change, which are associated with deterioration in human health, biodiversity, ecosystems, economies, among others; climate effects such as floods, droughts, sea level rise, and changes in the intensity and frequency of extreme weather events will be seen. These changes are visible today and affect mainly the most vulnerable population. It was also found that temperatures in the study area will increase on an annual scale and precipitation will decrease, especially during the winter season, among other aspects. See Figure 2.

Figure 2. Observed widespread and substantial impacts and related losses and challenges attributed to climate change.

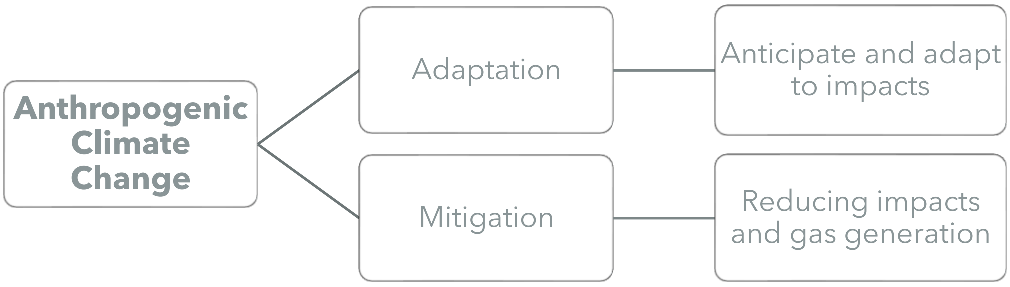


Source: (IPCC, 2021b)

In response to climate change, seen as a problem that requires immediate action, it should be taken into account that GHG emissions have been standardized in terms of CO2 equivalent, as a result of multiplying the emissions of reference GHGs by their warming potential over a 100-year horizon (IPCC, 2018). Estimating the amount of CO2 equivalent emitted by production and consumption activities taking place in an organization, city or country makes it possible to generate a baseline to incorporate strategies to decrease emissions and mitigate the effects of climate change. Two types of strategies are needed to combat climate change: adaptation and mitigation. The strategies are presented graphically in Figure 3.

Mitigation strategies can reduce projected impacts; shared responsibility for GHG emissions and local impacts mean that these strategies must be implemented at the global, national, local, and municipal levels. Adaptation strategies make it possible to design schemes to address the problem and design schemes to reduce vulnerability to the effects of climate change.

Figure 3. Climate change management strategies.



Source: IDOM

2.3.2. NDC Belize

The update of Belize's NDC under the Paris Climate Change Agreement references the availability of more robust data on land use trends and emission factors over the previous version of the NDC submitted in 2016, including the availability of Belize's first Forestry and Other Land Use (FOLU) sector Greenhouse Gas Inventory showing long-term trends in emissions and removals since 2001.

Within the NDC, Belize as a small country commits to achieving the ultimate objective of the Convention and supports the even more ambitious target to limit the increase in global average temperature to 1.5°C, compared to pre-industrial levels. This even when Belize, as a small country with relatively minor contributions to global greenhouse gas emissions, has limited capacity to contribute to mitigation of global climate change.

As a Small Island Developing State, Belize recognizes that the health and integrity of coastal ecosystems are vital for the health of people and the planet. "Blue carbon", fringe and island mangrove and seagrass ecosystems, play many important roles as a nature-based solution to climate change with mitigation, adaptation, and resilience co-benefits. This updated NDC reflects Belize's commitment to enhancing its climate ambition. Notably, ambition has been integrated into the updated NDC through the following enhancements:

- Improvements in the data availability and analysis of projections underpinning commitments, especially in the FOLU sector
- Realistic and achievable commitments
- Increased ambition through expanded sectoral targets
- Expanded coverage of gases covered in targets to include N_2O and Methane in AFOLU interventions
- Further specification of targets including addition of time frames, quantified emissions reductions and other outcomes
- Increased transparency in the development of targets
- Detail on the financing, monitoring and implementation of actions included in the NDC

2.3.3. Mitigation analysis

As mentioned above, mitigation consists of reducing GHG emissions produced in a territory; in this sense, the first step is to estimate the baseline.

2.3.3.1. GHG Inventory for community-scale

The GHG inventory is based on the GPC methodology, an accounting and reporting standard for cities, created by the World Resources Institute (WRI), C40 Cities Climate Leadership Group (C40), and ICLEI - Local Governments for Sustainability (ICLEI), in collaboration with the World Bank, UNDP and UN-HABITAT. This standard seeks to establish a framework that allows comparison between city inventories.

The GPC bases the development of the inventory on the following principles, which were considered in the development of the inventory:

- **Relevance**: Select emission sources and sinks, data and methodologies appropriate to the needs of the intended user. The inventory should reflect the activities taking place within the geographical boundaries of the inventory. Based on the principle of relevance, it is possible to exclude emissions that are not representative of the territory.
- **Completeness**: Include all relevant GHG emissions and removals. Explanatory notes should be included when an emission source is excluded, is not relevant or does not exist in the territory.
- **Consistency**: Calculations should be consistent in approach, methodology and scope. Thus, comparisons of results over a time series should be allowed. The methodologies recommended by GPC should be applied, reporting and justifying any deviation.
- **Transparency**: Activity data, emission factors and methodologies should be adequately documented and ready for verification. The information should be sufficient to ensure that the inventory can be replicated. It is especially important to clearly state the sources of information used.
- **Accuracy**: Systematic errors that lead to over- or underestimation of emissions should be avoided. The accuracy of the calculations should be sufficient to serve the purpose for which the inventory is carried out. Uncertainty should be reduced as much as possible and practical limits.
- **Measurability**: The data needed for inventory development should be readily available in time and cost. Any exclusions or estimates should be well documented.

In practice, conflicts may arise between the different principles. For example, complying with the completeness principle may require the use of less accurate data, affecting the accuracy principle. On the other hand, the GPC considers two types of emissions to be estimated, defined according to where they are generated:

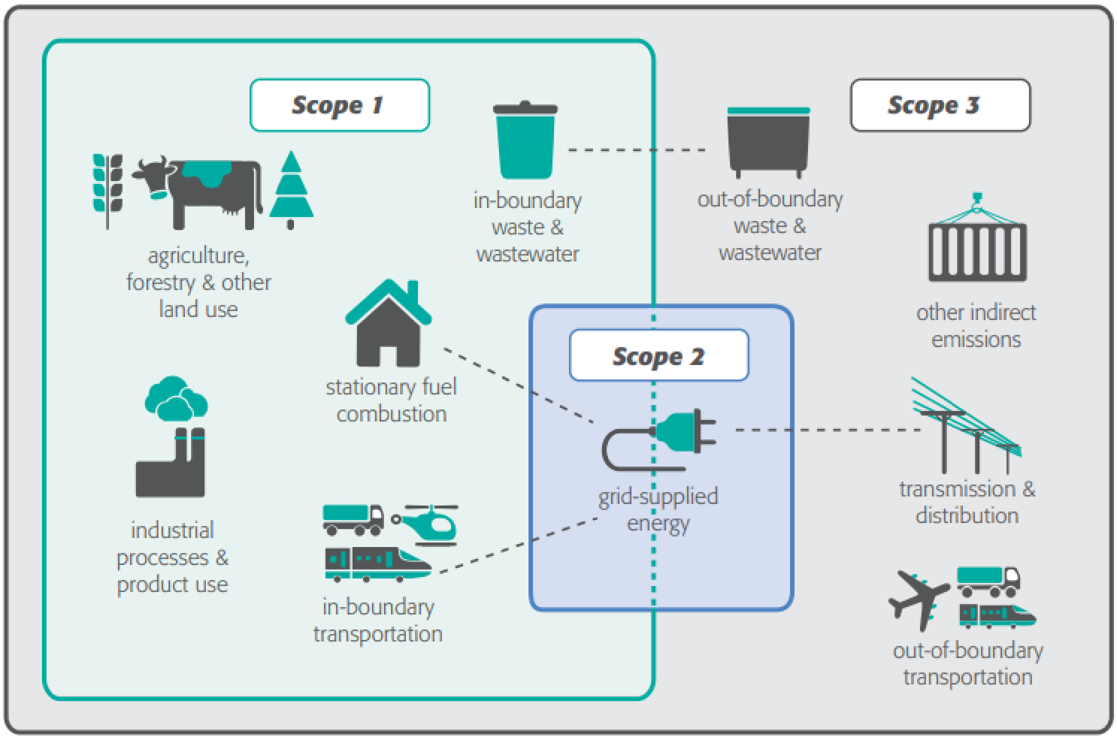
- **Direct emissions**: these are emissions that occur within the geographical boundaries of the inventory (in the study area).
- **Indirect emissions**: these are emissions that occur outside the geographical boundaries of the inventory but are directly related to activities that occur within the study area.

Based on this first classification, the GPC proposes three different scopes, in line with other carbon accounting protocols such as the GHG Protocol Corporate Standard or ISO 14064-1:2018.

- **Scope 1**: All direct emissions. This is the case of emissions associated with combustion in boilers or vehicle engines produced within the study area.

- **Scope 2**: All indirect emissions associated with grid energy consumption within the geographical boundaries of the inventory, such as electricity consumption (part of the electricity is generated in the study area while another part is generated outside).
- **Scope 3**: All other indirect emissions not covered in Scope 2. For example, emissions associated with waste management generated within the geographical boundaries but managed outside the study area.

Figure 4. Climate change management strategies.

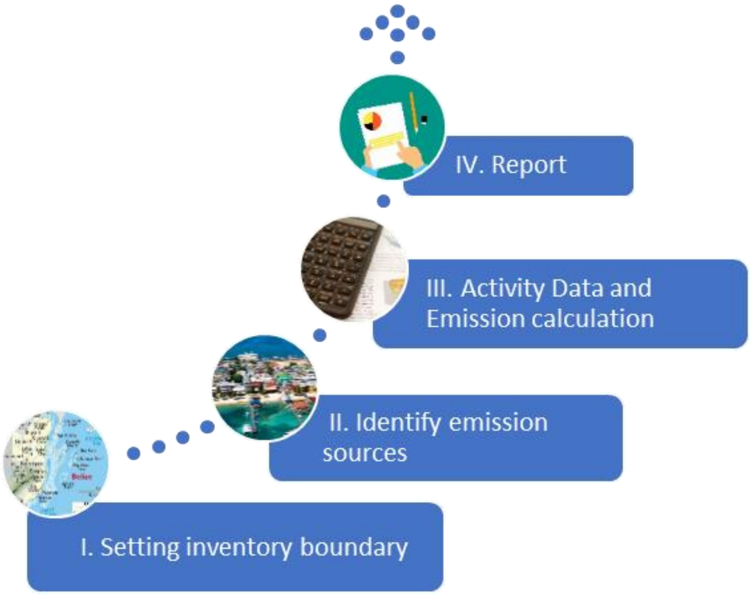


Source: (WRI et al., 2021)

Since electricity is accounted for on the demand side in Scope 2, and to avoid double counting, Scope 1 emissions associated with electricity generation in the study area should not be accounted for in the total emissions value. However, these emissions should be reported in Scope 1, at an informative level.

Similarly, GHG emissions associated with the management in the study area of waste from outside the study area. These emissions are counted as Scope 1, but not in the total emissions. Because of these two exceptions, the sum of Scopes 1, 2 and 3 does not equal the total emissions considered in the study area. Nevertheless, any GHG emissions inventory of a territory must include the four steps shown in Figure 5.

Figure 5. GPC general standard process.



Source: IDOM

Step 1: Definition of boundaries

It is necessary to define the boundaries of the inventory at two levels:

- Geographical: defines the geographical area of study. This can be a municipality, a metropolitan area, an organization, etc. All emissions occurring within these boundaries will be direct emissions.
- Operational: defines the emission sources to be considered. The GPC presents three different types of operational limits.
  - GPC 2014 BASIC: considers all Scope 1 and Scope 2 sources for emissions associated with stationary units, mobile units, waste, as well as Scope 3 emissions from the waste sector.
  - GPC 2014 BASIC+: considers in addition to the above the emissions associated with the Industrial Processes and Product Use (IPPU) and Agriculture, Forestry and Other Land Use (AFOLU) sectors, and Scope 3 emissions associated with transboundary transport.

Step 2: Identification of emission sources

Once the inventory boundaries are known, it is necessary to identify all emission sources. Some emission sources, such as diffuse sources, should be identified in aggregate form, for example, private road transport; while others, such as point sources, due to their relevance, should be identified individually, as in the case of emissions associated with industrial processes.

For the identification of emissions, it is necessary to rely on agents with local knowledge, existing documentation (inventories, statistical yearbooks, etc.) and cartography. Once the emission sources have been identified, it is necessary to define the calculation strategy for each emission source and establish the data to be collected.

Step 3: Data collection and emissions calculation

The information gathering process is iterative since it depends largely on the available data. In the previous step, the optimal data for the calculation to be collected should have been defined. However, it is common that some of these optimal data do not exist or cannot be obtained, in which case it is necessary to rethink the calculation strategy affected by this data and look for alternatives.

The data should come either from official documents and statistics (secondary data) or from direct survey processes of emission sources (primary data).

The calculation of emissions should be carried out whenever possible, applying the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. These guidelines are oriented to national inventories, and therefore, in some cases, are not directly applicable to inventories of subnational territories or municipalities. In addition, to be consistent and follow the principle of comparability, this inventory has used emission and removal factors derived from research and calculation with information from Mexico and which have been published in national documentation. Due to its relative complexity, this calculation will be explained in detail in the Emission Calculation Methodology section.

Step 4: Reporting

The emission report is constructed according to the format established by the GPC and grouped according to the IPCC, which allows for alignment of state and federal methodology data. The GPC reporting table includes emission results for each gas type and total emissions in terms of CO_2 equivalent (CO_2e) with both IPCC scope and sector classification. The GPC reporting format should provide information on the quality of the data used (*data quality*) and notes on exclusions emission sources (notation keys), according to the following key:

Data quality:

A High: Local emission factors and detailed activity data.

M Medium: National emission factors and detailed activity data or generic activity data and local emission factors.

B Low: National or international emission factors and generic activity data.

Notes on exclusions[2]:

- IE Included elsewhere: Category has been grouped with another category.
- NE Not estimated: Although emissions exist, they have not been accounted for.
- NO Not occurring: The activity or process does not exist.
- NA Not applicable: the activity exists but does not generate emissions.

The emissions report includes, for information purposes, CO_2 emissions associated with the combustion of biomass (firewood, charcoal, vegetable waste, biodiesel and alcohol). Biomass combustion implies that, with proper resource management, such fuel could be considered CO_2 neutral, without producing a long-term effect on climate change.

This applies only to CO^2 emissions; the rest of the greenhouse gases emitted in biomass combustion (CH_4, N_2O) do have a long-term effect on climate change and should be considered in the inventory.

2.3.3.2. Emission calculation

[2] The 2006 IPCC Guidelines also include the note "NA - Not Applicable" for those activities that do occur but do not result in the emission of a specific GHG. To the GPC, the NA note is not applicable as the use of notes in the GPC is focused on categories, rather than specific gases, and does not require the same level of disaggregation as for national inventories.

The calculation methodology is based on the GPC, which follows the IPCC (2006) Guidelines for National Greenhouse Gas Inventories. Except in special cases such as the Waste Sector or some concepts of the AFOLU sector, the emissions calculation methodology is based on the use of Activity Data and Emission Factors.

$$GHG\ Emissions\ (t\ GHG) = Activity\ data\ \cdot\ emission\ factor$$

Where:

Activity Data: stands for the quantitative measure of the activity that produces an emission.

- In the case of emissions associated with fuel consumption, the activity data is usually the fuel consumed.
- In the case of emissions associated with industrial processes, the activity data is usually industry production or raw material consumption, depending on the type of industry.
- For emissions associated with electricity, the activity data is usually the energy consumed in terms of kWh.
- In the case of AFOLU, activity data such as number of head of cattle or crop area are used.

Emission Factor: Ratio relating activity data to GHG emissions. Expressed in tons of GHG/units (depending on the unit of the activity data units).

- For each fuel there is a specific GHG emission that is closely linked to the carbon content of the fuel in question.
- There are also sectoral emission factors for production processes, emission factors for organic matter degradation and emission factors for distance traveled for different types of vehicles.
- When choosing the emission factor, it is advisable to do so by applying criteria of geographical suitability (the more specific to the geography, the better) and temporal suitability (the closest in time to the calculation period). Recognized sources for the search of emission factors will be considered as those registered in "http://www.ghgprotocol.org/Third-Party-Databases", as well as documents published by local, national or international authorities. In this opportunity and as previously mentioned, the Emission and Absorption Factors available for Mexico, used in the last National Greenhouse Gas Inventory of the country, are used.

Sometimes, to adapt the units of the activity data to the units of the available emission factor, it is necessary to use conversion factors such as density or lower calorific value in the case of fuels. Direct GHG emissions from leaks or releases, such as refrigerant gases, are accounted for directly as the mass of GHGs released to the atmosphere, without the need to apply emission factors.

To use a common unit and to be able to compare the impact of each gas, the emissions of each GHG are converted to tons of CO_2e by applying a new factor called global warming potential.

$$GHG\ emissions\ (t\ CO_2e) = emission\ data\ \cdot global\ warming\ potential$$

Where:

Emission data: Quantitative measure of the emission produced (t GHG).

Global warming potential: Factor that describes the impact on climate change of each type of GHG. This factor is formulated based on the reference unit, CO2, and is therefore expressed in tons of CO2e (t GHG); there is a factor for each type of GHG. The factor refers to the action of the GHG on global warming over a period of 100 years. The definition of global warming potentials remains within the scientific domain, and they have significant uncertainty. The IPCC publishes the most current global warming potentials in its periodic Assessment Reports. For the purposes of this inventory, the global warming potentials published by the IPCC in the Second Assessment Report are used, as used in the National Inventories of Non-Annex I Countries. In this sense, the global warming potentials for the GHGs considered can be seen in Table 2.

Table 60. Global warming potentials.

GHG	Global warming potential
CO_2	1
CH_4	27,9
N_2O	273
HFC-32	771
CFC-11	5560

Source: (IPCC, 2021a)

2.3.3.3. Specific Cases: Waste Sector and AFOLU

In the case of CH4 emissions associated with the decomposition of organic matter in landfills, the calculation is more complex and cannot be simplified by using emission factors. The emission has a time lag with respect to the deposition of the residue and has non-linear kinetics. The First Order Decomposition (FOD) model is applied as indicated in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. This model can be summarized in the following steps:

1. Based on the amount of waste, its composition and the organic carbon content of each stream, the degradable organic carbon in the waste deposited in year zero is calculated.
2. Assume the amount of carbon that decomposes per year (default 50%).
3. Calculate the decomposition constant of the waste, based on the decomposition constant of each stream.
4. Apply an exponential equation (first order reaction) and calculate CH4 emissions.
5. Calculate the degradable organic carbon remaining in the landfill and accumulate it to the new waste entering the following year.

In the case of AFOLU, emission factors are applied for emissions associated with livestock, nitrogen fertilization and some crops such as flood rice. For land uses (soils that remain in the same use and soils that change use), the carbon accumulated in biomass in each type of vegetation and in each type of soil is calculated. Changes in land use are considered over a period of 20 years. After 20 years, they are not counted as changes in use. For each of the land use categories (settlements, cropland, forest land, grassland and wetlands) three carbon pools are considered:

- Biomass (above and below ground);
- Dead Organic Matter (dead wood and litter);

- Soils.

Estimates of emissions and removals are made for each land use. They are evaluated separately:

- Land remaining in the same land use category in the inventory year;
- Areas that have undergone a change in land use. An area that undergoes a change in land use must be considered as such for a period of 20 years. In other words, during those 20 years, this change of use should be considered as a source of emissions or removals.

2.3.3.4. GHG emissions inventory for Ambergris Caye

The GHG emissions inventory is proposed according to the Protocol "Global Protocol for Community-Scale Greenhouse Gas Emissions" (GPC) - Version 1.1 – Updated in June 2021 (ICLEI, C40, WRI)". According to the calculation principles described and the objectives of the Emerging and Sustainable Cities program, this section relates to the study framework and results (see Table 61).

Table 61. Scope and city study framework

Protocol	Global Protocol for Community-Scale Greenhouse Gas Emissions" (GPC) - Version 1.1 – Updated in June 2021 (ICLEI, C40, WRI)
Scope	Basic +
Country	Belize
Geographic boundary	Ambergris Caye
City-induced framework	- All scope 1 emissions from Stationary Energy sources (excluding energy production supplied to the grid) - All scope 1 emissions from Transportation sources - All scope 1 emissions from Waste sources (No emissions from imported waste were identified) - Scope 1 emissions from fluorinated gases that are used in refrigeration and air conditioning systems - All scope 1 emissions from AFOLU - All scope 2 emissions from Stationary Energy sources - Scope 3 emissions from treatment of exported waste - Scope 3 emissions from Stationary Energy sources (only transmission and distribution losses), and from Transportation
Reporting year	2022

Source: IDOM, 2023

For the purposes of classifying emissions for the diagnosis and for the Mitigation Roadmap, 6 sectors and sub-sectors are considered as shown in Table 62.

Table 62. Sectors and sub-sectors considered in the inventory.

SECTORS AND SUB-SECTORS	
GPC I. STATIONARY ENERGY	I.1 Residential buildings
	I.2 Commercial and institutional buildings and facilities
GPC II. TRANSPORTATION	II.1 On-road transportation

	II.3 Waterborne navigation
	II.4 Aviation
GPC III. WASTE	III.1 Solid waste disposal
	III.4 Wastewater treatment and discharge
GPC IV. IPPU	IV.2 Emissions from product use occurring within the city boundary
GPC V. AFOLU	V.2 Emissions from land within the city boundary

Source: IDOM, 2023

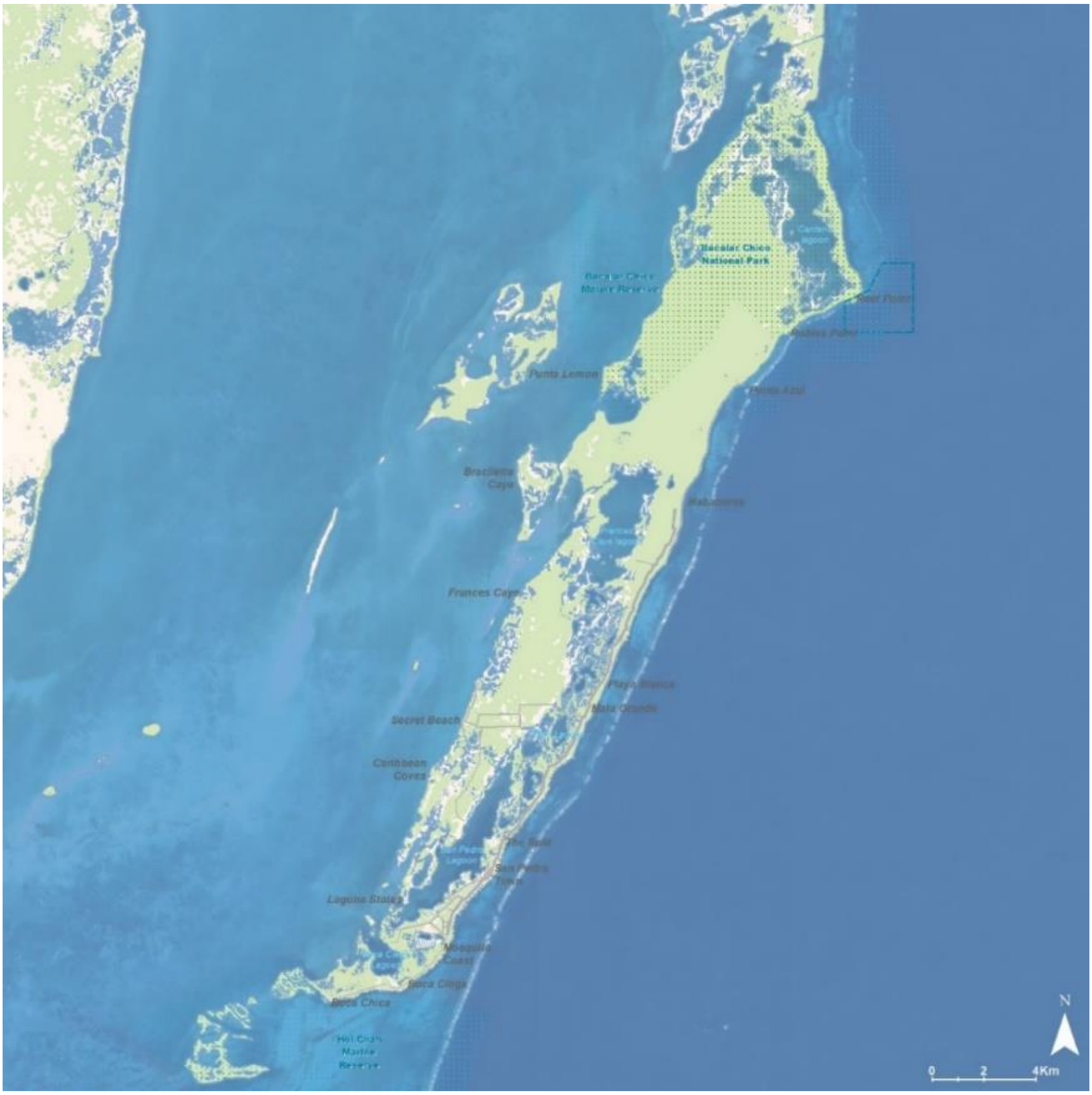
Subsequently a follow-up of the 4 general steps for the elaboration of the GHG emissions inventory defined previously in section 2.3.2, applied to the case of the Ambergris Caye.

2.3.3.4.1. Step 1: Definition of boundaries

To better understand the territorial framework of Ambergris Caye, a national scale approximation was made prior to the geographic boundary definition: Belize is situated on the north-eastern coast of Central America, and encompasses a rich variety of ecosystems, including lush rainforests, pristine coastlines, and the magnificent Belize Barrier Reef, a UNESCO World Heritage site. Belize´s population is about 441,471 people (According to the Spanish Diplomatic Information Office (April 2023) – Census 2010).

Ambergris Caye, is situated on the Caribbean coast of Central America with Mexico to the North and Guatemala to the west and south, is an island part of Belize. It lies between 15° 45' and 18° 30' N and 87° 30' and 89° 15' W, on the eastern coast of Belize in the Caribbean Sea. Ambergris Caye has an area of approximately 25 square miles (65 square kilometres), with about 18,319 inhabitants on the island according to projections to 2022 made through the last census of 2010. At the regional level, Ambergris Caye is an important source of tourism for the region and the country.

Figure 6. Territorial Scope of the GHG emission inventory



Source: IDOM, 2023

The operational limits are established by the GPC. This is the BASIC+ scope, which includes the following emission sources:

- All relevant Scope 1 and Scope 2 emissions from:
  - Stationary units
  - Mobile units
  - Waste
  - Industrial processes and product use (IPPU)
  - As well as from agriculture, forestry and other land uses (AFOLU)
- All relevant Scope 3 emissions from the waste sector, mobile units and stationary units.

2.3.3.4.2. Step 2: Identification of emission sources

The table addresses all the GHG emissions sources considered in the accounting for each sector and sub-sector for the Ambergris Caye inventory.

Table 63. Identification of emission sources for Ambergris Caye

GPC Ref No.	Sector	GHG Emissions Source
I.	**STATIONARY ENERGY**	
I.1	Residential buildings	○ Emissions from fuel combustion, the fuels identified were: GLP and the use of biomass for residential energy (cooking) ○ Emissions from the electric energy consumed in households. ○ Emissions from transmission and distribution losses from grid-supplied energy.
I.2	Commercial and institutional buildings and facilities	○ Emissions from fuel combustion, the fuel identified was GLP. ○ Emissions from the electric energy consumed in Commercial and institutional buildings. ○ Emissions from transmission and distribution losses from grid-supplied energy.
II.	**TRANSPORTATION**	
II.1	On-road transportation	Emissions from fuel combustion, the fuels identified were Gas and Diesel.
II.3	Waterborne navigation	Emissions from fuel combustion, the fuels identified were Gas and Diesel.
II.4	Aviation	Emissions from fuel combustion, the fuel identified was Jet fuel.
III.	**WASTE**	
III.1	Solid waste disposal	Emissions from solid waste generated within the Ambergris Caye, collected, storage in a transfer station but disposed in landfills or open dumps outside the boundary.
III.4	Wastewater treatment and discharge	Emissions from wastewater generated and treated within the boundary
IV.	**IPPU**	
IV.2	Emissions from product use occurring within the city boundary	Fluorinated gases that are used in refrigeration and air conditioning systems
V.	**AFOLU**	
V.2	Emissions from land within the city boundary	Emissions from land use and land use change within the Ambergris Caye

Source: IDOM, 2023

2.3.3.4.3. Step 3: Data collection and emissions calculation

The data collection process has been the result of an iterative process of searching and requesting data from key stakeholders, identifying barriers and proposing calculation alternatives to overcome them. The calculation strategy was top-down, when the activity data was only available for the country level; or bottom-up, when the activity data related to individual data from the different emission sources in the study area.

Bottom-up strategies are more precise and specific to the territory under consideration, while they have the disadvantage of a higher risk of non-compliance with the GPC principle of completeness and a greater laboriousness in the data collection process, which may make the repetition of the inventory unfeasible.

Figure 7. Key stakeholders for data collection.

NATIONAL GOVERMENT

- **Ministry of the Public Service**
- **Ministry of Sustainable Development, Climate Change and Disaster Risk Management**
- **Ministry of Labor, Local Government and Rural Development**
  E-mail: ceo@labour.gov.bz
  Phone: +(501)-802-2297
  Address: 6/8 Trinity Boulevard, Belmopan
- **Statistical Institute of Belize**
  Web: https://sib.org.bz/
- **Ministry of Agriculture, Food Security and Enterprise**
  Address: H.M. Queen Elizabeth II Blvd., Belmopan City, Belize C.A
  Phone: (501) 822-2241 / 42
  Fax: (501) 822-2409
  Email: info@agriculture.gov.bz

NATIONAL AUTHORITIES

Solid Waste Management Authority

- **National Climate Change Office**
  Government office in Belmopan, Belize
  Phone: +501-822-0160
  Email: secretary1@environment.gov.bz
- **Department of Environment**
  2nd Floor, Green Complex Building, 7552 Hummingbird Highway, Belmopan City, Belize, C.A.
  Email: envirodept@environment.gov.bz
- **Solid Waste Management Authority**
- **Energy Unit**
  Address: Second Floor, North Wing West Block, Belmopan City, Cayo District, Belize
  Phone: +501-828-5986
  E-mai: energy.secretary@energy.gov.bz

ACADEMIC INSTITUTIONS

- **Puma Energy Bahamas S.A.**
  Cesar Ridge Road, Loyola Park, Ciudad de Belice, Belice PO Box 328
  Tel: +1 5012277323
  Email: enquiries@pumaenergy.com
- **University of Belize**
- **University of the West**
- **Caribbean Agriculture Research Development Institute**
  Location: Central Farm, Cayo District, Belize
  Telephone: (501) 824-2934 / (501) 824-2936 / (501) 615-4903
  Email: cardi@btl.net

Source: IDOM, 2023

For the calculation of the inventory, a specific tool has been developed for the study area. The tool presents a balance between the simplicity necessary for the inventory to be repeated periodically and the accuracy necessary to obtain the results required to formulate mitigation measures and monitor their implementation. The tool is programmed in Microsoft Excel. In this way the formulas can be tracked and changes can be made to improve it or to incorporate new emission sources in the future. The tool has been designed to produce results in the GPC reporting format.

2.3.3.4.3.1. Consideration of biomass combustion in the inventory

There are certain fuels used in the study area that are associated with the short carbon cycle. This means that, with proper resource management, these fuels could be considered CO_2 neutral, without producing a long-term effect on climate change. Following the GPC guidelines, the CO_2 generated in the combustion of biomass is reported separately and is not taken into account when analyzing the total emissions of the study area.

In any case, this applies only to CO_2 emissions; the other greenhouse gases emitted in the combustion of these fuels (CH_4, N_2O) do have a long-term effect on climate change (because they have a higher global warming potential than CO_2) and are therefore accounted for in biomass combustion.

2.3.3.4.4. Step 4: Reporting

In this section, a diagnosis of GHG emissions is presented. As stated above, the diagnosis is based on two sources of information: the emissions inventory, which presents quantitative results; and the qualitative diagnosis, which seeks to identify mitigation potential.

Inventory results are available for the year 2022 as presented in Table 64, according with GPC protocol. Included in Scope 1 are the emissions associated with the management of waste generated within the study area but managed outside. Therefore, the total value does not correspond to the sum of the three scopes.

Table 64. Ambergris Caye GHG emissions report summary.

Sector		Total by scope (tCO_2e)				Total by city-induced reporting level ($t\ CO_2e$)	
		Scope 1	**Scope 2**	**Scope 3**	**Other Scope 3**	**BASIC**	**BASIC +**
Stationary Energy	Energy use (all I emissions except I.4.4)	16,210.78	7,957.04	1,071	-	25,238.35	25,238.35
	Energy generation supplied to the grid (I.4.4)	-	-	-	-	-	-
Transportation (all II emissions)		7,458.74	-	1,724.65	-	9,183.39	9,183.39
Waste	Generated in the city(all III.X.1 and III.X.2)	3,501.02	-	934.12	-	4,435.13	4,435.13

Sector	Total by scope (tCO₂e)				Total by city-induced reporting level (t CO₂e)	
	Scope 1	Scope 2	Scope 3	Other Scope 3	BASIC	BASIC +
Generated outside city (all III.X.3)	-	-	-	-	-	-
IPPU (all IV emissions)	14.89	-	-	-	-	14.89
AFOLU (all V emissions and removals)	-82,396.62	-	-	-	-	-82,396.62
TOTAL					**38,856.88**	**-43,524.86**

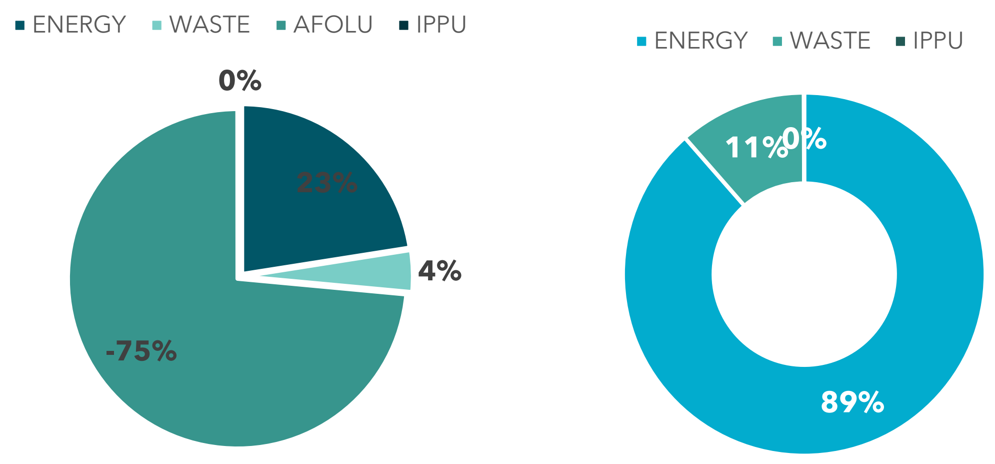
Source: IDOM, 2023

2.3.3.5. Integrated vision

According to the results of the 2022 GHG emissions inventory of the Ambergris Caye emitted 38,856.88 t CO_2e during that year, this regarding a BASIC scope, while for the BASIC+ scope the Ambergris Caye is a net carbon sink with -43,524.86 t CO_2e.

The balance of total emissions of the Ambergris Caye is distributed as follows: 23% of the emissions are linked to the consumption of energy in households, and commercial and institutional facilities which integrates the touristic activities. While the waste represents 4% of the emissions, which includes the emissions related to the waste received at the San Pedro transfer station and disposed in landfill, and the emissions related to the wastewater treatment system.

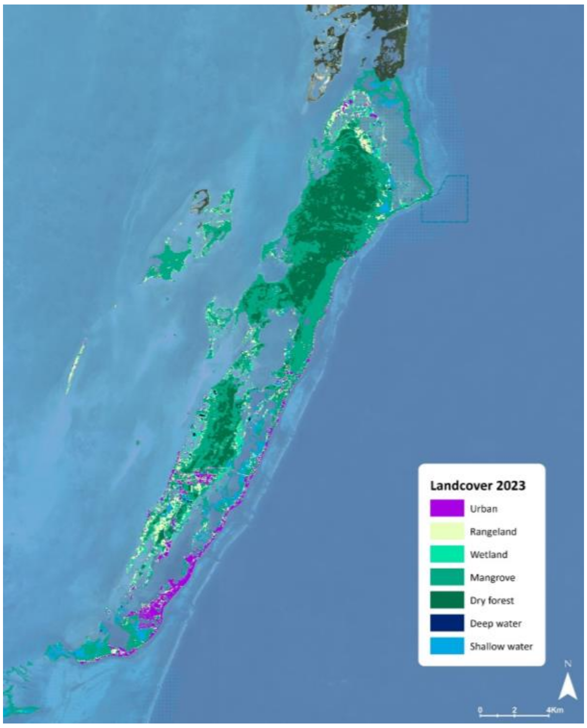
Figure 8. Ambergris Caye GHG emission distribution.



Source: IDOM, 2023

The AFOLU sector represents a -75% of the net emissions, which shows that the key ecosystem service of the Caye is its carbon storage capacity. Therefore, there is an impact related to the land use change, accounted in the emissions from mangrove degradation and urbanization: 407 t CO_2 eq for 2022.

Figure 9. Ambergris Caye land cover for 2023.



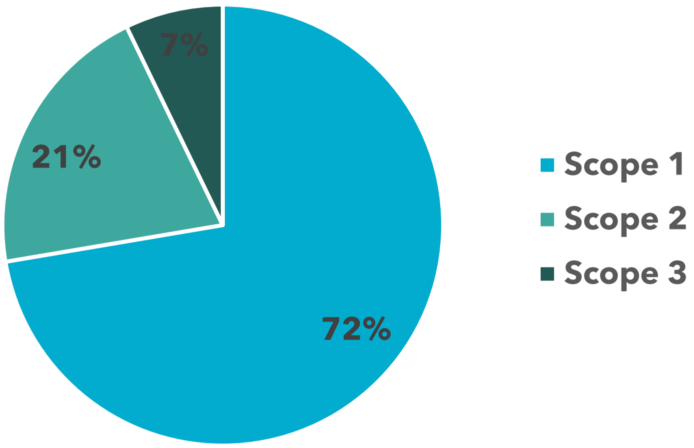
Source: IDOM, 2023

For information purposes, CO_2 emissions from fuel combustion total 23,669 t CO_2e, which amounts to 1.29 t CO_2e per capita. There is a significant tourist activity that generates emissions, primarily, for air and waterborne transport during 2022 there were about 116,000 tourists registered at Ambergris Caye.

Focusing on total emissions, as can be seen in Figure 10, most emissions are Scope 1 emissions, accounting for 72% of total emissions, while Scope 2 emissions, directly linked to electricity consumption, account for 21%, as do Scope 3 emissions, which account for 7%, mainly associated with mobility and waste.

This distribution is relevant since there is normally a greater capacity to act on Scope 1 and 2 emissions than on Scope 3 emissions.

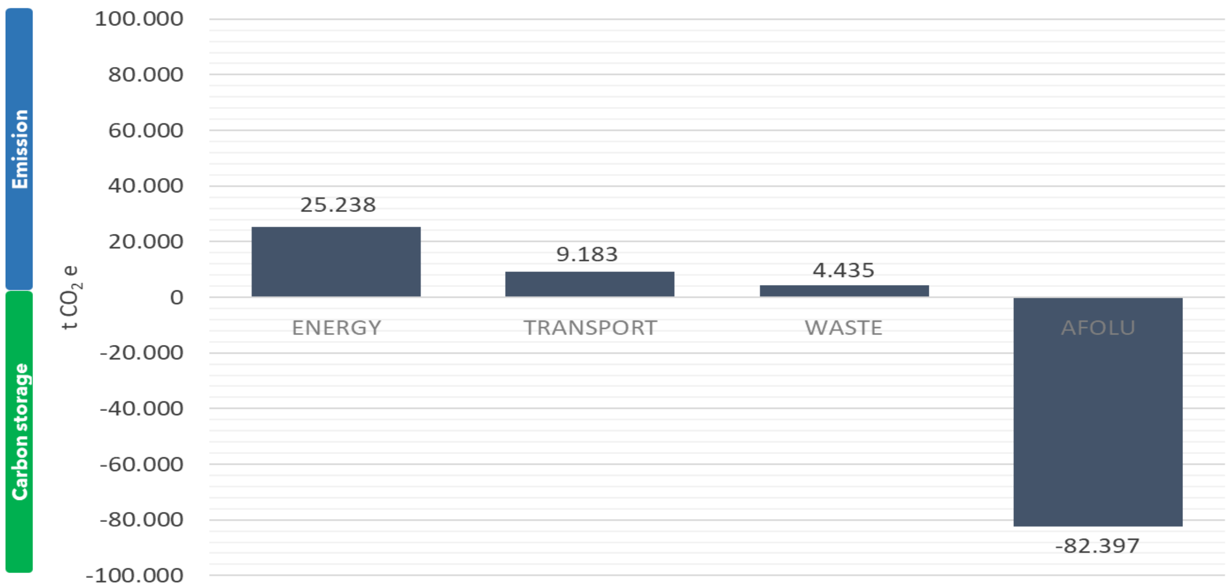
Figure 10. GHG emissions by Scope



Source: IDOM, 2023

Figure 11 shows the results of the GHG emissions balance in terms of t CO_2e by aggregated sectors. This figure clearly shows that the sector with the greatest impact on total GHG emissions is the stationary energy sector, followed by the transport sector.

Figure 11. GHG emissions balance in terms of t CO_2e by aggregated sectors.



Source: IDOM, 2023

2.3.3.5.1. Residential buildings

Photo 27. Example of residential buildings.	**Qualitative diagnosis**: The three categories of GHG emission sources of scope 1 correspond to thermal energy sources: LPG, Charcoal and other Biomass, and whose activity data is given in kBEP which stands for *"kilo barrels of oil* equivalent" which is in turn an energy unit that represents about 6,12 MWh each.

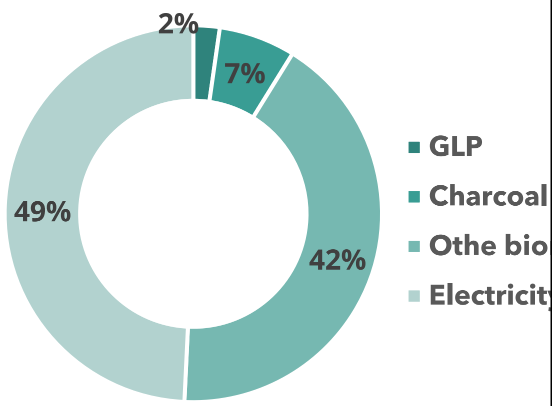
Source: IDOM, 2023

This means that *Other Biomass* represents 30.84 MWh (5.04 kBEP), thus being the main source of scope 1 with 42% of share, followed by *Charcoal* with 4.83 MWh (0.79 kBEP) and by *LPG* with 1,65 MWh (0.27 kBEP), representing 7% and 2% respectively.

As for scope 2 and scope 3 whose activity data categories are given in a different type of energy: electric power in MWh units. Both scopes represent up to 49% of share with a total of 11,150.32 MWh, indicating a high mitigation potential in these categories for residential buildings.

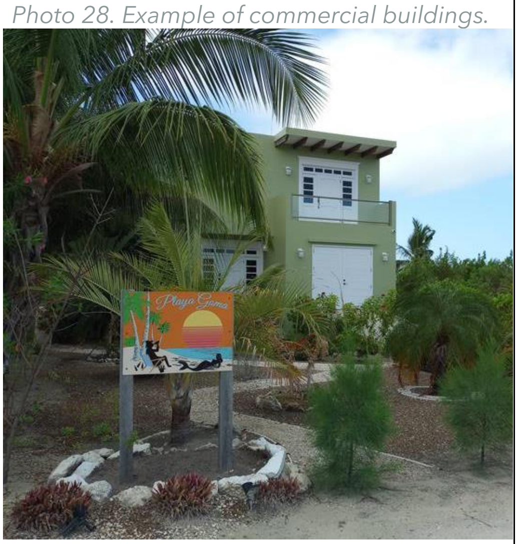
Activity data for 2022:

SCOPE 1		
Fuel	**Data**	**Unit**
LPG	0.27	kBEP
Charcoal	0.79	kBEP
Other biomass	5.04	kBEP
SCOPE 2		
Fuel	**Data**	**Unit**
Electric energy	10,028.73	MWh
SCOPE 3		
Fuel	**Data**	**Unit**
Distribution losses from grid	1,121.59	MWh



2.3.3.5.2. Commercial and institutional buildings and facilities

Photo 28. Example of commercial buildings.



Source: IDOM, 2023

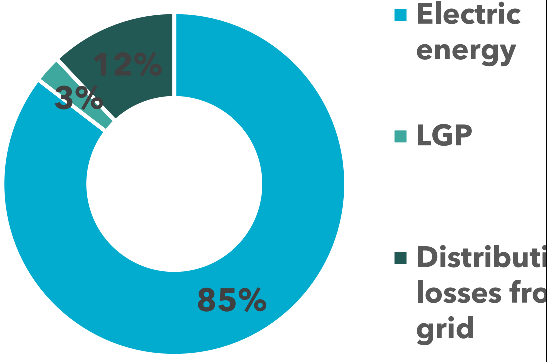
Qualitative diagnosis:

In line with the previous category, *for Commercial and Institutional Buildings and Facilities,* scope 2 and 3 lead the share with 16,128.55 MWh and 2,266.55 MWh respectively, as they both are electric power sources and summing 97% of the share and concentrating the mitigation potential.

As for the scope 1, this reports only LPG as a thermal energy source with a 3% of share and with 2.63 MWh (0.43 kBEP) despite it a direct emission category, however, considering an estimated cost of 217 USD per MWh, mitigation actions in this category could be significant.

Activity data for 2022:

SCOPE 1		
Fuel	**Data**	**Unit**
LPG	0.43	kBEP
SCOPE 2		
Fuel	**Data**	**Unit**
Electric energy	16,128.55	MWh
SCOPE 3		
Fuel	**Data**	**Unit**
Distribution losses from grid	2,266.55	MWh



2.3.3.5.3. Transportation

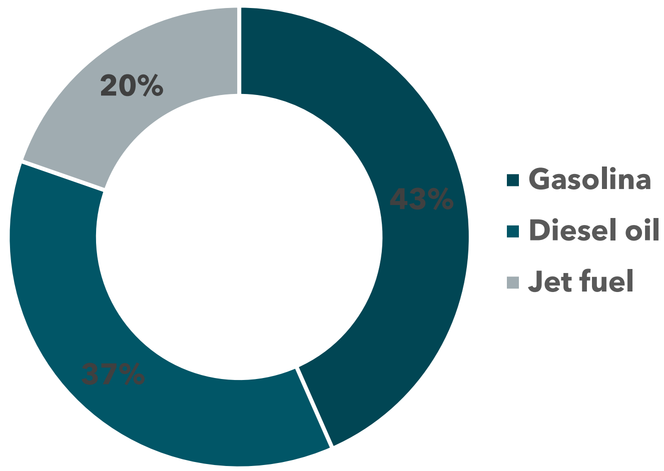
Photo 29. Example oftransport facilities.

Source: IDOM, 2023

Qualitative diagnosis:

For *Transportation,* 3 emission sources were considered: Gasoline, Diesel oil and Jet fuel, which are thermal energy sources with a high climate and environmental impact.

Gasoline has the main share with 43% followed by Diesel with 37% and Jet fuel with 20%, considering activity data, however, this category must be analyzed also in terms of type of technologies and means of transportations in which these fuels are used and in terms of amount of fuel burnt.



2.3.3.5.4. Waste

Photo 30. Example of waste disposal.

Source: IDOM, 2023

Qualitative diagnosis:

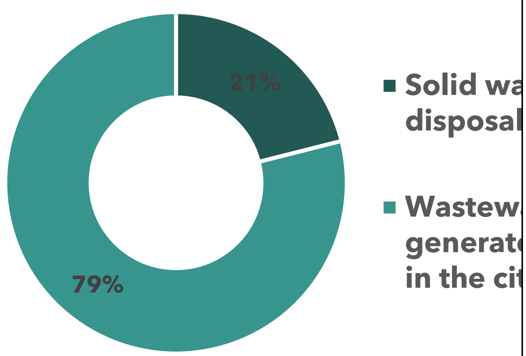
For the *waste* category, 2 emission sources were considered: solid waste generation and wastewater.

According to the provided activity data, the wastewater generated in the city counts on a share of 79% with a total of 652,81 m3/year. Solid waste generation, for its part, has a share of 21% with an estimated of 1,03 kilograms of waste per capita per day which is slightly above the Latin American average (Domestic Solid Waste (DSW) and Municipal Solid Waste (MSW) is 0.6 kg/cap/day and 0.9 kg/cap/day, respectively (IADB, 2015).

Activity data for 2022:

SCOPE 1

Fuel	Data	Unit
Solid waste generation	1.03	Kg/per capita/d
Wastewater	652,816	m^3/year



2.3.4. Business as usual (BAU) scenario

This scenario corresponds to the projection of Ambergris Caye emissions growth over time with a horizon of 2045, assuming that no mitigation measures are applied (public policy, investments, behavioral changes, or others) or that these have a minimal impact on the abatement of GHG emissions. Therefore, it is called a "Business as usual" scenario, which implies maintaining the current management conditions of the territory in terms of GHG emissions. For this purpose, the following procedure was applied:

2.3.4.1. Search for growth data of independent variables of the territory and adjustment to 2045

For this purpose, data associated with the following variables listed in the table were found, corresponding to the year 2022 and with a time horizon projected to the year 2045. However, since the horizon year for estimating and comparing the scenarios is 2045, a calculation formula was applied, estimating an annual growth rate, to calculate the change in these variables for this last specific year, yielding the following results:

Table 65. Independent variables result projected to 2045 and average annual rate

	PROVIDED DATA CURRENT 2022	PROVIDED DATA AS USUAL 2045	CALCULATED DATA AS USUAL AVERAGE ANNUAL GROWTH RATE 2045
POPULATION	18,319.00	30,877.00	0.023
DWELLINGS	6,112.00	12,241.00	0.031
ACRES OF URBAN FOOTPRINT	1,795.00	3,729.00	0.032
NET DENSITY	34.20	21.00	- 0.021
GROSS DENSITY	8.40	8.10	-0.002
GREEN AREA (sqm/inhab)	0.80	0.40	- 0.030
% POPULATION AT LESS THAN TEN MINUTES WALKING DISTANCE GREEN AREA (TOTAL FOOTPRINT)	4%	3%	-0.012
% POPULATION AT LESS THAN TEN MINUTES WALKING DISTANCE FACILITIES (EDUCATION & HEALTH)	84%	59%	- 0.015
PRECARIOUS DWELLINGS	1,560.00	3,125.00	0.031
POPULATION ON FLOOD AREA	11,099.00	20,737.00	0.028
PROTECTED AREA AFFECTED (ACRES)	46.70	67.00	0.016
MANGROVE AFFECTED (ACRES)	236.73	546.50	0.037
AVERAGE			**0.010**

Source: IDOM, 2023

2.3.4.2. Search for national GHG emission inventories conducted in the past for the purpose of making estimates for Ambergris Caye and applicable to previous years.

According to the National GHG Emissions and Removals Inventory for Belize published in 2020 and which, covers a reporting period from 1997 to 2017, the following results were found for each of the IPCC modules:

Table 66. National GHG Inventories results from 1994 to 2017 (Gg CO_2 e).

SECTOR	1994	1997	2000	2003	2006	2009	2012	2015	2017
ENERGY	NE	NE	NE	NE	NE	NE	538.07	781.81	786.36
WASTE	0.37	0.41	0.45	0.34	0.37	12.21	22.73	19.89	26.81
IPPU	0.67	2.96	6.36	10.57	15.4	22.83	31.43	42.5	43.69
AFOLU	-6,614.01	-7,197.2	-7,725.07	-11,755.29	-11,218.4	-9,868.83	-7,771.37	-6,104.27	-6,683.66

2.3.4.3. Calculation of an annual average of national emissions per IPCC module and calculation of the average percentage share of Ambergris Caye according to the baseline performed for 2022.

In order to calculate the estimated GHG emissions for Ambergris and which can be applicable to previous years based on previous national inventories, 2022 emissions were calculated for each IPCC module and the percentage share of the Ambergris Caye in these emissions considering the baseline calculated for 2022, obtaining the following results:

Table 67. 2022 projected national GHG emissions per module and Ambergris Caye share

Sector	NATIONAL PROJECTED EMISSIONS (Gg CO2eq)	% AMBERGRIS CAYE SHARE ACCORDING TO THE NATIONAL INVENTORY
ENERGY	1,085.34	3.2%
WASTE	29.32	15.1%
IPPU	51.96	0.03%
AFOLU	-7,929.79	1.0%

Source: IDOM, 2023

2.3.4.4. Estimation of the behavior of GHG emissions for Ambergris Caye with regression to previous years applicable to national GHG inventories

Based on the behavior of national GHG emissions reported in official inventories from 1994 to 2017 and considering the participation of GHG emissions of Ambergris with respect to the national level and according to baseline data obtained, the behavior of emissions at the level of the municipality was weighted, obtaining the following results.

Table 68. GHG emissions estimation for Ambergris in previous years.

SECTOR	2012	2015	2017	2022	2045

ENERGY	19.73	30.74	32.19	**34.42**	**67.16**
WASTE	0.83	0.78	1.10	**4.44**	**12.58**
IPPU	1.15	1.67	1.79	**0.01**	**0.03**

Source: IDOM, 2023

2.3.4.5. Treatment for calculating AFOLU emissions in BAU Scenario

Considering that some specific data related to AFOLU (Agriculture, Forestry and Other Land Use) was provided, regarding changes for 8 land categories between 1997 and 2023, and data for 2045 was projected, the following calculation was developed to estimate GHG emissions in the BAU scenario for 2045:

Table 69. GHG emissions estimation for AFOLU

Year:	**1997**		**2023**		**2045 BAU (Area)**		**Gg CO_2 e**
Land cover	**Area (HA)**	**%**	**Area (HA)**	**%**	**Area (HA)**	**%**	
Urban	297	2.5%	655	5.4%	1141	9.4%	
Rangeland	729	6.0%	1259	10.4%	1402	11.6%	
Wetland	808	6.7%	655	5.4%	629	5.2%	-
Mangrove	6381	52.7%	5765	47.6%	5223	43.1%	
Dry forest	3239	26.8%	2836	23.4%	2774	22.9%	
Deep water	159	1.3%	89	0.7%	89	0.7%	
Shallow water	492	4.1%	846	7.0%	846	7.0%	
TOTAL	**12105**	**100.0%**	**12105**	**100.0%**	**12105**	**100.0%**	**-50.89**

Source: IDOM, 2023

Where GgCO2e is calculated by using: tC/Ha (Carbon stock per hectare) according to the land use category (FREL, IPCC, IIN); total area of the land use (Ha) projected for 2045 for each category in Ambergris, and the emission factor for calculating CO_2 removals, obtaining a result of :-50,89.

2.3.4.6. BAU Scenario Estimate for Ambergris Caye to 2045

Based on all the above calculations, the behavior of emissions in 2045 for Ambergris was estimated in a BAU scenario, considering only the average growth rate of the independent variables shown in the first step of this exercise. The estimates obtained for the behavior of Ambergris emissions for the year 2045 are the following, presented comparatively with the baseline calculated for 2022:

Table 70. Projected emissions to 2045 BAU Scenario (Gg CO_2 e)

Sector	**BASELINE: 2022**	**BAU: 2045**
ENERGY	34.42	67.16
WASTE	4.44	12.58
IPPU	0.01	0.03
AFOLU	-82.40	-50.89
Total Emissions (GgCO_2e)	**-43.52**	**28.87**

Source: IDOM, 2023

According to this result, the modules of Energy, Waste and IPPU tend to increase their GHG emissions in a BAU scenario projected to 2045. On the contrary, the CO2 removals from AFOLU would decrease significantly. In this context, the absolute CO_2 emissions of Ambergris would go from a negative carbon level (-43.52) <best scenario> to a positive carbon level (28.87) <worst scenario> in a BAU scenario.

2.3.5. Mitigation roadmap

According to the GHG emissions inventory of the Ambergris Caye and the emission classification by sector, a mitigation roadmap was established to address the reduction of the emission within the Caye. A set of mitigation measures was established considering the Nationally determined contribution of Belize, an evaluation of the projects related to stationary energy transition and the vision of relevant actors. The present Mitigation Roadmap has a time horizon to 2045.

2.3.5.1. Analysis of competencies

In the sectors of energy use, regarding the energy production, competencies are limited as the Caye power used is mostly supplied by general energy company within the country, so greater support from other levels of government or actions to encourage more sustainable behaviors from a voluntary point of view will be required.

On the other hand, Ambergris Caye has a high capacity to act in the institutional sector and in the residential sector, although in the case of the latter, it is mainly up to the Mayor's Office to implement housing projects and urban development programs. Regarding the service sector, primarily tourism sustainable operation can be promoted through the local government.

In the mobility sector, the Ambergris Caye is responsible for the transformation of the transport fleet, as well as for the construction and management of the infrastructure.

Finally, in the waste sector, the municipality is fully responsible for solid waste management and urban wastewater management.

Table 71. Sectors and sub-sectors considered in the inventory.

SECTOR	SUBSECTOR	EXCLUSIVE CAPACITY OF THE MUNICIPALITY TO ACT
STATIONARY ENERGY	I.1 Residential buildings	Significant, although there is a lack of instruments to encourage more sustainable behavior in this sector, especially in the services sector.
	I.2 Commercial and institutional buildings and facilities	
TRANSPORTATION	II.1 On-road transportation	Total with planning and management capacity.
	II.3 Waterborne navigation	
	II.4 Aviation	
WASTE	III.1 Solid waste disposal	Total with planning and management capacity.
	III.4 Wastewater treatment and discharge	
IPPU	IV.2 Emissions from product use occurring within the city boundary	Limited there are no competences.

AFOLU	V.2 Emissions from land within the city boundary	Significant action can be taken on the urban footprint and in relation to mangrove conservation. However, there is a lack of instruments to act on the protection of natural capital.

Source: IDOM, 2023

2.3.5.2. Prioritized mitigation measures

Table 72. Prioritized emission mitigation measures for Ambergris Caye.

	MITIGATION MEASURES	2045 MITIGATION TARGET
	LAND USE CHANGE AND FORESTRY	
Target	Structure projects and promote the protection and reforestation of mangroves as the main carbon sink and climate risk mitigator.	37 %
Action	Develop a local capacity in REDD+ Strategy to maintain Ambergris Caye baseline forest and mangrove reference level.	
Action	Reduce degradation in 5700 hectares of mangrove within Ambergris Caye by reducing land use change and controlling other human disturbance.	
Action	Support forest protection and restoration, including REDD+ performance-based payments, multilateral and bilateral funds, insurance products, debt-for-nature swaps, private investment, carbon credits and bonds, and other innovative conservation financing mechanisms.	
	ENERGY	
Target	Enable an investment portfolio that encourages the inclusion of renewable energy systems to improve energy security conditions in the Caye.	81 %
Target	Create an energy efficiency fund to support the development of renewable energy projects for the business and residential sector.	16 %
Action	Explore the feasibility of solar power generation and flexible storage technologies for housing and institutional use.	
Action	Facilitate the implementation of renewable energy projects for the business sector within the Caye.	
	TRANSPORT	
Target	Improve the efficiency of the transport system by deploying hybrid and electric mobility by 2030.	20 %
Action	Facilitate the adoption of hybrid and electric vehicles by conducting feasibility studies and assess the implementation of incentives for the investment.	
Action	Implement a policy framework to promote more efficient waterborne transport and/or low carbon fuel transition.	
	SOLID WASTE	
Target	Optimize logistics and coverage related to the management of regular municipal services to all households and tourism providers, mainly in terms of solid waste and wastewater treatment.	76 %
Action	Expand the wastewater management system outside San Pedro Town, including touristic activities. And develop a feasibility study to upgrade the current management technology.	
Action	Implement waste management system outside San Pedro Town, including collection and drop off services.	
Action	Generate a zero-waste project program for touristic, residential and institutional activities.	

Source: IDOM, 2023

Although forests represent an important vegetation cover for the capture and storage of carbon (CO_2), ecosystems classified as blue carbon ecosystems (BCE) such as mangroves, seagrasses and marshes. In addition to fulfilling ecological functions of regulation, provisioning and sustainability that protect the coasts and ensure the supply of fish for the communities, have a high importance as they are considered to capture CO_2 at a higher rate.

As a result, these ecosystems are sources of interest for local economies and buyer countries in the carbon market as they are attractive sources of blue carbon credits. Although the price of carbon credits varies depending on several factors such as location, according to CarbonCredits.com projects in Asia and Central America pay an average of US$50 for blue carbon credits (1T CO_2e), these values can even increase up to US$80 in the voluntary market.

According to Macreadie et al., 2021 in Blue carbon as a natural climate solution it is estimated that, on a global scale, ECBs store more than 30,000,000,000,000 T of C in about 185 million hectares, i.e., if these ecosystems are protected in addition to all the benefits of coastal protection, the emission of 304,000,000 T CO_2e per year would be avoided. In fact, conservation in conjunction with potential ECB restoration could reduce an additional 841,000,000 TCO_2e per year by 2030. Mangrove protection and/or restoration could provide the greatest carbon-related benefits as a cost-effective and scalable natural climate solution in that the price of a blue carbon credit multiplies the more area of these ecosystems that is conserved and protected.

2.3.6. Smart (intelligent) scenario

This scenario corresponds to the projection of the growth of Ambergris Caye emissions over time if the following mitigation measures defined by the NDC of Belize are applied and whose target year is 2030, so an estimated was run to project those targets up to the year 2045 as the smart scenario horizon.

Table 73. Projected mitigation actions and potential reduction targets up to 2045 - Smart Scenario

MITIGATION ACTIONS	NDC TARGET	YEAR	PROJECTED TARGET RELATED TO THE NDC	YEAR
AFOLU	31%	2030	89%	2045
Reforestation of mangroves				
ENERGY & IPPU				
Renewable energy systems	75%	2030	100%	2045
Energy efficiency	10%	2030	29%	2045
TRANSPORT				
Efficiency of transport	15%	2030	43%	2045
WASTE				
Optimize logistics	70%	2030	100%	2045

Source: IDOM, 2023

Based on the previous mitigation actions and their corresponding targets for 2045, the total amount of estimated emission reductions which would be achieved by 2045 were calculated starting from the BAU scenario considering that the emissions tend to grow due to different variables regardless the mitigation actions parallel implementation.

Table 74. Smart scenario results

SECTOR	SMART 2045
ENERGY	46,50
WASTE	6,29
IPPU	0,01
AFOLU	-60,28
Total Emissions ($GgCO_2e$)	**-7,48**

Source: IDOM, 2023

In the Smart scenario, the IPCC modules Energy, Waste and IPPU decrease their GHG emissions due to the mitigation actions which are planned to be implemented; on the contrary, the IPPC module AFOLU increase its carbon removals reaching a level of -60.28 GgCO2 of carbon storage.

TOURISM ANALYSIS

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2.4. Tourism analysis

Tourism analysis is one of the key components of the Multisectoral Diagnosis for Ambergris Caye (AC). Considering its importance in the economic development of the Island, this document contains a descriptive study of the tourism activity with its characteristics, value chain, trends, and projections according to official information.

The study of the tourism sector is based on a quantitative and qualitative analysis, including tables and graphs according to the topics addressed, starting with the existing resources at the destination, and then continuing with the analysis of the tourism value chain, supported using primary and secondary information collected as part of the multisectoral tourism diagnosis. Afterwards, the analysis will the pros and cons of their development in terms of competitiveness, sustainable and regenerative conditions, and trends, considering international references such as Tourism & Travel Competitiveness Index and Global Sustainable Tourism Criteria for Destinations.

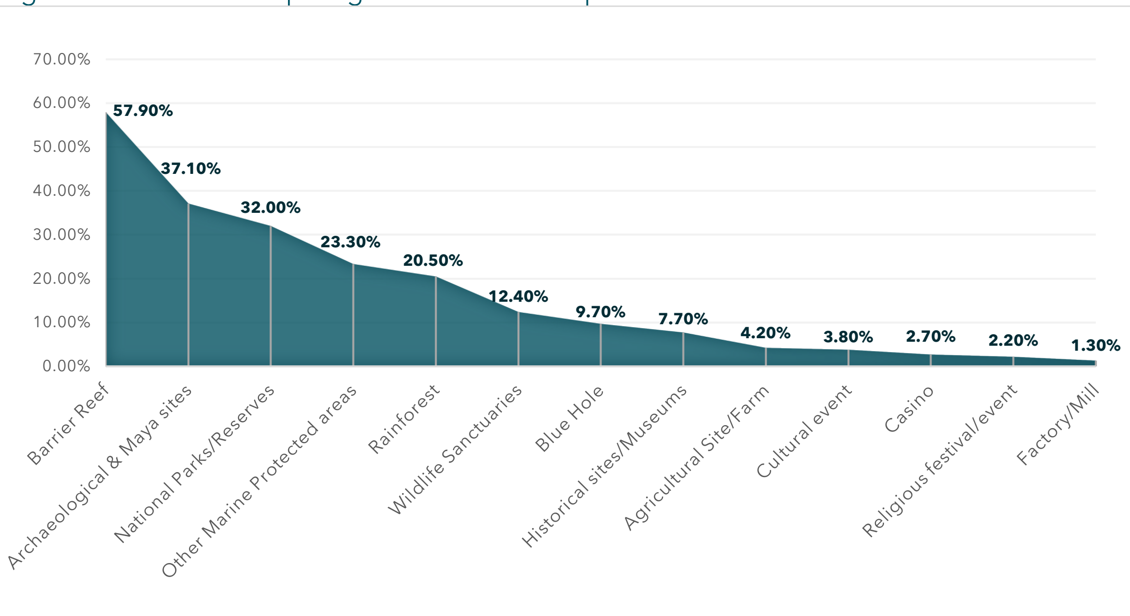
2.4.1. Context

The transformation of Ambergris Caye into a tourist destination was historically linked to resource extraction and fishing. The inhabitants of these areas were originally farm workers who settled along the coasts and engaged in agriculture and fishing. After Hurricane Janet in 1955, they shifted their focus to commercial fishing (lobstering) and tourism.

The hotel industry in Ambergris Caye began in 1965, and small-scale tourism gradually grew with the establishment of hotels, primarily owned by Belizeans in the town and foreigners in other parts of the island. By the late 1980s and early 1990s, the number of visitors to Ambergris Caye had increased significantly, with tourists mainly coming from North America. In 1998, Ambergris Caye became part of the UNESCO World Heritage List, emphasizing the need for sustainable and regenerative development.

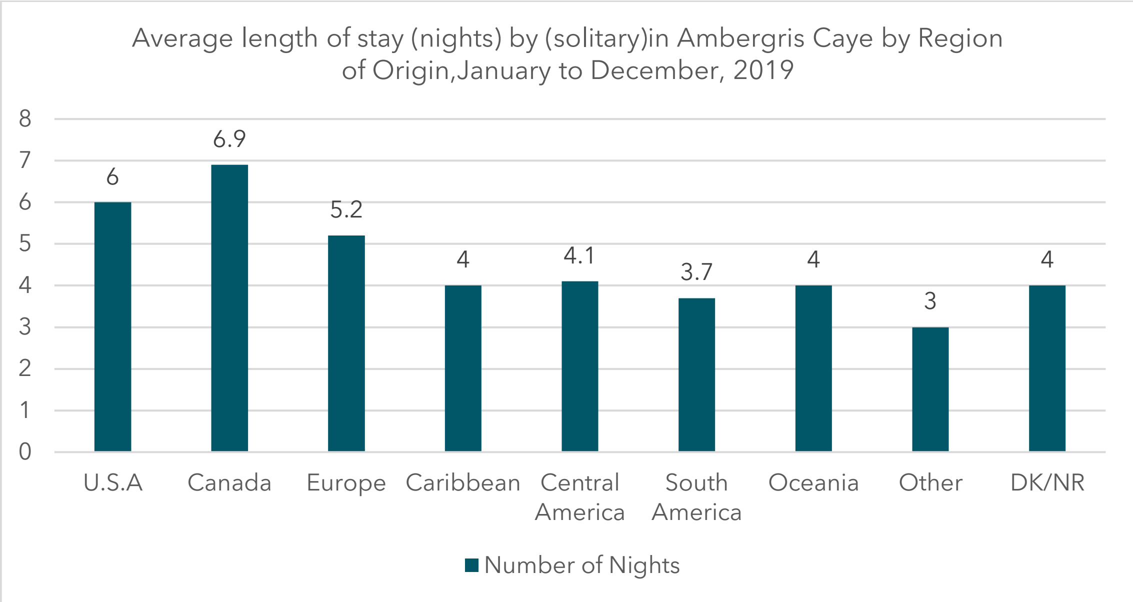
According with Belize Tourism Board (BTB), the Barrier Reef was the most visited tourism site in 2019, followed by the Archeological/Maya Sites and the National Parks/Reserves:

Figure 184 - Relationship diagram between components



Source: BTB, 2020

Figure 185 – Average Length of Stay in Ambergris Caye



Source: BTB´s Statistics - Survey on 11,346 international tourists, 2019

2.4.1.1. Natural and cultural tourism resources

Three marine reserves and national parks are located in Ambergris Caye: Corozal Bay Wildlife Sanctuary, Hol Chan Marine Reserve and Bacalar Chico National National Park and Marine Reserve. These reserves are part of the Belize Barrier Reef Reserve System and are some of the most important natural tourist sites in the country.

Figure 186 - Marine reserves in Ambergris Caye

Source: BTB, 2020

Intensive tourism activity in these protected areas poses a major challenge to their conservation. In the case of Hol Chan Marine Reserve, between 2013 to 2021 a total of 862,934.00 visits were recorded, which mostly took place in 2019 (20%). The highest visitation records happened between January - April, June - August and November - December. The average annual growth of visits for the past 9 years was around 11%, with a registered average visit of 95,883 visitors. According to data provided BTB´s statistics, the majority of performed activities were snorkeling (87%), followed by diving (13%).

On the other hand, in terms of cultural tourism, Belize is home to over 600 ancient Mayan sites out which 19 are located at Ambergris Caye (3%). However, most of these sites are in the northern end of the island and have a difficult access for most tourists. There are also at least 15 festivals, celebrations and festivities registered in Ambergris Caye including San Pedro Carnival (February), Saint Pedro´s Day (June) and San Pedro's Lobster Festival.

2.4.1.2. Importance on the national and local economy

According with Belize Tourism Board (BTB), tourism contributes over 15% of GDP and represents the 12% of Belize's workforce. From 173,990 employees in Belize - 20,594 belong to the tourism industry (9,552 in Belize District and an estimated 5,027 in Ambergris Caye). About the tourism employees, the majority are men (60%), and Belizean (86%). Most of the employees dedicate themselves to work with accommodation for visitors (42%), followed by Food and Beverage Serving Activities (30%) and Travel Agencies or Tour Operators (15%).

Figure 187 - Marine reserves in Ambergris Caye

N°	INDUSTRY	NUMBER OF EMPLOYMENTS	%
1	Wholesale and Retail Trade; Repairs	33,206	19%
2	Agriculture and Related Activities	24,561	14%
3	Government Services; Compulsory Social Security	24,283	14%
4	**Tourism**	**20,594**	**12%**
5	Community, Social & Personal Services; Extra Territorial Organizations & Bodies	13,936	8%
6	Real Estate, Renting and Business Activities	13,880	8%
7	Construction	13,729	8%
8	Manufacturing	13,269	8%
9	Transportation, Storage and Communication	8,996	5%
10	Other	7,536	4%
	Total	**173,990**	**100%**

Source: Statistical Institute of Belize. Labour Force Survey, 2021

As reported by the BTB, the highest year with overnight tourism arrivals has been 2019, with 503,167 arrivals. The average stay was of 6 days with a medium expenditure of USD$ 159.93 day (reaching an overall tourist's expenditure of $1,093.60 million Belizean (USD$541.39 million).

In Ambergris Caye, according with BTB, the average expenditure by international tourists per day in 2019 was USD$182 american dollars (Belizean 367.64). These expenses were mostly related to Accommodation (39%), followed by Food & Beverages (21%), Shopping (17%), entertainment (16%) and Local Transportation / excursions (7%).

Tourism is one of the main pillars of Belize's economy, as well as one of the most representative sources of income and employability. This is evidenced by the fact that tourism represents over 15% of Belize´s Gross Domestic Product (GDP), compared to other countries such as México where tourism is 8.7% and Dominican Republic is 5%.

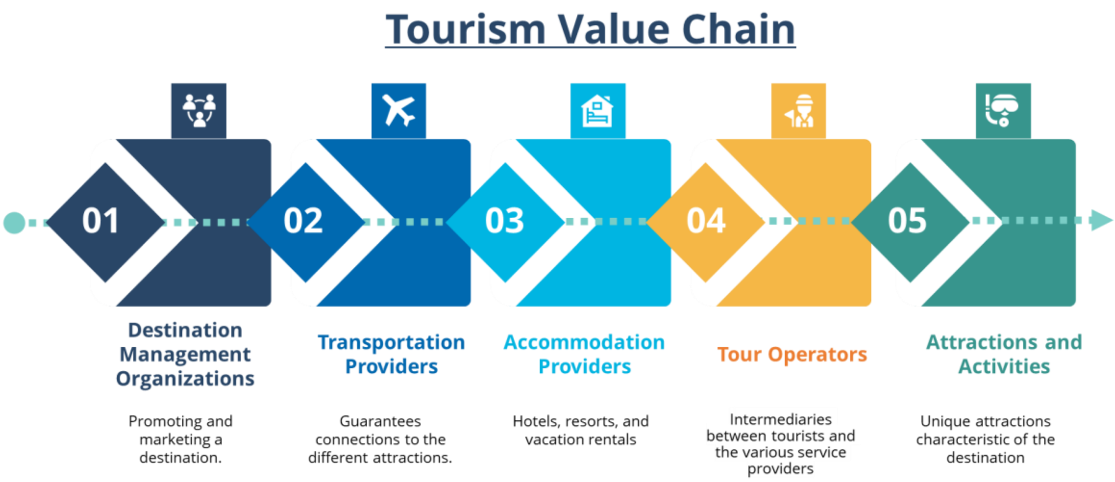
In Ambergris Caye, the most visited destination of Belize, tourism is the main source of commercial and service dynamics, generating in 2022 a total of 5,027 employments.

Therefore its development and strengthening is fundamental for the improvement of the population's living conditions.

2.4.2. Tourism Value Chain

Tourism value chain is a set of transactions that enables the production of goods or services. It begins by providing input for a service, and it continues with other services, conversion, marketing, final consumption, and after-sales support, having a tourist as the main costumer that consumes a tourism product or service. Tourism´s Chain Value take a countries leading framework and verifies its implementation efforts, contrasting what is desired from what really happens. In Belizean case´s tourism is lead from what is the vision in its National Sustainable Tourism Master Plan (NSTMP). Below are the different key elements of the Ambergris Caye's Tourism Value Chain.

Figure 188 - Tourism Value Chain Scheme



Source: IDOM, 2023

For a better understanding, each of the elements that are in the island's tourism value chain will be analyzed. Below are the key components of the tourism system in Ambergris Caye:

2.4.3. Destination Management Organizations

As one of Belize's top tourist destinations, Ambergris Caye has grown under the management and support of various entities, notably the Belize Tourism Board (BTB) and Destination Management Organizations (DMOs). These organizations play a fundamental role in shaping and promoting tourism in Ambergris Caye, striving to strike a balance between economic growth and sustainable tourism practices. This section explores the functions, operations, and significance of the BTB and DMOs in facilitating tourism development in Ambergris Caye. The BTB operates through a multifaceted approach that encompasses various core functions:

Belize Tourism Board (BTB)

- **Marketing and Promotion:** One of BTB's primary responsibilities is to market Ambergris Caye as an attractive tourist destination on both domestic and international platforms. Through targeted marketing campaigns, social media engagement, and participation in travel fairs and events, the BTB strives to attract a diverse range of visitors who seek to explore the island's natural attractions, enjoy the adventure activities, and immerse themselves in its culture.

- **Product Development:** To ensure Ambergris Caye remains competitive and appealing to visitors, BTB collaborates with local businesses, tour operators, and hospitality establishments to continually develop and enhance the island's tourism offerings. By fostering the creation of sustainable and authentic experiences, the BTB helps diversify the range of activities available to tourists, thereby enriching their overall stay.
- **Quality Assurance:** The BTB plays a vital role in safeguarding the reputation of Ambergris Caye by enforcing industry standards and regulations. Through quality assurance measures, the BTB ensures that tourism operators adhere to responsible practices, maintaining the ecological integrity of the island and preserving its cultural heritage.
- **Research and Data Collection:** Informed decision-making is a cornerstone of successful tourism management. The BTB conducts research to understand travel trends, visitor preferences, and emerging markets. This data helps shape strategic initiatives and policies that align with the needs of tourists and the interests of the local community.

The BTB's concerted efforts to market the island's unique attractions, encourage sustainable product development and enforce quality standards contribute significantly to Ambergris Caye's reputation as a premier tourism destination. With BTB's dedication to achieving a balance between tourism growth and responsible practices, Ambergris Caye continues to thrive as a Caribbean destination that welcomes visitors from around the world while valuing its natural attractions and culture.

2.4.4. Transportation Providers

One crucial aspect of its tourism value chain is the availability of transportation and infrastructure to facilitate the arrival of visitors to the Island. There are diverse types of transportation with connections to Ambergris Caye, which will be described below:

- **Aerial Transportation:** Ambergris Caye is well-connected by air, with flights available from Belize City's Philip S. W. Goldson International Airport to the island's airstrip. Domestic carriers operate frequent and efficient flights. Two national airlines provide several flights a day to reach the island from Belize City, these airlines are Tropic Air and Maya Island Air. The flight from Belize City to Ambergris Caye takes approximately 12 minutes, which is why it is the fastest method of getting to the island.
- **Water Transportation:** Given its location, water transportation plays a crucial role in linking Ambergris Caye to the mainland and other destinations. Water taxis and boat services are readily available, offering affordable and scenic options for travelers. Water taxis operate from Belize City, Chetumal, México, and other nearby islands, providing a convenient and enjoyable journey for visitors who prefer a maritime adventure. The journey by sea from Belize City to the port of San Pedro takes about two hours, however, it has a cheaper rate for tourists. Two companies provide water cab service to the island, San Pedro Belize Express Water Taxi and Ocean Ferry.
- **Road Infrastructure:** Although Ambergris Caye primarily relies on aerial and water transportation, the island does have limited road infrastructure for local transportation. In the town of San Pedro, the island's main hub, visitors can find golf carts and bicycles for rent, which serve as the primary means of getting around the island's narrow streets and sandy pathways.

In conclusion, Ambergris Caye offers various transportation options to facilitate the arrival of tourists. Air transportation is the fastest method to reach the island and water transportation, which includes water taxis and ferry services, offers service at lower prices. Overall, the well-organized and varied transportation options to get to Ambergris Caye contribute significantly to its appeal as an attractive tourist destination.

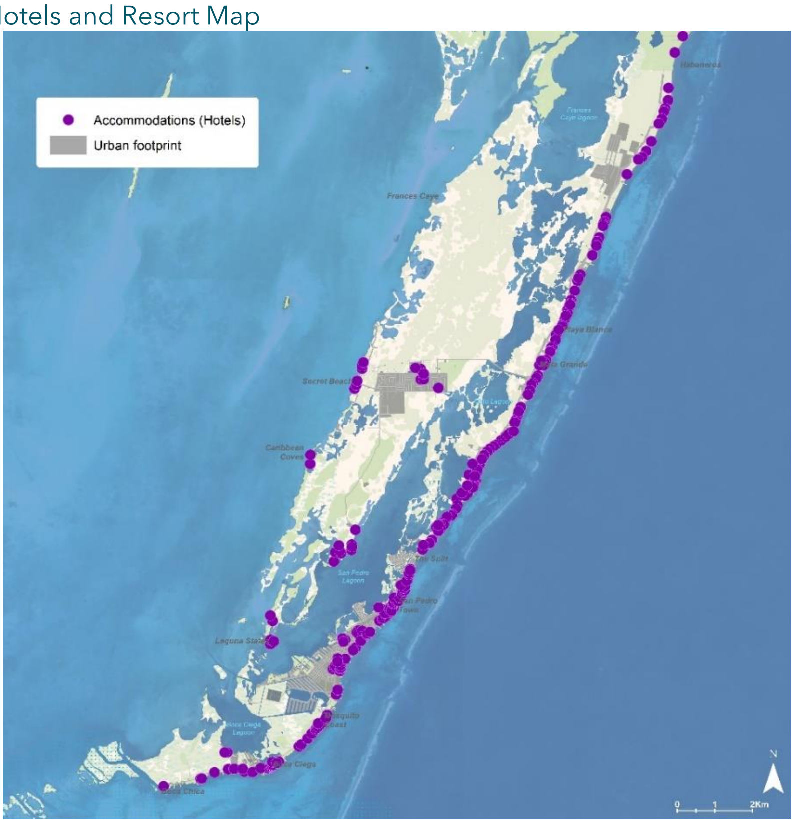
2.4.5. Accommodation Providers

The accommodation industry in Ambergris Caye operates through a combination of online and on-site bookings. Hotels, resorts, and vacation rentals have dedicated websites where visitors can explore available options, view photos, and make reservations. Many accommodations also partner with travel agencies and online platforms to reach a broader audience. This section explores the diverse types of accommodations available in Ambergris Caye, how the accommodation industry operates, and the most popular places where tourists choose to stay and the reasons behind their choices.

Types of Accommodation Offered

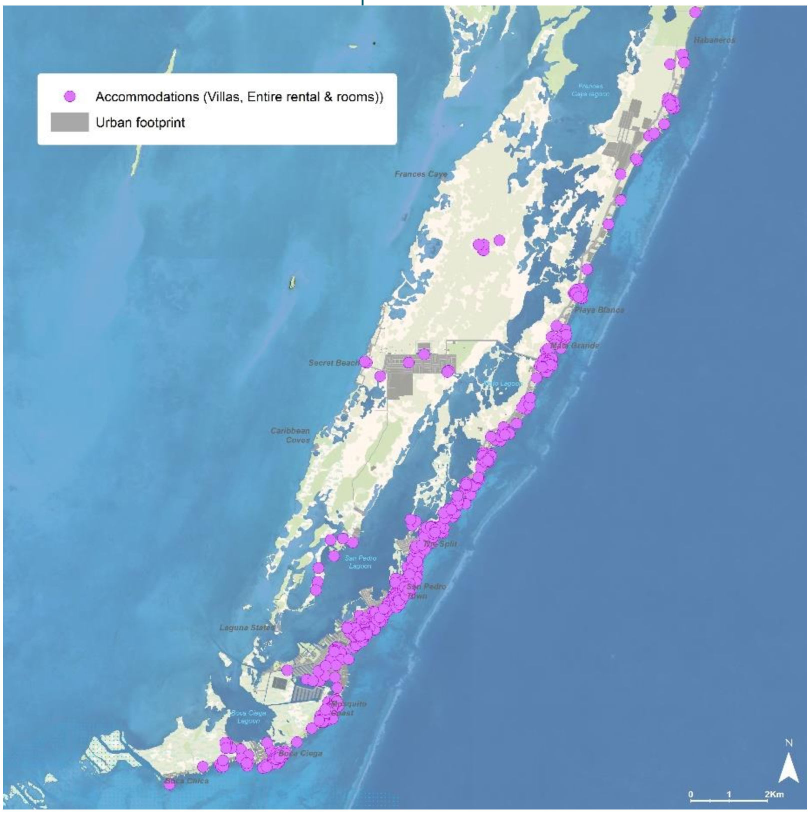
- **Resorts and Hotels:** Ambergris Caye offers a variety of luxurious resorts and hotels, according to the different types of travelers. These establishments provide good levels of amenities, including spacious rooms or villas, swimming pools, restaurants, spa facilities, and direct access to the island's pristine beaches.
- **Villas and Vacation Rentals:** For visitors who prefer more independence and privacy, vacation rentals are a common option. These include beachfront condos, private villas, and cottages. Vacation rentals often come with self-catering facilities, allowing guests to prepare their meals and immerse themselves in the local culture and community.
- **Boutique Hotels:** Ambergris Caye features boutique hotels that provide a more intimate and personalized experience. These smaller establishments often showcase unique architecture, design, and ambiance, reflecting the local culture and heritage. Boutique hotels are favored by travelers seeking a more authentic and local stay.

Figure 189 - Hotels and Resort Map



Source: IDOM, 2023

Figure 190 - Villas and Vacation Rentals Map



Source: IDOM, 2023

The most popular places where tourists choose to stay on Ambergris Caye are the resorts and hotels. These accommodations offer a combination of comfort, convenience, and an array of amenities, making them an attractive choice for a wide range of travelers.

The accommodation industry in Ambergris Caye operates through a combination of online booking platforms and on-site services, ensuring a seamless experience for tourists. While vacation rentals and boutique hotels provide personalized experiences, resorts and hotels remain the most popular choices due to their convenience, beachfront locations, and comprehensive facilities.

Accommodation for High-End Tourists

According to BTB's information, about 10% of accommodation in Ambergris Caye is considered in the luxury category, with an average availability of 21 to 50 rooms, reaching occupancies of over 60% per year. This represents about 110,000 tourists per year, willing to pay a price of USD$125.00 per night.According to BTB, these tourists come from mainly from the United States and enter the country mostly through Philip Goldson International Airport in Belize City. They visit Ambergris Caye specially for recreation and leisure purposes with an average stay of 6 nights, using hotels and resorts for lodging, with an average annual income of USD $40,000 - 79,999.

2.4.6. Tour Operators

Tour operators are entities that design, plan, and organize tours and travel packages, offering a comprehensive and hassle-free experience to tourists. They act as intermediaries between travelers and various service providers, combining accommodations, transportation, activities, and other elements into a coherent package.

Tour operators in Ambergris Caye work closely with local businesses, transportation providers, and other stakeholders to curate unique and memorable experiences for tourists. They collaborate with dive shops, fishing charters, wildlife guides, and other activity providers to create comprehensive tour packages.

Upon arrival, tourists can book tours directly with the tour operators or through their accommodations. Many tour operators also offer online booking options, allowing visitors to plan their activities in advance. Water-based tour operators are prominent on Ambergris Caye. These operators specialize in activities such as snorkeling, scuba diving, sailing, fishing, and jet skiing, taking advantage of the abundant marine life and well-known underwater landscapes.

The following are the different Tour Operators that the island has to offer.

- **Water-Based Tour Operators:** Given Ambergris Caye's coastal location and the allure of the Caribbean Sea, water-based tour operators are prominent on the island. These operators specialize in activities such as snorkeling, scuba diving, sailing, fishing, and jet skiing, taking advantage of the abundant marine life and stunning underwater landscapes.
- **Land-Based Tour Operators:** While Ambergris Caye's main attractions are marine-focused, land-based tour operators cater to tourists interested in exploring the island's natural beauty, wildlife, and cultural heritage. Tours may include jungle expeditions, visits to ancient Mayan ruins, wildlife encounters, and birdwatching excursions.
- **Adventure Tour Operators:** Ambergris Caye also offers adventure tour operators that combine water and land-based activities to create thrilling and adrenaline-pumping experiences. These may include zip-lining, cave tubing, and exploring cenotes (natural sinkholes) on the mainland.

The most offered tours to visitors on Ambergris Caye are around the Island's marine attractions and adventure activities. Snorkeling and scuba diving tours to explore the Belize Barrier Reef, the second-largest coral reef system in the world, are highly sought-after. Additionally, fishing excursions, including reef fishing and deep-sea fishing, are part of the most popular experiences.

Tour operators, alongside their collaborations with local businesses and accommodations, contribute significantly to the island's tourism industry, providing visitors with an unforgettable experience in the island.

2.4.7. Attractions and Activities

As a crucial component of the tourism value chain, tour operators on the island offer an array of attractions and activities to captivate and delight visitors. This section explores the diverse attractions and activities available in Ambergris Caye, the most visited ones by tourists, and the prominent tourist landmarks that enrich the island's appeal.

Attractions and Activities Offered

- **Snorkeling and Scuba Diving:** Ambergris Caye boasts proximity to the Belize Barrier Reef, a UNESCO World Heritage Site, and the second-largest coral reef system in the world. Tourists can indulge in mesmerizing snorkeling and scuba diving experiences to encounter colorful marine life, coral formations, and underwater caverns.
- **Fishing Excursions:** The island offers various fishing excursions, from reef fishing to deep-sea fishing. These trips give anglers the opportunity to catch a variety of species, including snapper, grouper, and tarpon, in the crystal-clear waters of the Caribbean.

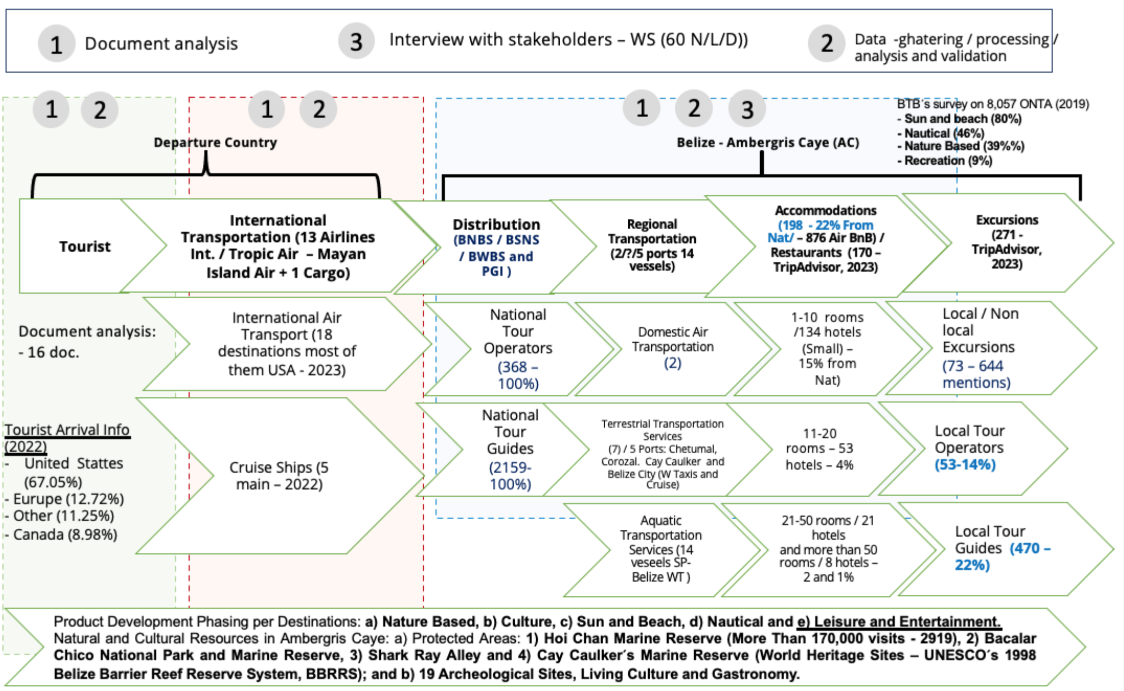
- **Wildlife Encounters:** Tourists can embark on wildlife encounters that allow them to witness the rich biodiversity of Ambergris Caye. Popular activities include birdwatching to spot a wide array of avian species and manatee tours to observe these gentle marine mammals.
- **Water Sports:** Ambergris Caye offers an array of water sports for adventure enthusiasts. Jet skiing, paddleboarding, kiteboarding, and kayaking are just some of the thrilling activities available for visitors to enjoy.

Similarly, on the island, you can find different tourism milestones that have generated a unique identity in the sense of belonging to the Caye. Some of the most popular milestones for visitors are:

- **Hol Chan Marine Reserve:** This marine reserve is a haven for snorkelers and divers, offering encounters with a variety of marine species, including nurse sharks and stingrays. The reserve's unique underwater topography and marine life make it a must-visit attraction.
- **Shark Ray Alley:** Located within the Hol Chan Marine Reserve, Shark Ray Alley is famous for its encounters with nurse sharks and southern stingrays. Tourists can snorkel or dive with these gentle creatures in their natural habitat.
- **Secret Beach:** A serene and secluded stretch of coastline, Secret Beach is a popular destination for relaxation and water activities. Visitors can swim, sunbathe, and enjoy beachside restaurants and bars.
- **Bacalar Chico Nature Reserve:** Located on the northern tip of Ambergris Caye, Bacalar Chico is a pristine nature reserve offering hiking opportunities and nature appreciation. Visitors can explore lush mangroves, observe diverse wildlife, and learn about the area's ecological importance through guided hikes and tours.

The following is a detailed description of the value chain associated with Ambergris Caye:

Figure 191 – Detailed tourism value chain for Ambergris Caye



Source: IDOM, with information from BTB, 2023

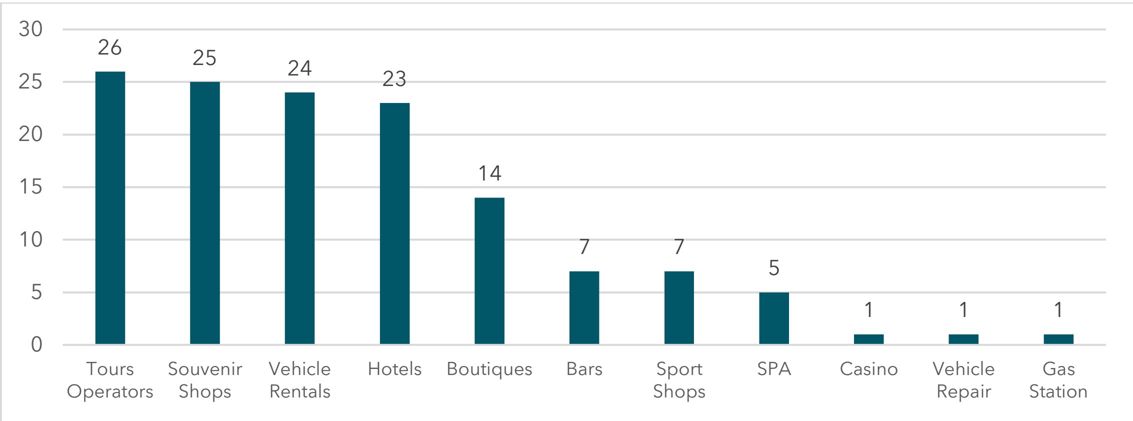
2.4.8. Tourism Value Chain in San Pedro Center

For the central area of San Pedro, the consultancy carried out a detailed identification of the uses associated with the value chain, considering that this is the most commercially active area of Ambergris Caye and where the largest number of tourism-related services are concentrated. To this purpose, the following type of tourism uses were identified:

- AG (Art Gallery)
- B (Boutique)
- BAR (Bar)
- CAS (Casino)
- GS (Gas Station)
- H (Hotel)
- R (Restaurant)
- SOUS (Souvenir Shop)
- SPA (Spa)
- SS (Sport Shop)
- TO (Tour Operator)
- VR (Vehicle Rental)
- VRP (Vehicle Repair Shop)

According to the information gathered in the field, the most predominant use associated with the value chain in San Pedro Center is restaurants, with a total of 94 establishments, representing about 39% of the uses related to tourism. The following graph shows the total number of establishments corresponding to each use of the value chain:

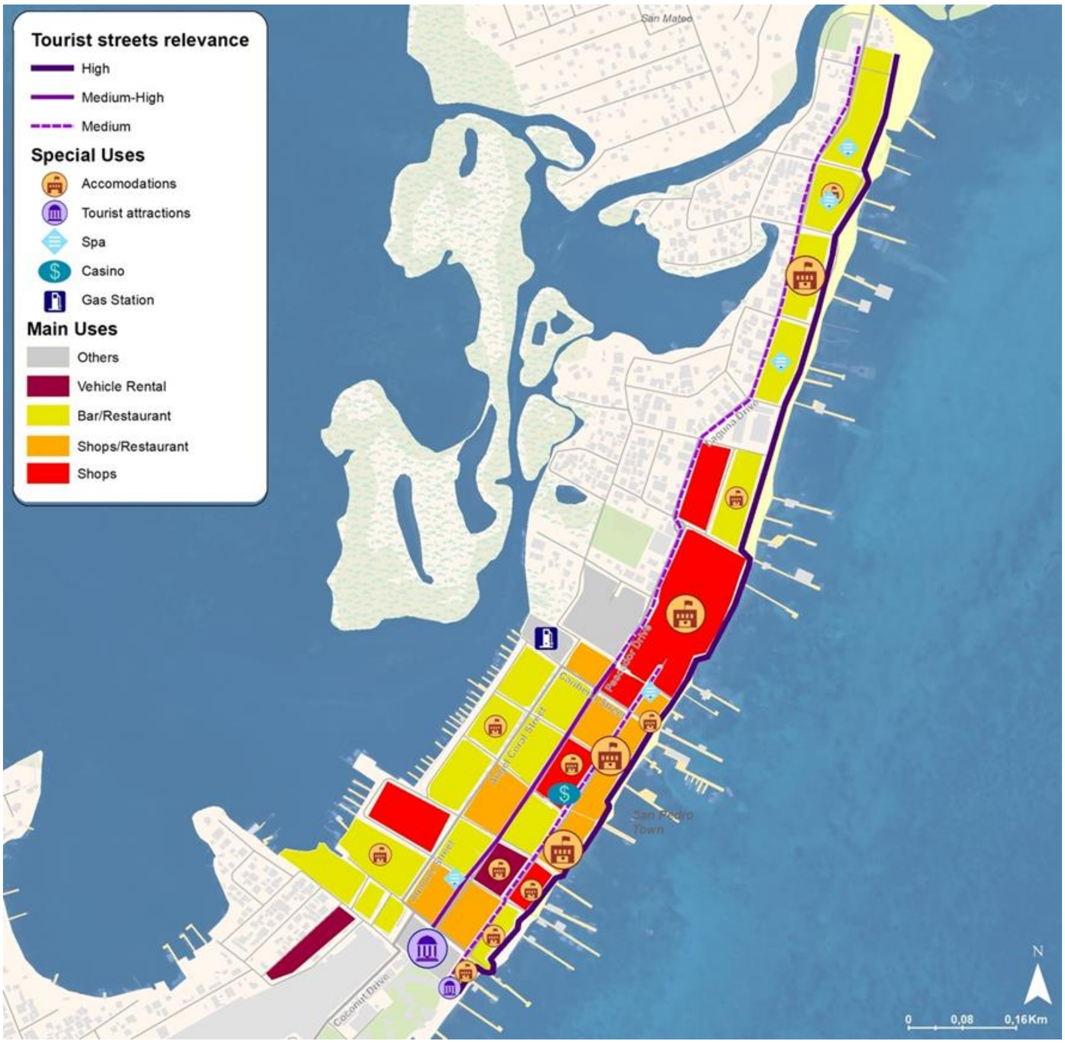
Figure 192 – Counting of uses associated with the Tourism Value Chain in San Pedro Center



Source: IDOM, 2023

The map below shows the predominant tourism uses in the analyzed blocks of Downtown San Pedro. Bars and restaurants prevail in most of the blocks, while stores are more predominant in the areas located between Caribeña Street and the San Pedro Airport.

Figure 193 - Uses associated with the Tourism Value Chain in San Pedro Center



Source: IDOM, 2023

In conclusion, the most developed and present linkages for Ambergris Caye´s Tourism Value Chain are related to Accommodations (198), Restaurants (170), Tour Operators (53) and Tour Guides (470). All alone these represent approximatly the 20% of Belize´s Tourism Specific Supply on Tourism.

In this sense, the synergy between all the elements of the Value Chain is important to create a good environment for tourism development, fostering sustainable practices. The value chain's efficient functioning is fundamental for the Ambergris Caye's visitors, in order to have the best possible experience, with high quality services. At the same time, the different components of the value chain generate sources of employment and constant income for the island, allowing for the economic development of the territory.

2.4.9. Competence and Trends

2.4.9.1. Market and decision factors

A study realized by Destinations Analysts and Miles Partnership (January to December 2021), research was conducted with more than 2,000 leisure travelers in the United States. Among the data collected, the preference of these travelers was most for destinations including the following experiences: a) Enjoying the beauty of scenery (69%), b) Outdoor activities (65%), c)

Road trips (61%), and Beaches (61%). Regarding the trip planning stage, when a destination prepares promotional videos, the length of the video is a key factor. For those who use videos in their decision making, the videos that most influenced the destination of choice were between 45 seconds and up to 4 minutes.

Considering the terms of receptivity to marketing channels, travelers prefer websites found through search engines (SEM) 35.8%, email 25.1% and social networks (36.8%). The study also mentioned that in the next three years, most leisure travelers responded that they plan to visit Europe (30.6%); Canada 24.4%; Mexico, Central America and the Caribbean (21.9%, including Belize); Asia and the Middle East (11%); and South America (7.7%).

2.4.9.2. Conditions for sustainable tourism development

Sustainable tourism is defined by the UN Environment Program and UN World Tourism Organization (2005), as "tourism that takes full account of its current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities." One of the best references of good sustainable tourism practices to consider for Ambergris Caye is the Global Sustainable Tourism Criteria from the Global Sustainable Tourism Council for destinations (GSTC).

The next table contains the assessment of Ambergris Caye applying the GSTC´s Destination Criteria, where most of them can be Effortlessly Achievable - EA, fulfilling compliance with 80 of the 170 indicators related to Sections A and B (Sustainable management and Socio-economic sustainability – 47%), followed by54 indicators More or Less Achieved - MLA (25 from Section C + 24 from D – 32%) and 36 indicators Greater Effort Required s – GER (from Section D – 21%).

:

Table 75 – Analysis of conditions for implementation of good sustainable tourism practices in Ambergris Caye using GSTC´s Destination Criteria

<table>
<tr><th>1</th><th>SECTION A: SUSTAINABLE MANAGEMENT</th><th>SUBSECTION`S ISUUES DETAILED</th><th>INDICATORS</th><th>PARTIAL VERIFICATION (EA, GER AND MLA)</th><th>SDG´S</th></tr>
<tr><td rowspan="3">1.1</td><td rowspan="3">A(a) Management structure and framework</td><td>A1 Destination management responsibility</td><td>5</td><td>EA</td><td>16 and 17</td></tr>
<tr><td>A2 Destination management strategy and action plan</td><td>4</td><td>EA</td><td>17</td></tr>
<tr><td>A3 Monitoring and reporting</td><td>4</td><td>EA</td><td>12</td></tr>
<tr><td rowspan="4">1.2</td><td rowspan="4">A(b) Stakeholder engagement</td><td>A4 Enterprise engagement and sustainability standards</td><td>5</td><td>EA</td><td>12 and 17</td></tr>
<tr><td>A5 Resident engagement and feedback</td><td>5</td><td>EA</td><td rowspan="4">11 and 17</td></tr>
<tr><td>A6 Visitor engagement and feedback</td><td>4</td><td>EA</td></tr>
<tr><td>A7 Promotion and information</td><td>3</td><td>EA</td></tr>
<tr><td rowspan="4">1.3</td><td rowspan="4">A(c) Managing pressure and change</td><td>A8 Managing visitor volumes and activities</td><td>4</td><td>EA</td></tr>
<tr><td>A9 Planning regulations and development control</td><td>6</td><td>EA</td><td>9 and 11</td></tr>
<tr><td>A10 Climate change adaptation</td><td>5</td><td>EA</td><td>13</td></tr>
<tr><td>A11 Risk and crisis management</td><td>4</td><td>EA</td><td>11 and 16</td></tr>
<tr><td>2</td><td colspan="5">SECTION B: SOCIO-ECONOMIC SUSTAINABILITY</td></tr>
<tr><td rowspan="3">2.1</td><td rowspan="3">B(a) Delivering local economic benefits</td><td>B1 Measuring the economic contribution of tourism</td><td>3</td><td>EA</td><td>1, 8 and 9</td></tr>
<tr><td>B2 Decent work and career opportunities</td><td>4</td><td>EA</td><td>4,5, 8 and 10</td></tr>
<tr><td>B3 Supporting local entrepreneurs and fair trade</td><td>5</td><td>EA</td><td>2, 8 and 12</td></tr>
<tr><td rowspan="5">2.2</td><td rowspan="5">B(b) Social wellbeing and impacts</td><td>B4 Support for community</td><td>3</td><td>EA</td><td>3 and 4</td></tr>
<tr><td>B5 Preventing exploitation and discrimination</td><td>4</td><td>EA</td><td>10 and 16</td></tr>
<tr><td>B6 Property and user rights</td><td>4</td><td>EA</td><td>11 and 16</td></tr>
<tr><td>B7 Safety and security</td><td>3</td><td>EA</td><td>3 and 16</td></tr>
<tr><td>B8 Access for all</td><td>5</td><td>EA</td><td>3 and 10</td></tr>
<tr><td>3</td><td colspan="5">SECTION C: CULTURAL SUSTAINABILITY</td></tr>
<tr><td rowspan="2">3.1</td><td rowspan="2">C(a) Protecting cultural heritage</td><td>C1 Protection of cultural assets</td><td>3</td><td>MLA</td><td rowspan="2">11</td></tr>
<tr><td>C2 Cultural artefacts</td><td>3</td><td>MLA</td></tr>
</table>

1	SECTION A: SUSTAINABLE MANAGEMENT	SUBSECTION`S ISUUES DETAILED	INDICATORS	PARTIAL VERIFICATION (EA, GER AND MLA)	SDG´S
		C3 Intangible heritage	4	MLA	11 and 12
		C4 Traditional access	3	MLA	11
		C5 Intellectual property	3	MLA	16
3.2	C(b) Visiting cultural sites	C6 Visitor management at cultural sites	4	MLA	11 and 12
		C7 Site interpretation	5	MLA	4 and 11
4	**SECTION D: ENVIRONMENTAL SUSTAINABILITY**				
4.1	D(a) Conservation of natural heritage	D1 Protection of sensitive environments	6	MLA	14 and 15
		D2 Visitor management at natural sites	6	MLA	
		D3 Wildlife interaction	6	MLA	
		D4 Species exploitation and animal welfare	7	MLA	
4.2	D(b) Resource management	D5 Energy conservation	4	MLA	7
		D6 Water stewardship	5	GER	6
		D7 Water quality	5	GER	3 and 6
4.3	D(c) Management of waste and emissions	D8 Wastewater	4	GER	3 and 14
		D9 Solid waste	8	GER	12, 14 and 15
		D10 GHG emissions and climate change mitigation	5	GER	13
		D11 Low-impact transportation	6	GER	9 and 13
		D12 Light and noise pollution	3	GER	3 and 11

Source: IDOM, 2023: Effortlessly Achievable (EA), Greater Effort Required (GER) and More or Less Achieved (MLA). SDGs: Sustainable Development Goals.

2.4.9.2.1. Considerations about tourist carrying capacity

In terms of the tourist carrying capacity in the case of Ambergris Caye, it is important to analyze the historic the accommodation capacity and occupancy. Public services and other elements of local development in the Island must be adjusted to serve locals and visitors, promoting the expected quality of the destination.

The following table shows the Overnight Tourist Arrival (ONTA), Overnight Cruise Tourism Arrival (ONCTA), the hotel capacity in terms of rooms and the occupancy from 2014 to 2022. The highest number of Licensed Hotels Rooms was recorded in 2022 and the highest occupancy occurred in 2014 (50.9%). After the COVID-19 effects in 2020, the amount of arrivals, rooms and accommodation occupancy have showed a sustained growth, but still far from the numbers showed years before:

Table 76 – Overnight Tourist Arrival (ONTA), Overnight Cruise Tourism Arrival (ONCTA), Accommodation capacity and occupancy from 2014 to 2022

	INDICATOR	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	BTB´s Total Registered ONTA and ONCTA to AC***	151,383	151,429	173,767	203,935	230,628	209,012	66,460	78,754	128,360
2	BTB´s Registered Licensed Hotel Rooms**	1,833	1,898	2,231	2,086	2,253	2,378	2,288	2,301	2,412
3	Hotel Occupancy for AC (%)*	50.9	47.9	48.3	42.6	40.1	38.4	10.3	23.9	37.2

Source: BTB, 2023

BTB´s annual average room rate by region for Ambergris Caye (2015 – 2022), shows that highest amount registered is of $592 per night Belizean (US$257 - 2022), with an average of $442.30 Belizean (USD$219, average 2013-2022), and a lowest price of $398 Belizean (USD$197 - 2013).

Last 10 years information related to registered and licensed hotels:

- The lowest: 166 hotels in 2013
- Average: 179 hotels
- The highest: 196 hotels in 2019

Last 10 years information related to registered and licensed rooms:

The lowest: 1,833 rooms in 2013
Average: 2,187 rooms
The highest: 2,412 rooms in 2019

Last 10 years information related to registered and licensed beds:

- The lowest: 3,388 beds in 2013
- Average: 3,393 beds

- The highest: 3,981 beds in 2019

In terms of projections, according to BTB statistics it is expected 216,202 arrivals in 2030, an accommodation capacity of 2,638 beds, with a projected occupancy of 63.5%. Although a fluctuation in the number of tourist arrivals is expected in the coming years, the hotel occupancy rate maintains a stable growth.

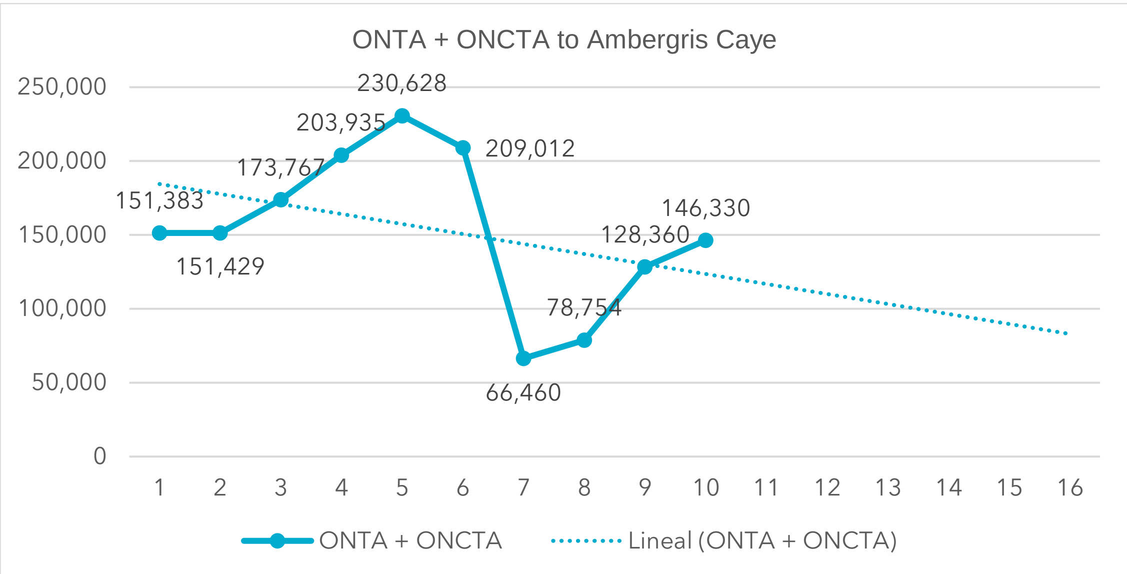
Table 77 – Overnight Tourist Arrival (ONTA), Overnight Cruise Tourism Arrival (ONCTA), Accommodation capacity and occupancy projected from 2023 to 2030

	INDICATOR	2023	2024	2025	2026	2027	2028	2029	2030
1	BTB´s Total Registered ONTA and ONCTA to AC***	146,330	144,875	174,568	167,724	166,787	158,918	193,939	216,202
2	BTB´s Registered Licensed Hotel Rooms**	2,436	2,484	2,510	2,535	2,560	2,585	2,612	2,638
3	Hotel Occupancy for AC (%)*	39.8	42.5	45.4	48.5	51.90	55.5	59.38	63.5

Source: BTB, 2023

Applying probabilistic models (a simple regression statistics model and a visitor forecast statistics model), it is possible to identify the trend of visitation is downward, while the trend of rooms is upward.

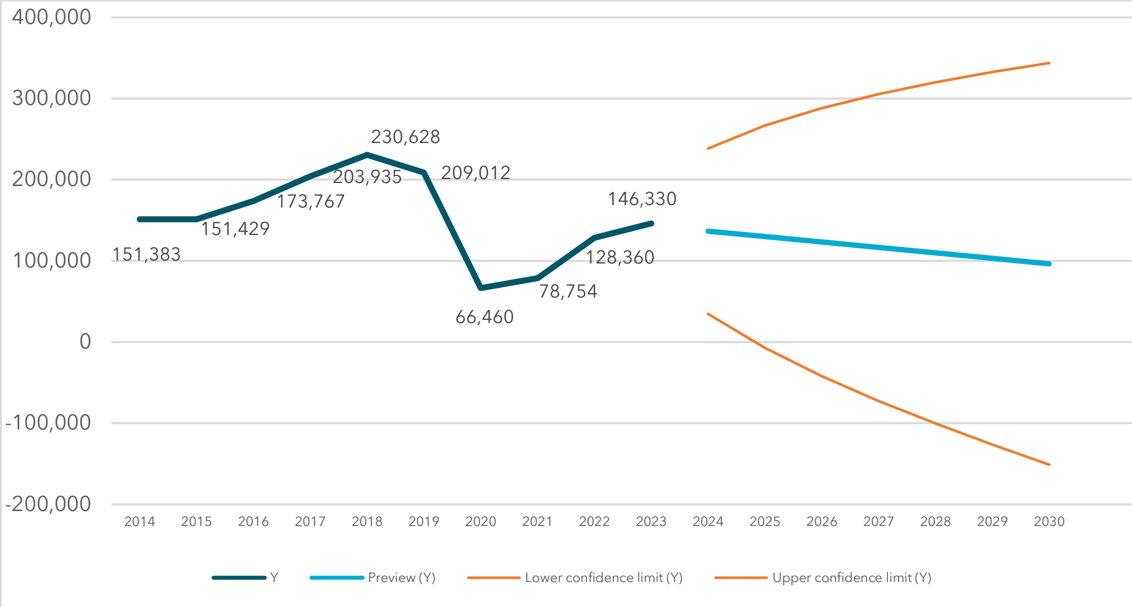
Figure 194 - Simple linear regression model for Overnight Tourist Arrival + Overnight Cruise Tourism Arrival for Ambergris Caye (2014 – 2030)



Source: IDOM with information from BTB, 2023

On the other hand, when applying a visitor forecast statistics model, it shows that the tendency is oriented downward, with an upper confidence limit and a lower confidence limit with a wide spectrum of possibilities than can be achieved through a proper planning process.

Figure 195 - Simple linear regression model for Overnight Tourist Arrival + Overnight Cruise Tourism Arrival for Ambergris Caye (2014 – 2030)



Source: IDOM with information from BTB, 2023

In terms of need for public services, the Center for Responsible Tourism (2021) estimates an average of 2,000 liters of water used by tourists a day or its equivalent of 528.3 gallons. Also, McDowall, J. (2023), identifies that a tourist can produce around 2 kilograms of solid waste per day.

2.4.9.2.2. Constrains and needs for future development:

The National Sustainable Tourism Master Plan (NSTMP) in 2011 and its current update by the University of Melbourne, identify some constraints regarding the constrains and needs for Belize and Ambergris Caye future tourism development:

National Sustainable Tourism Master Plan (NSTMP) - 2011

Poor level of accessibility on land.
Lack of sufficient and qualitative tourism services in National Parks like Bacalar Chico.
Scarce of Belizean made handcrafts.
Inadequate (natural & heritage) asset management.
Deficient communication and promotion of tourism assets.
Insufficient waste disposal and seawage systems.
Lack of urban land planning and land use regulations.
Lack of public awareness programmes.
Need of integration of local communities to the tourism value chain.

NSTMP´s update in process by Melbourne University - 2023

GIS-based-special analysis to inform the planning process.
Lack of elaborated goals, strategies, and outcomes (Frameworks).
Limited Acknowledgement of vulnerability Issues, sea level rise, tidal, drainage, salinity, etc.

Examine the implications of sea level rise and related climate impacts on peninsula (modeling).
Advance clear defensive climate mitigation measures, integrated with human enhancements.
Mangroves are rapidly being cleared to make way for new mega developments.
Poor protection and no clear recognition and understanding of the management implications.

2.4.10. Recommendations

- The existence of 21 luxury hotels with up to 50 rooms (10%) vs. 134 small hotels with 1 to 10 rooms (68%), suggests the need of implementing a Destination Management Organization (DMO) that manages the provision of High-End Tourism services, verifying that they are operating and in what conditions. Also, there is a need for a moratorium on the construction of new rooms or conditioning that these comply with competitiveness and sustainability schemes proposed in this document in the short (3 years), medium (6 years) and long term (9 years).
- Formulation of sustainable business plans making of resources that could give a tourism service in the protected areas.
- Formulation of Management Plans for archeological sites for their sustainable use.
- Creation of rules and regulations for visitor behavior.
- Evaluation and monitoring of the impacts in the environment
- Integration of the community in the valorization and establishment of co-management relationships / concessions of archeological with conservation purposes and establishment of tourism businesses or services related to cultural resources.
- Obtaining conservation labels and certifications for sustainable / regenerative destinations and tourism´s businesses / services.

In conclusion, the special characteristics of Ambergris Caye pose significant challenges in terms of future tourism development. While the projections indicate a progressive growth in tourist arrivals and increased availability of accommodations, the factors of the carrying capacity model must be considered to determine the sustainable path in which tourism development on the Island should be approached.

Additionally, the five protected natural areas declared as UNESCO's World Heritage Site in 1998 and the identification of 19 archeological site at Ambergris Caye, indicate an urgent need to establish management and protection plans for the natural and cultural heritage of the island, which, in addition to generating restoration and conservation processes, will lead to a greater diversification of the tourist offer, enhancing the attractiveness of the territory for Tigh-End tourists.

CURRENT CARRYING CAPACITY

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2.5. Current Carrying Capacity

2.5.1. Concept and Definition Approach for a Carrying Capacity Model

The preceding chapters have described in detail the current situation of Ambergris Caye, a territory of insular characteristics with a high exposure to natural disasters, a highly threatened natural heritage and high urban growth. These characteristics of the Caye are related to a series of critical parameters and challenges to achieve a sustainable development in the next years, among which the following stand out:

- 98.5% of the Caye is exposed to some type of conditioning or limiting factor for urban growth.
- In only 25 years, more than 10% of the vegetation cover of the entire Caye has been lost (2,470 acres).
- In the last 45 years, more than 7% of the Caye's mangroves have been lost (about 20 acres per year).
- 25% of the current dwellings are in poor living conditions.
- Only 29% of the inhabitants have Access to Sewage
- Only 83% of the population has access to Potable Water
- Less than 1 m2 of qualified green areas per inhabitants

If the current situation is complex, the challenge for the coming years is immense. Especially if the trends observed are maintained and the forecasts made (12,000 new inhabitants and about 7,000 new homes) are fulfilled.

This shows the urgent need to generate a change in the development paradigm of the Caye, where including the concept of Carrying Capacity in territorial management appears as a very interesting opportunity. But it is essential to understand that estimating the Carrying Capacity is not enough to achieve sustainable development, since it is only a tool to measure possible impacts and define scenarios, but what is essential is to generate changes in the instruments of territorial management and planning, and above all, to reach a consensus on a development vision.

2.5.2. Carrying Capacity Basic Concepts

The origin of the concept is related to the Capacity of some Territories to Produce Food. This type of analysis began to be carried out in the 19th century, due to the problems caused by over-farming (introduction of machinery).

The first documents that mention the challenge of carrying capacity date back to 1798, when Thomas R. Malthus pointed out that the planet's crisis would arise from demographic growth, under the assumption that if control mechanisms were not put in place, the time would come when the planet would not be able to produce the food necessary for its inhabitants.This is related to the principles of Modern Ecology.

Later, in the 1960s, the concept began to be developed by the institutions that administer natural areas in the USA, seeking to estimate the number of visitors that a Protected Natural Area can receive. An example of this type of application is the study conducted in 2022 in the Hol Chan Marine Reserve with the help of Green Reef Environmental Institute and the World Wildlife Fund Mesoamerican Project.

Over the last 20 years the concept has evolved and become more complex, incorporating biological, cultural, institutional and economic variables. The following definition encompasses this broad view of the concept: "**NUMBER OF HUMAN BEINGS THAT CAN MAKE USE OF A SPACE WITHOUT DEGRADING ITS NATURAL, CULTURAL AND SOCIAL ENVIRONMENT,**

WITH THE ULTIMATE AIM OF MAINTAINING THE DESIRED QUALITY OF LIFE OVER THE LONG TERM" (Abernethy, 2001).

The challenge that arises from this broader vision of carrying capacity is how to calculate it in an objective way. This is related to the fact that some of the variables are measurable, and others are not, because they are related to the perception (of inhabitants or visitors).

The definition of which variables to consider in the model will depend on the characteristics of the territory, the available information, and the objectives of the model. But even more important will be to define the associated management tools, as this will be the only way for the model to be an input for territorial management and allow the identified gaps to be reduced.

Another key concept is that the carrying capacity of a territory is dynamic, i.e. it can increase or decrease.

Figure 196 - Carrying Capacity Scheme

Source: IDOM, 2023

This is due to both objective and subjective factors that may evolve over time:

- **Baseline Factors Change:** effects of Climate Change, immigration phenomena, changes in regulation (normative) or the consequences of an eventual natural disaster.
- **Infrastructure Investments**: the construction of infrastructures such as wastewater treatment plants, reinforcement of distribution networks or a new airfield would also change the baseline conditions and could reduce gaps. But infrastructures can also cause adverse effects on ecosystems and decrease the carrying capacity of the territory (for example, the destruction of mangroves for the construction of housing developments increases vulnerability to disasters and decreases CO_2 absorption).
- **Changes in the Development Vision** (perception of inhabitants or visitors): In addition to the more objective factors, the Carrying Capacity can change due to the evolution of perceptions, objectives, and agreements on the development of the territory. This can be related to more information, demographic changes, political changes or because of punctual effects (a natural disaster for example).

This dynamic condition of the Carrying Capacity generates the need to constantly update models and predictions. And since it is necessary to update, it is advisable to have tools that are easy to understand and apply.

2.5.3. Why include Carrying Capacity in ambergris integrated planning

As mentioned, the current situation of Ambergris is critical in many aspects, and it is urgent that important definitions be made for future development.

The tendency scenario that will be detailed later in the document, details a series of effects that could be generated if the development of the Caye continues with the current model: irremediable deterioration of the natural patrimony (mangroves and reef), loss of tourist attractions, serious losses due to the effect of hurricanes, decrease in the quality of urban life and eventual sanitary crises due to bad wastewater management.

To conclude, the current development trend in Ambergris is moving towards an environmentally, socially, and economically unsustainable scenario. It is, therefore, urgent to change the development paradigm, where it will be fundamental to establish limits to this growth. Advancing in the understanding and estimation of the carrying capacity of Ambergris represents an interesting opportunity to advance in this sense.

In summary, including the Carrying Capacity concepts in an Integral Planning allows:

- **Protect the environment**
- **Protect the Cultural Valuess**
- **Improve the Life Quality of the inhabitants**

2.5.4. Carrying Capacity Modelling

Determining the carrying capacity of a territory is not simple, mainly because of the diversity of variables to be considered (many of them subjective as mentioned above). Some of the definitions that must be considered in order to carry out this modeling are identified below:

- **Variables:** As mentioned above, the carrying capacity depends on a series of factors that directly and indirectly influence a territory. These factors or variables are related to each other, generating complex dynamics to analyze and project. The variables can be classified in three main categories:

Variables can be of different types:

- **Environment Impacts:** Ecosystem Services, Biodiversity, Soil erosion.
- **Human needs:** Basic services provision, Housing, Health, Education, Security
- **Cultural Variables:** Language, Traditions, Landscape protection, Urban typology

  The determination of which variables to use will depend in the first place on the Objectives of the Model, the Vision for the development and the feasibility of being able to measure and project indicators and thresholds for the variable.

  Given the great diversity of variables that can be used, the data that must be collected will also be very heterogeneous:

  - Data related to Biodiversity: number of individuals of certain species, average age of individuals, reproduction rates, etc.
  - Consumption data for human needs (electricity, drinking water, food)
  - Data from citizen perception (obtained from surveys): perception of security, immigration, landscape values, use of public spaces

- **Thresholds:**For each Variable identified, Thresholds must be defined, i.e. limits that allow comparison of the current and projected situation with a fixed parameter. The gaps between the threshold and the estimated parameter will make it possible to identify whether the Carrying Capacity has been exceeded or whether there is slack (current or projected).

  Thresholds can be of different types, most of them being the product of a technical agreement based on the development objectives and visions to be established:

Threshold Identification:

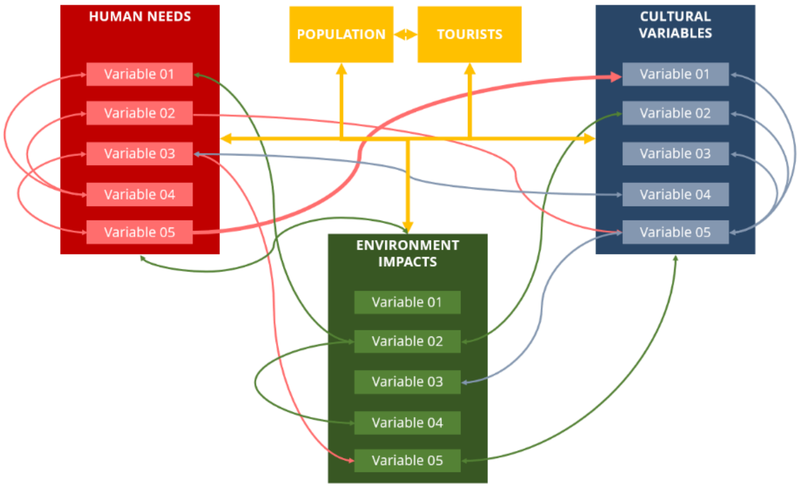
- **Environmental Impacts:** Biocapacity, Ecosystems Services
- **Laws, Regulations:** International regulations, Urban Planning, National Standards
- **Development Vision:** Language, Traditions, Landscape protection, Urban typologies
- **Investment Feasibility:** Financial, Technical, Environment, Social.

- **Type of Model:** Given the systemic nature of the Carrying Capacity, the way to determine it has become more complex. This is explained by the impact that different variables have on other variables. These impacts can be of different types and strengths, generating a series of iterations and loops that are difficult to estimate and model. It is for this reason that the modeling of the Load Carrying Capacity can be done in different ways, depending mainly on the resources and objectives set.

  A key factor to determine which type of model to use is that it must be a practical and updatable tool, mainly due to the variable character of the Load Carrying Capacity, explained above. To summarize, the models can be divided into 2 main types:

- **Integrated Model:** As indicated by the name, it refers to complex models that seek to understand the different effects between the variables, seeking to generate a single result (index) to measure the Carrying Capacity of the Territory.

Figure 197 - Integrated Model Scheme

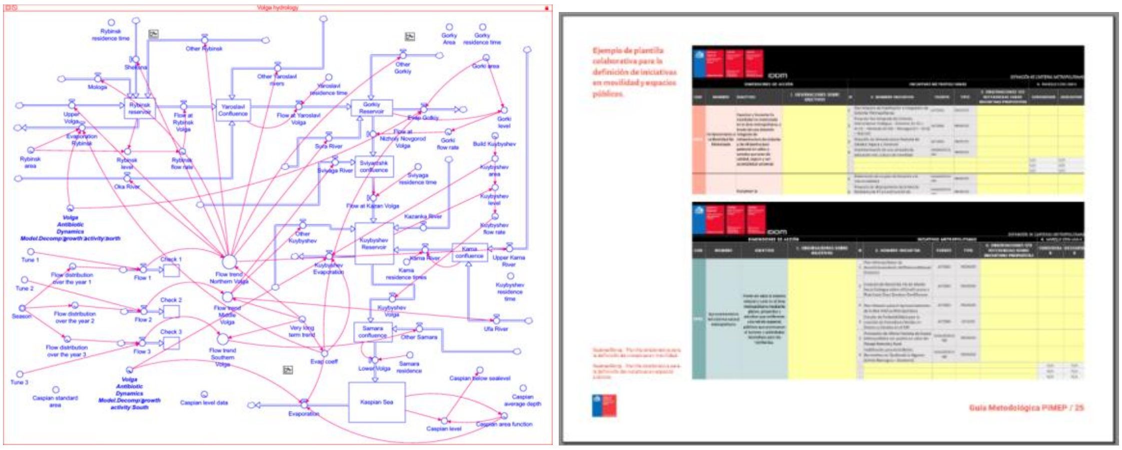


Source: IDOM, 2023

- **Non- Integrated Model:** Given the complexity of generating integrated models, a more feasible and practical alternative is to use non-integrated models, that is, in which each variable generates indices separately. The restriction of this type of model is that it makes it difficult to understand the systemic effects, which in some cases can generate effects that are very difficult to foresee. But on the other hand, it allows a simpler understanding of the effects and a feasible update to be carried out by local organizations.
- **Modelling Tool:** depending on the type of Model that is determined to be used, different tools will be required to be able to estimate the Load Capacity. In general, the tools can be divided into two main types: Based on Dynamic Simulation Software and Based on a Spreadsheet.

  The use of dynamic simulation software makes it easier to work with Integrated Models, however it limits their updates (for license purchase and ability to use the software). On the contrary, the use of spreadsheet-type tools allows for easier use, although with certain limitations for the work of integrated models.

Figure 198 Examples of modellings based on Software Stella (Dynamic Simulation) and with a Spreadsheet



- **Management Instruments:** Finally, and as previously mentioned, the incorporation of Carrying Capacity as a variable for sustainable planning requires the link with binding Territorial Management Instruments, so that the results of the Model allow real decision-making. This is perhaps the most important challenge, since some of the determinations that have to be made will be complex from the political, social and economic point of view:
    - **Regulations for Tourism**: A probable result of the modeling is the need to limit the number of visitors to a given territory. In territories highly dependent on this activity (such as Ambergris), it is foreseeable that this is the main conclusion of the cargo model. The number of tourists is directly related to the need for labor, the consumption of basic services, the use of land, the need for mobility, and security, among others. Taking definitions regarding controlling the number of visitors will be an issue that must necessarily be addressed in Ambergris if sustainable development is sought and maintained over time as an attractive tourist destination.
    - **Regulations for migration and number of inhabitants:** a second management tool that may be required is the limitation of the number of population and migrants. This definition could require legal modifications at the national level.
    - **Urban Planning Instruments:** a third type of instrument is related to urban and territorial planning. For example, in the case of Ambergris Caye, it is urgent to regulate the destruction of mangroves and lagoons. This is directly related to environmental variables that also affect the possibility of building new homes, infrastructure, and tourist facilities.
    - **Investment Plans:** there are some variables directly related to the need for new infrastructure (sewer systems, potable water, roads). But what is important here is the feasibility of these infrastructure projects (environmental, social and economic).

2.5.5. Ambergris Caye's Current Carrying Capacity

The diagnostic proposed a methodology, some objectives, and the variables for analyzing the carrying capacity of Ambergris Caye. It is suggested that including these variables could provide an opportunity to focus investments and introduce new management tools. It is very clear that there is an urgent need to change some development patterns to fill some of the gaps that have been identified.

If the current situation is complicated, the challenge for the upcoming years will be immense. This is especially true if the observed trends continue and the predicted increase of 12,000 new inhabitants and approximately 7,000 new homes is realized.

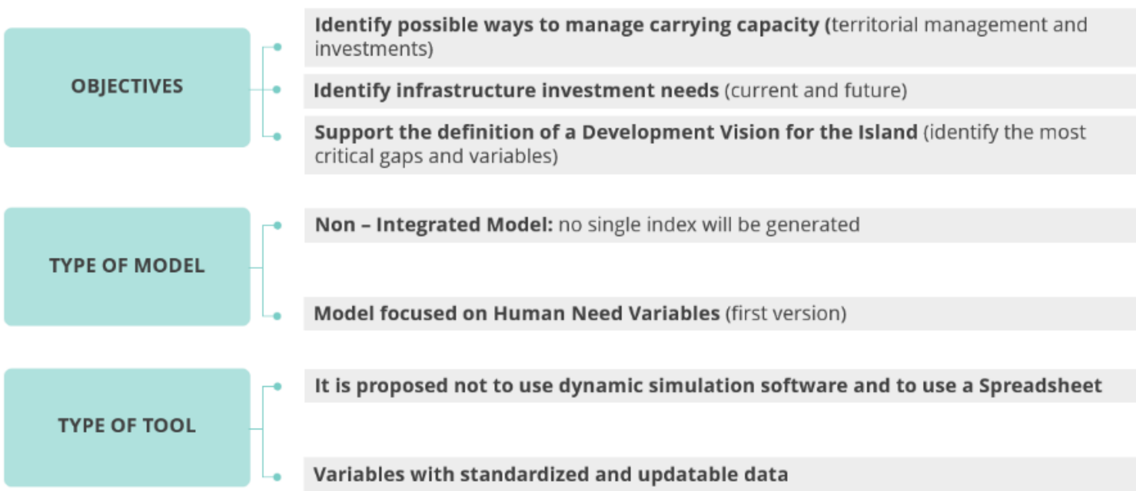
This highlights the pressing need to shift the development paradigm of the Caye. Incorporating the concept of Carrying Capacity into territorial management presents a compelling opportunity. It is important to note that estimating the Carrying Capacity is not sufficient for achieving sustainable development. It is merely a tool for measuring potential impacts and defining scenarios. What is truly essential is to implement changes in the instruments of territorial management and planning, and almost importantly, to reach a consensus on a development vision.

2.5.5.1. Proposal Model

Based on the conclusions of the diagnosis and the participation of the interested parties, some base guidelines have been identified for the development of an initial carrying capacity model for Ambergris Caye.

The proposal is to develop a basic model, which allows later adding complexity, as local actors better understanding of the tool. In this way, the concept can be transmitted more clearly and, above all, identify concrete measures that will continue to be implemented in the short and medium term.

Figure 199 - Carrying Capacity Model



Source: IDOM 2023

This first Carrying Capacity Model for Ambergris Caye, will be developed focused on Human Needs Variables[3]. As previously stated, these variables are easier to understand and measure, which is crucial for introducing the concept in the territory. In a subsequent version, additional variables could be introduced to potentially generate an integrated model.

Based on the diagnosis, six variables have been identified to be included in the Model:

- **Fresh Water**: Production Capacity and Coverage
- **Wastewater:** Collection coverage and Treatment Capacity
- **Solid Waste:** Collection Coverage
- **Housing:** Quantitative deficit
- **Education:** Preschool, Elementary and Secondary coverage

2.5.5.2. Fresh Water

This variable is related to the users who currently have access to freshwater service and is compared to the total number of inhabitants.

Regarding daily consumption, an average of 68.64 gallons per day was used for the calculation[4].

The estimate of current consumption was based on the estimated population (preliminary Census data) and the estimated maximum number of expected daily tourists (using the historical maximum of February 2019).

Table 78 - Fresh Water Demand and Gap Current Situation

Unit	2022
Population	18.319
Average Daily Tourists	1.272
TOTAL Fresh Water Demand (liters/seg)	58.83
TOTAL Fresh Water Production gap (liters/seg)	17.65
Percent of inhabitants with current service	73%

Source: IDOM, 2023

Currently, the water production capacity has a deficit of approximately 27%, which means that the production capacity should increase to meet Belize's average standard.

2.5.5.3. Wastewater

Wastewater management was identified as a significant issue during the diagnosis. Currently, only 20% of the island's houses are connected to the network, with the rest utilizing individual solutions of varying characteristics.

The collected water is treated in a plant where only primary processes, such as oxidation, are carried out. The treated wastewater does not meet the environmental standards required for the natural value of Ambergris. Furthermore, the treatment plant is located only meters away from urban development areas without adequate buffer zone.

To analyze the current and future Carrying Capacity, two variables related to wastewater have been defined: Sewage Network Coverage and Treatment Plant Capacity.

[3] Human needs variables: Carrying capacity models for tourism and population growth in a region are based on the evaluation of the current social and economic infrastructure and the possibility of its future expansion. These response capacities are initially analyzed based on the possibility of meeting the basic needs of an inhabitant, such as: water for domestic use, sanitation, health, education, waste management and housing. Which for this consultancy have been defined as Human Needs Variables.

[4] Average of urban areas in Belize according to UN Global Compact Water Action Hub).

Table 79 - Wastewater Current Situation

Unit	2022
Population	2.022
Dwellings	6.112
Average Daily Tourists	1.272
Wastewater Treatment Demand (liters/seg)	70.75
Wastewater Treatment Capacity (liters/Seg)	8.23
Wastewater Treatment Gap (liters/Seg)	32.94
Wastewater (Dwellings with Sewage coverage)	20%
Sewage Coverage Gap	80%

Source: IDOM, 2023

According to the data collected and estimates made, the indicators related to wastewater are currently critical. Only 20% of households would be connected to a sewage network and less than 20% of all wastewaters generated is treated. This has a direct impact on natural systems and is also a critical vector for the health of the inhabitants.

2.5.5.3.1. Solid Waste

Currently, solid waste generated on Ambergris is transported to a transfer station located south of the Caye. This facility, which opened in 2015, stores the waste generated, which is then transported to the mainland.

With the increase in population and visitors, waste generation will rise sharply in the coming years, which will require optimizing this system, mainly through the incorporation of recycling systems. In this manner, it is possible to decrease the impact on the environment and enhance the system's efficiency.

According to the aforementioned characteristics, two variables are proposed for the load capacity model for this topic: Capacity of the Transfer Plant and Percentage of solid waste that is recycled.

To calculate these current and projected variables, the following assumptions were made:

- Production of solid waste per inhabitant (daily): 1 kilogram
- Production of solid waste per visitor (daily): 2 kilograms
- Capacity of the current transfer plant: sufficient for the current waste production.[5]

Based on these calculations, it is estimated that around 260,000 tons of waste are currently generated annually on the island.

Table 80 - Solid Waste Current Situation

	Unit	2022
Inhabitants	Total, Inhabitants	18,319
Total, Tourists visits	Tourists/year	464.120
Waste production inhabitants	Kg/day	6.686.435
Waste production inhabitants	Kg/year	2.440.548.775
Waste production tourists	Kg/year	338.807.600
Waste production total	Kg/year	345.494.035
Waste production total	Tons/year	345.494
Required capacity increase	Tons/year	-

Source: IDOM, 2023

[5] Precise capacity data could not be obtained from the sources requested.

Regarding the second proposed variable, there are currently no recycling programs have been identified in Ambergris. Therefore, it is considered that there is a 100% deficit in this aspect.

2.5.5.4. Housing

Currently, there is a significant tension in the housing market due to high costs and increased demand, particularly related to tourism activity.

Although in the participatory processes it was identified that there is a housing deficit for the reasons mentioned above, accurate data collection in this regard has been challenging. Therefore, to estimate the current carrying capacity, it has been assumed that there is no quantitative deficit, meaning that there is sufficient housing for the current demand. In the event that it is subsequently possible to identify the actual unsatisfied demand, this variable will be updated accordingly.

Data on the number of housing units have been obtained from the Census (preliminary data), where a total of 6,112 housing units have been identified (excluding housing units for tourist rental).

Within these existing housing units, 80 units have been identified as showing significant deterioration and therefore in need of replacement. These units have been considered as the current gap for this variable.

In summary, the housing variable currently has a shortfall of only 80 units, so it would not be considered critical.

As will be detailed later in the future carrying capacity, given the projected population growth, the demand for housing will be very significant, so it is considered a key factor for development.

2.5.5.5. Education: Preschool, Elementary and Secondary

This variable is related to the current capacity to offer education services at the preschool, elementary and high school level.

Based on the lack of information and the difficulties encountered collecting it, this consultancy started from the last census recorded in 2010, where the typical distribution of the groups of people between 0 and 9 years old and between 10 and 19 years old can be observed.

Thus, the census data shows 24% for people between 0 and 9 years old, and 22% for people between 10 and 19 years old.

In addition to this, schools active on websites or Google maps were identified, to determinate the number of education institutions currently operating on the Caye. Thus, the following is a list of the schools found:

Table 81 - Current Schools at Ambergris Caye

Preschool	Elementary School	Secondary
New Horizon SDA Preschool	Ambergris Caye Elementary School	San Pedro High School
ABC Preschool	Holy Cross School	
Brighter Tomorrow Preschool	Isla Bonita Elementary School	
	San Pedro Roman Catholic School	

Source: IDOM 2023

Thus, with the population projections made for the year 2022, the following relationships are presented.

Table 82 Population growth

	Population	Group between 0 a 9 years	Group between 10 a 19 years
2022	18.319	4.397	4.031

Source: IDOM 2023

Therefore, the current carrying capacity analysis for the education service considers that with 7 preschool and primary schools, 4,397 children between 0 and 9 years of age are being educated and with 1 secondary school, 4,031 adolescents are being educated.

2.5.5.6. Conclusions for Current Carrying Capacity

As explained, the Carrying Capacity model developed does not consider the generation of a single index but is composed of individual results for each of the 8 variables considered.

To facilitate the understanding of the results, the results of the variables related to the deficit of each one of them have been homologated. A "traffic light" classification of three categories is proposed:

- **GREEN: ACCEPTABLE DEFICIT** The deficit identified in the variable is less than 15%.
- **YELLOW: WARNING CONDITION** The deficit identified in the variable is between 15% and 35%.
- **RED: CRITICAL DEFICIT** The deficit identified in the variable is more than 35%.

This allows for a simple and clear visualization of current and future carrying capacity gaps, because it is shown the percentage of deficit that was obtained by this consultancy with the collected information, and it was apply the traffic light mentioned before.

Table 83 Summary Table Current Carrying Capacity

	Deficit on install capacity obtained for 2022
Production Capacity of Fresh Water	27%
Wastewater Treatment	80%
Wastewater (Sewage coverage)	80%
Solid Waste Transfer Station Capacity	0%
Recycled Solid Waste	100%
Housing *	1%
Preschool and Elementary Education *	0%
High schools Education *	0%

Source: IDOM 2023

There are 4 variables in a critical state: Production Capacity of Fresh Water, Wastewater Treatment, Sewage coverage and Recycled Solid Waste. These are directly related to the quality of life and environmental impact on Ambergris ecosystems; Just recycling capacity could be solve by management than new infrastructure, others require important investments.

Those "acceptable" categories, were estimated based on outdated or insufficient information (*). These are: Housing and those related to Education; Information from 2012 Census, it will be possible to update these variables and verify if their status.

Finally, Critical categories need to have urgent actions, given the expectancy to increase population and visitors; otherwise it will increase the critical state of these variables.

DEVELOPMENT SCENARIOS

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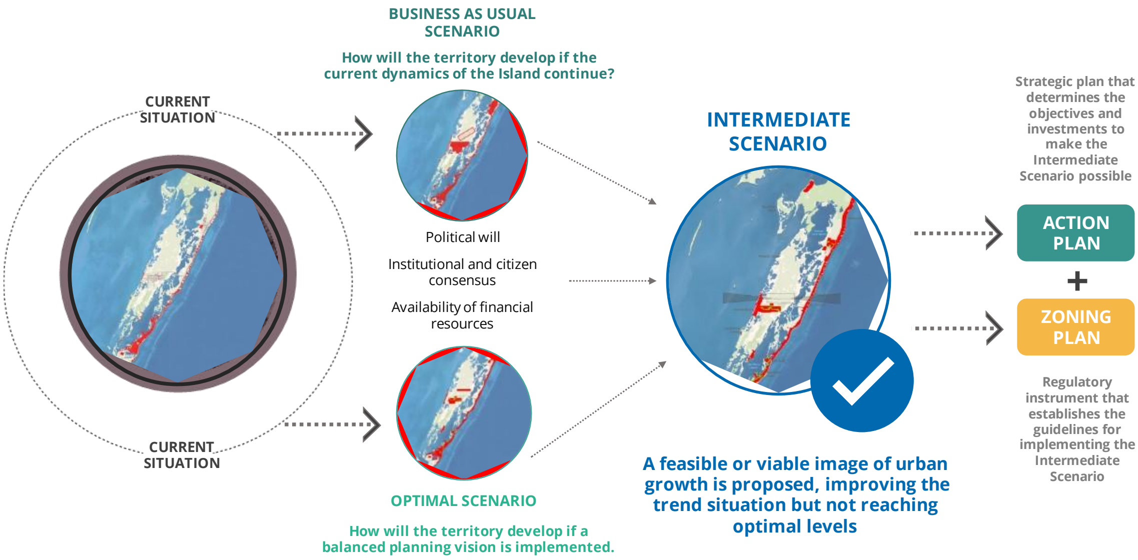
3. Development Scenarios

The study will propose scenarios with a time horizon of 2045, with the objective of identifying recommendations for a sustainable growth model that will improve the island's position with respect to natural risk mitigation and prevention, and adaptation to climate change. This will increase the local and regional competitiveness of the territory.

Figure 200 - Urban Growth Scenario Diagram



Source: IDOM, 2023

The design of the different scenarios is represented cartographically. The maps obtained are the result of the analysis of trends and areas of possible development, incorporating the criteria established by the three components of the studies.

In addition to the cartographic design of the scenarios, the study compares scenarios from the point of view of land and resource consumption. A comparative analysis of the cost of basic infrastructure in the different scenarios is also performed in Phase 3.

Finally, the guidelines and recommendations for the urban growth of Ambergris Caye are presented in the next phase, summarizing the main challenges and strategies aimed at achieving the Optimal scenario and the Vision for 2045.

3.1. Urban growth "as usual"

The design of this scenario considers two main criteria: the analysis of current trends and decision making according to the variables that define the scenario. Considering these analyses, characterization of the demand for land between 2022 and 2045 is quantified at 2,157 acres. That is, multiplying the footprint by 2.2 over the next 20 years.

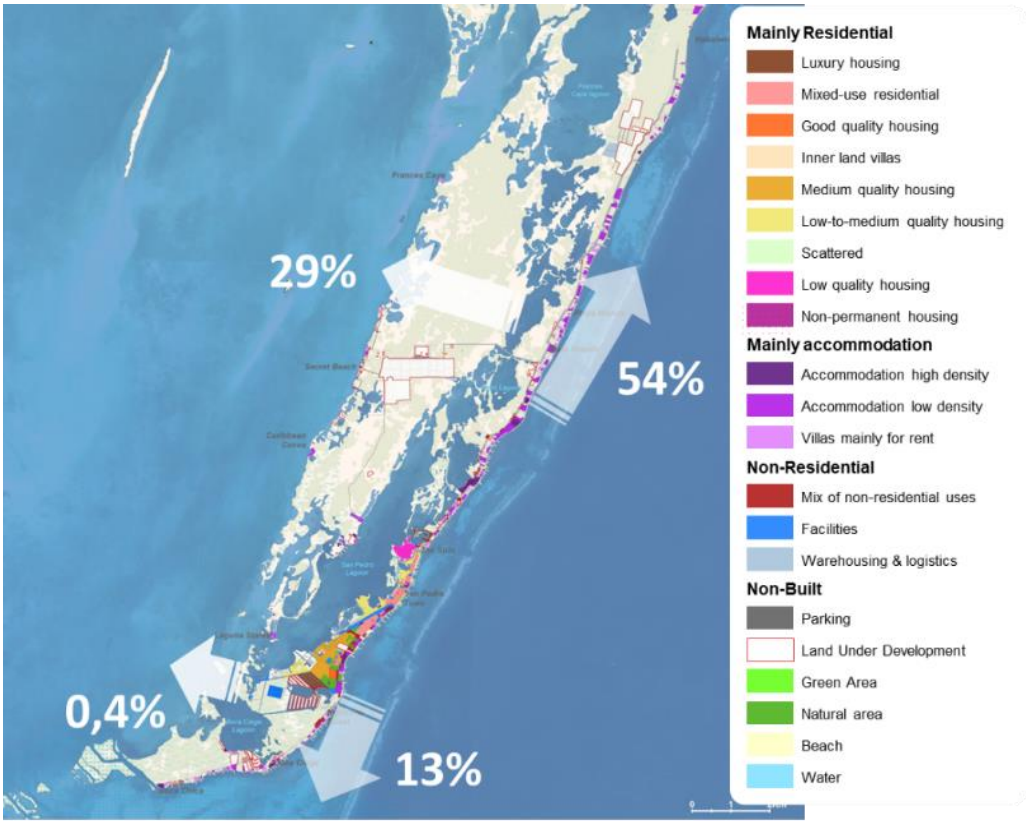
This theoretical land demand is distributed on the island according to the vectors analyzed, considering both dynamics within the current footprint, either by the development of Land Under Development, or the growth in vacant land.

The urban growth "as usual" scenario illustrates the warnings regarding the disorganized growth of the urban footprint. The demand for residential land, pushed to the cores without adequate urban development and supply of public space, is unattractive to residents who are without infrastructure, far from the island's communication points, employment centers and health and education facilities. The result is a low rate of consolidation in contrast to the expansion of land under development, which causes inefficient land use and encroachment on areas of high ecological value (mangroves and wetlands).

Likewise, the demand for land fort the tourist infrastructure located along the northern road exceeds sustainable growth and affects the natural dynamics of the coastal edge, limiting access to the beaches and forming a peri-urban continuum with negative repercussions on the island's mobility.

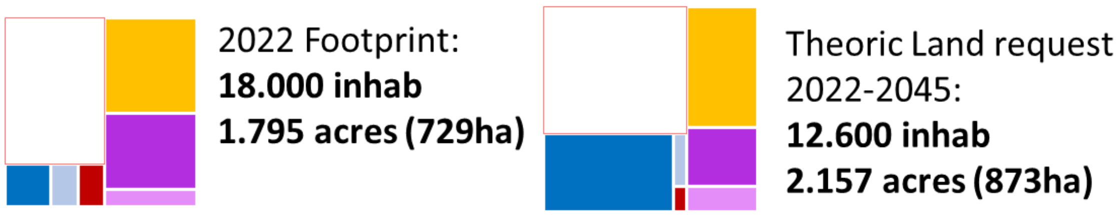
Regarding current trends, recent changes were analyzed, and growth vectors have been quantified, as shown below.

Figure 201 Growth vectors



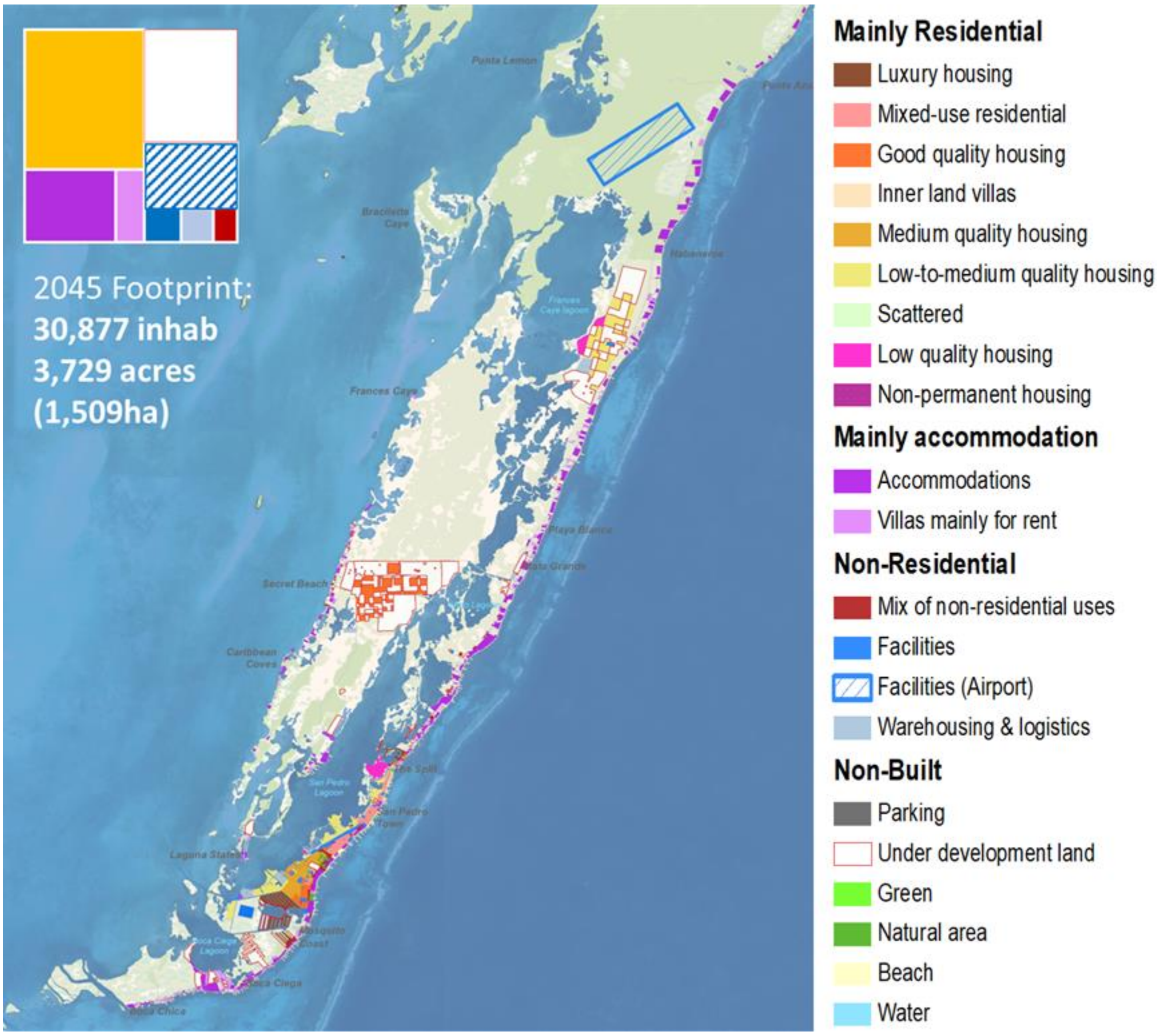
Source: IDOM, 2023

Considering these analyses, characterization of the demand for land between 2022 and 2045, is quantified at 2,157 acres. That is, multiplying the footprint by 2.2 over the next 20 years.



This theoretical land demand is distributed on the island according to the vectors analyzed, considering both dynamics within the current footprint, either by the development of Land Under Development, or the growth in vacant land.

Figure 202 Scenario 1 – Urban growth "as usual"



Source: IDOM, 2023

According to the parameters that specify the situations, these dynamics are in-depthly examined.

3.1.1. Projects under consideration

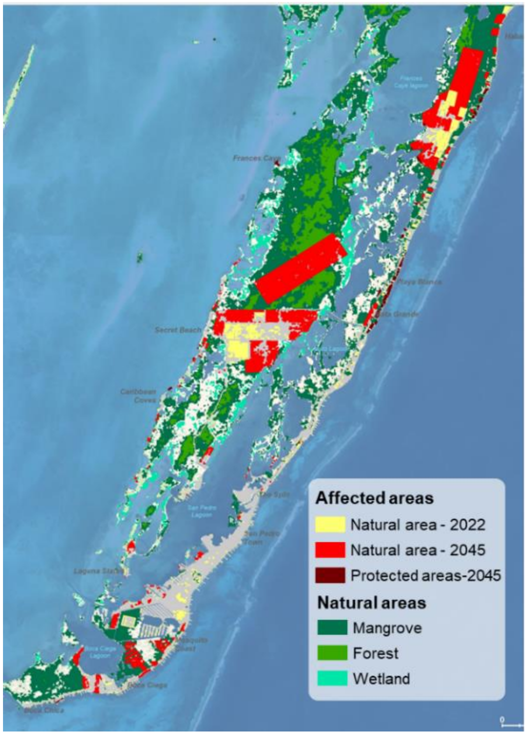
This scenario considers the execution of the following projects:

Hospital- 4.3 acres (1.7 ha). This project currently has available land and financing for its construction.

School - 4.9 acres (2 ha). This educational facility has land available for construction.

3.1.2. Natural areas and public space

Figure 203 Trend environmental impact



Source: IDOM, 2023

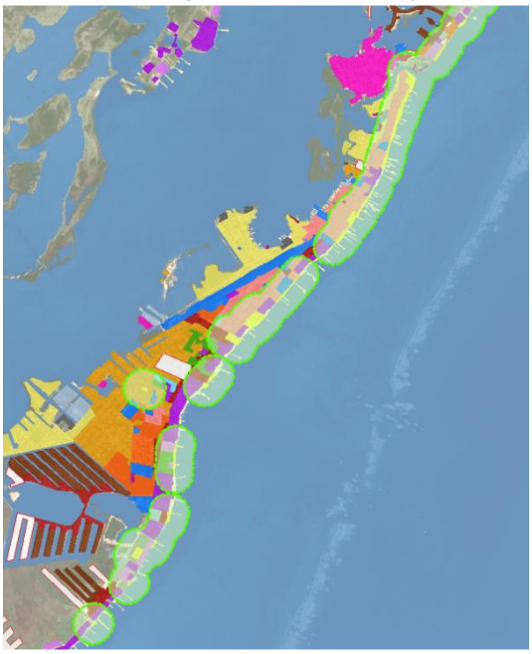
Unplanned growth does not offer any guarantees of respecting areas of high ecological value. Thus, there has been a gradual reduction of mangroves and wetlands on the island, and in a projection to 2045 this trend continues, with an estimated deforestation of more than 300 acres of mangroves in the next 20 years. Regulatory protection is also not currently being respected, and the urban footprint impacted on protected natural areas could approach 70 acres by 2045.

Along with the impact of areas of high ecological value is the modification of the natural environment and its ecological dynamics such as the cases of marine landfills for the development of luxury housing or the impact of the coastal edge with the constructions destined for tourism.

The latter trend also affects the available public space, cause hotels & resorts frequently use the neighboring section of the beach exclusively, restricting access for locals and visitors from outside the area.

Public space in the trend scenario continues to be deficient and offers, in the urban and peri-urban context, an endowment of 0.4 sqm/inhabitant of qualified green areas and 4.1 sqm/inhabitant including non-privatized beaches in the public space indicator. Thus, only 18% of the Caye's population has a public space area within a 10-minute walk.

Figure 204 Population at less than ten minutes walking distance Public Space



Source: IDOM, 2023

3.1.3. Residential growth

A minimum residential growth is considered within the current footprint, limited to consolidation processes in some sectors with ample availability of vacant lots.

430 acres (174 ha)

6,129 new dwellings
17% consolidation
83% vacant & new land

According to socioeconomic status, most of the residential land is allocated to new development regions, with the largest lots being those in Secret Beach. The area near to Cayo Frances Lagoon, more than 8 miles from the major job hub, is home to people of low socioeconomic status. Both situations have extremely low densities—around 10dw/ha—and underdeveloped endowments. Luxury housing continues to be built in the urban center's impact zone, filling up wetlands to make room for new development.

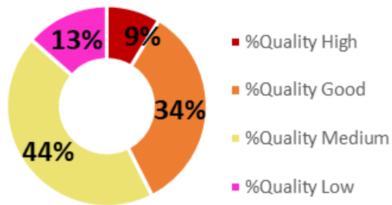
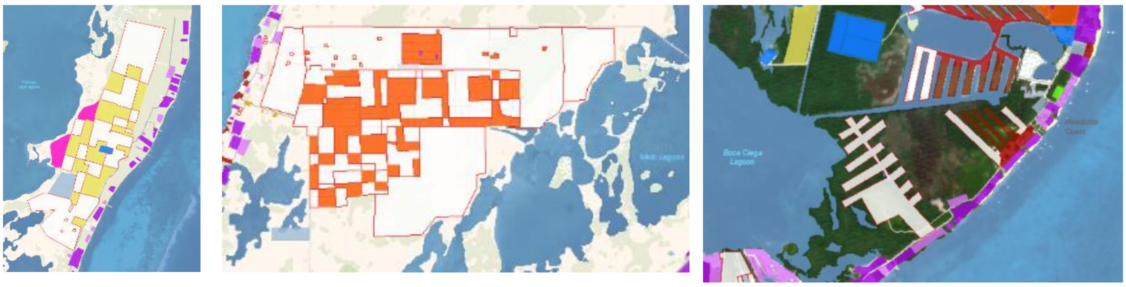


Figure 205 Samples of residential growth

Low&medium quality growth	**Good quality growth**	**High quality growth**



12.1 dw/ha	10.2 dw/ha	23.4 dw/ha

Source: IDOM, 2023

By 2045, there is a qualitative deficit of over 3,000 housing units, corresponding to poorly constructed or precarious housing. This means that 7,500 residents of Ambergris live in highly vulnerable housing.

Regarding expansion land, more than 900 acres of intervening land are predicted for future developments, primarily residential or related to residential property, reflecting the existing trends. This suggests that area Land Under Development will make up 25% of the metropolitan footprint.

Land Under Development

3.1.4. Accommodation growth

210 (85) 49 new hotels/resorts

A trend development of 49 new hotels, with a footprint of 210 acres, has been anticipated in light of the construction of new hotel sites between 2013 and 2022.

260 new vacational villas
60 acres (24 ha)

Additionally, the trend indicates that about 90 acres are occupied by villas, most of which are for rent, which reflects an increase in the number of holiday homes, which total 260 villas.

The island's eastern coastline edge has a continuity of vacation expansion that stretches for more than 15 miles and has a dispersed influence on the west shore.

3.1.5. Urban facilities

In this scenario, the developed projects include a new hospital in the urban core and a school in Promise Land, considering the ongoing projects and the level of development they have achieved. While the construction of an airport is not part of this scenario, is assumed that the existing airfield will remain in its current location. Also, is planned to allocate 500 acres of land in a region close to Secret Beach for future development.

508 acres (206 ha)
1 new airport
1 new hospital
1 new school

Warehousing
33 acres (13 ha)

Mix-use
16 acres (6 ha)

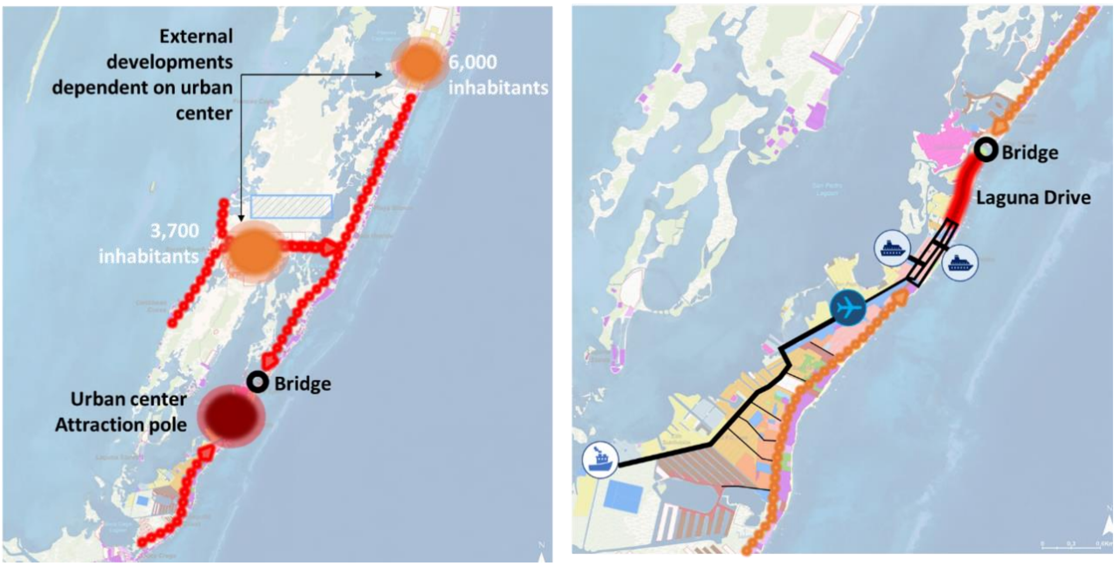
Approximately 50 acres of extra land will be required for various purposes, such as mixed-use development and warehouses. These properties will be scattered across downtown San Pedro and along the north road vector.

3.1.6. Mobility

Mobility problems are enhanced throughout the island. The presence of two large population centers with no facilities means a direct dependence on the urban center, which is communicated through a single entrance and exit road to the north, with a narrowing of the bridge. In addition, the hotel and vacation offerings on the east coastline cause increased traffic in the residential subdivision of Secret Beach and, together with the vacation infrastructure on the west coast, contribute to congestion on Honourable Heredia Jr. North Road. The bridge crossing is a single point of entry for supplies entering from the docks or airport and a crossing point for 10,000 inhabitants and population housed in 280 villas mainly for rent and 200 hotels & resorts located north of the island.

In the urban area, in addition to the difficulties caused by the narrowing of the bridge for north-south communication, there is also congestion on Laguna Drive when it becomes the only communication route to the bridge.

Figure 206 Schematic map of mobility challenges



Source: IDOM, 2023

3.1.7. Public services

The supply of services remains below the real needs of the population. Considering that there are no infrastructure projects in the pipeline for the coming years, sewerage coverage remains deficient, serving only 16% of the population. Wastewater solutions continue to be individualized outside the urban environment. This generates a significant environmental impact due to the lack of systems or the failure of treatment systems, that are highly dependent on an energy supply system that is also limited. Drinking water coverage does not cover the entire island and only reaches 49% of the population.

3.1.8. Summary of urban growth "as usual" scenario

The urban growth "as usual" scenario shows the warnings regarding the disorganized growth of the urban footprint. The demand for residential land, expelled to cores without adequate urban development and supply of public space, is unattractive to residents who are without infrastructure, far from island's communication points, employment centers and health and education facilities. The result is a low percent of consolidation in contrast to the expansion of land under development, which causes inefficient land consumption and invades areas of high ecological value (mangroves and wetlands).

Likewise, the tourist infrastructure land demand settled along the north road exceeds sustainable growth and affects the natural dynamics of the coastal edge, limiting access to beaches and forming a peri-urban continuum with negative repercussions on the island's mobility.

Figure 207 - Urban Growth "As Usual" Indicators

MAIN DATA	**Population**	**30,877**
	Dwellings	**12,241**
	Acres	**3,729**
	Ha	**1,509**
Natural areas and public space	Protected area affected (acres)	69
	Mangrove affected (acres)	735
	Green area (sqm/inhab)	0.4
	Public Space (sqm/inhab)	4.1
	% Population at less than ten minutes walking distance from/to Public Space (total footprint)	18%
Residential growth	Net density	21
	Gross density	8.1
	Number of precarious dwellings	3,729
Accommodation growth	Land consumption (acres)	541

Urban facilities	% Population at less than ten minutes walking distance from Facilities (education & health)	59%
Public services	% Population with sewerage	16%
	% Population with water	49%

Source: IDOM, 2023

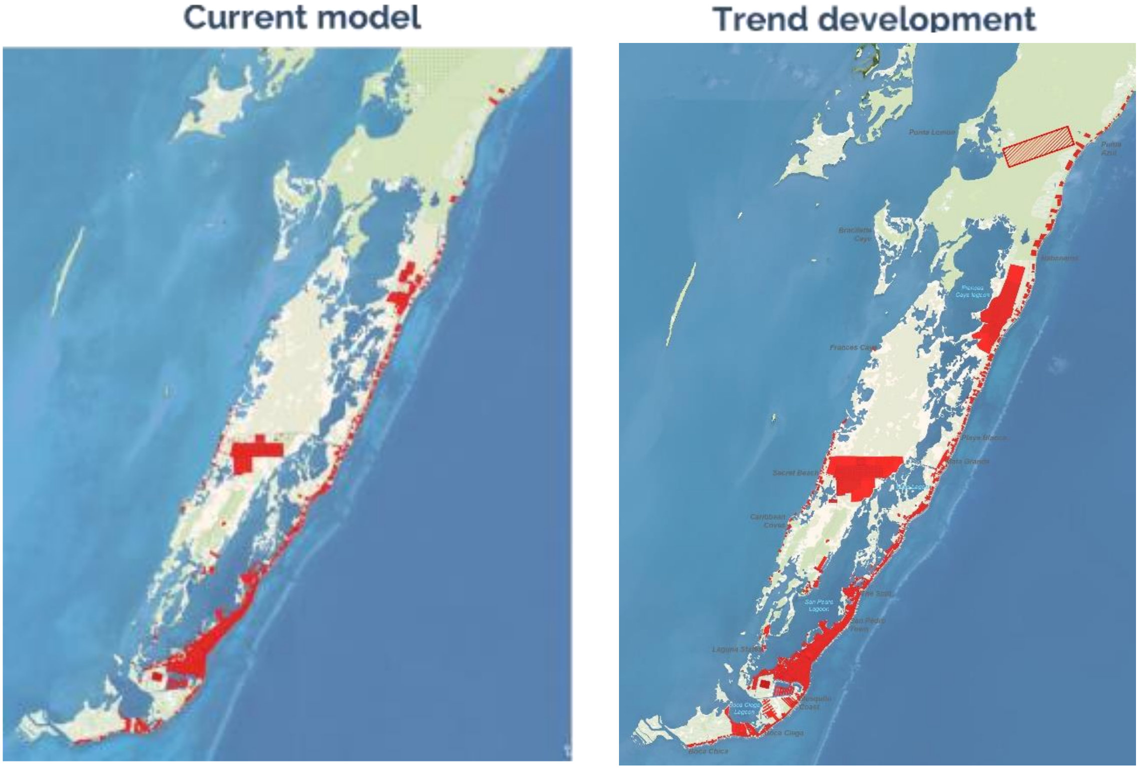
The following figures show the result of the comparison between the current model and the baseline scenario graphically and quantitatively.

Table 84 - Current model's indicators compared to trend indicators

	Current	Trend
Population	18.319	30.877
Dwelling	6.112	12.241
Acres	1.795	3.729
Ha	726	1.509
Net density	34,2	21
Gross density	8,4	8,1
green area (sqm/inhab)	0,8	0,4
% Population at less than ten minutes walking distance Public Space (total footprint)	33%	18%
% Population at less than ten minutes walking distance Facilities (education & health)	84%	59%
% Population with sewerage	31%	16%
Number of precarious dwellings	1.561	3.126
Protected area affected (acres)	46,7	69
Mangrove affected(acres)	236,73	735.13

Source: IDOM, 2023

Figure 208 Comparison of the 2022 model with the trend scenario 2045



Source: IDOM, 2023

3.2. Optimal Scenario

This scenario is consistent with the ideal vision of urban growth for a given area, allowing the sustainability perspective to be used to determine the maximum level of permitted future development. The basic requirements for its definition are focused on improving the quality of life for the population through the best use of natural resources, taking into account growth constraints, natural hazards, climate change adaptation measures, and a use of the territory that combines efficiency and equity, ensuring a high level of social cohesion.

The following guiding concepts, organized into the following basic criteria, were structured to build the Optimal Scenario:

3.2.1. Natural areas and public space

The proposal for the Caye is based on actions focused on the preservation of its ecological characteristics and biodiversity, as well as on urban development with minimal impact on ecosystems, following the guidelines specified in Phase 2.

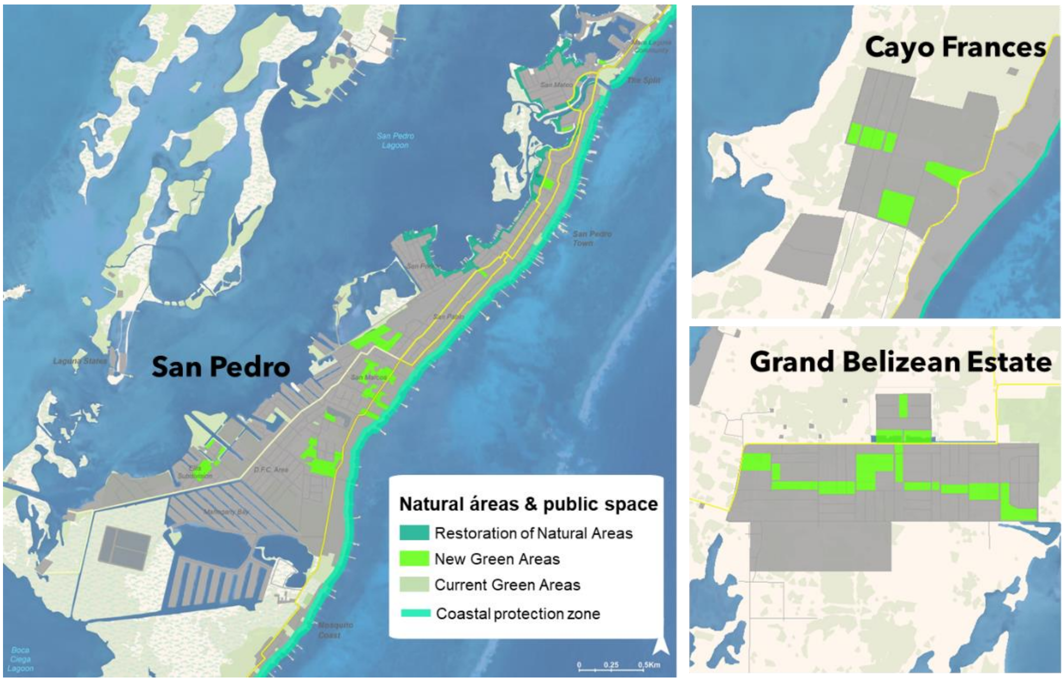
- Establish a public protection and public domain strip on the coastal edge, which remains free of construction and allows for the restoration of beaches and native ecosystems in these areas.
- Restrict the development of new projects that destroy or drastically affect the integrity of lagoons and native forests, including mangroves.
- Ensure ecological connectivity between coastal zones and inland protected areas of the island.
- Encourage mangrove restoration and the use of native species in public spaces.

- Prohibit the construction of new walls on the coastal edge and encourage nature-based solutions.

These guidelines translate into specific actions in the design of the scenario that create a public space equivalent to 19 sqm per inhabitant. This ensures that up to 60% of the Caye's population has a public space area within a 10-minute walk.

To achieve this, the qualification of 25 acres of urban green areas is proposed, along with the construction of 83 acres of parks and networks of green corridors in the new development areas. The preservation of the urban mangrove entails the restoration of up to 37 acres as part of the Urban Improvement Projects. Regarding the eastern edge, the proposal includes 28 miles of coastal protection to minimize the impact of the current development.

Figure 209- Scenario 2: Natural Areas & Public Space



Source: IDOM, 2023

3.2.2. Residential growth

Considering the estimated requirement of 6,129 new housing units by 2045, the following guidelines are proposed for housing development on the island:

- Develop existing vacant land in the Secret Beach (Grand Belizean Estate) areas and the subdivision known as Cayo Frances, through affordable housing programs that allow the local population to access quality housing.
- Restrict the development of new land parcels, especially in areas with mangrove or native forest cover.
- Develop comprehensive improvement programs in the sectors of San Mateo, San Juan, and San Pedrito, which include the structural upgrading or reconstruction of low-quality/substandard housing and the provision of quality infrastructure and urban services.

In the cartographic proposal, these guidelines translate into the construction of new homes in certain sectors of the island. Prioritizing the use of available land in the current urban core, they are distributed as follows:

1,560 dw → Consolidation: Considering the construction of housing with the same current typologies in the interstitial properties of the area of San Pedro.

Development of housing and mixed-use projects

376 dw →Vacant plots

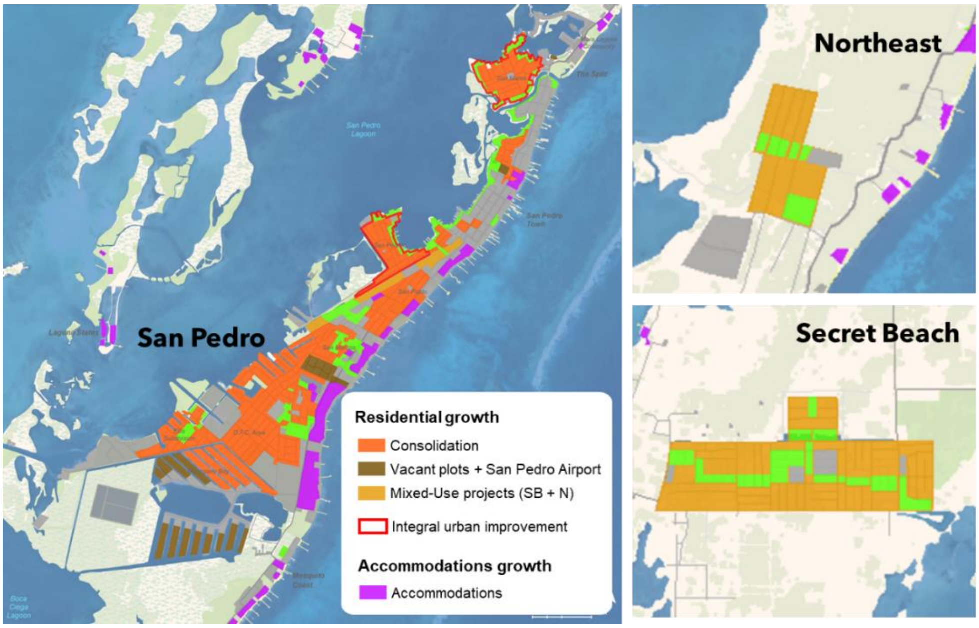
260 dw → Current San Pedro Airport

3,070 dw → Grand Belizean Estates

1,110 dw → Cayo Frances

For the development of these housing projects, the spaces that are currently intervened are considered, associating average densities of 20 or 35 dw/ha, equivalent to the mixed-use areas that are in the current footprint.

Figure 210 – Scenario 2: Samples of Residential Growth



Source: IDOM, 2023

A as measure to improve the quality of the inhabitants of the island, Integral Urban Improvement Projects are established on 76.5 acres and the renovation of the construction of the 1,560 precarious housing estimated in the diagnosis.

3.2.3. Accommodation growth

Regarding the space reserved for vacation development, the following guidelines were stablished in Phase 2:

- Restrict the development of hotel complexes and resorts on the coastline, respecting an isolation that allows public use of the beaches and the conservation of native vegetation.
- Establish norms that determine maximum occupancy rates in the lots to be developed, in order to avoid large deforestations.

- Preserve isolation with vegetation cover between hotel complexes and resorts, facilitating ecological connectivity and avoiding the formation of a continuous urban footprint.
- Integrate the natural environment into the spatial approach of the lodging complexes, avoiding large hard surfaces and facilitating permeability and infiltration into the subsoil.

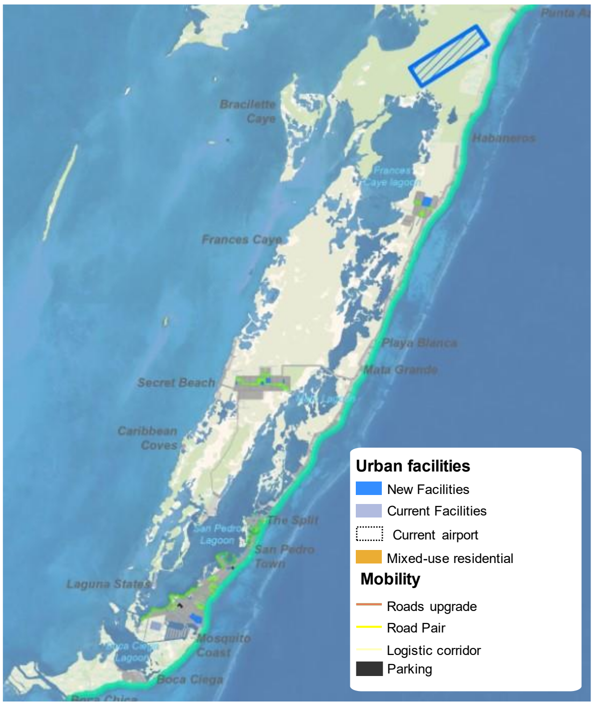
In the cartographic construction of the scenario, this translates into the restriction of land consumption for new vacation spaces. According to the premise of the scenario, compact tourist poles are established in Secret Beach, the north shore of San Pedro lagoon and a strip of land along the island's east coast. The growth in these places is estimated in 24 acres, according to the vacation demand but a total area of 990 acres is available for development.

3.2.4. Urban Facilities

In this scenario, the projects developed include a new hospital in the urban core, and at least one health center and a school in Grand Belizean Estates and a school in Cayo Frances development. In total, 59 acres are earmarked for the construction of facilities.

As for the San Pedro Airport, it is proposed to relocate this infrastructure on the southernmost alternative proposed in the National Transportation Master Plan, on land near Secret Beach. This will free up some 30 hectares of land in the urban center of San Pedro, where a mixed-use urban development project can be developed, with new facilities, green areas, social housing projects and compatible logistic uses. The new airport will extend over an area of 130 acres and will have a total of 500 acres due to operational constraints.

Figure 211 - Scenario 2: New Airport Location



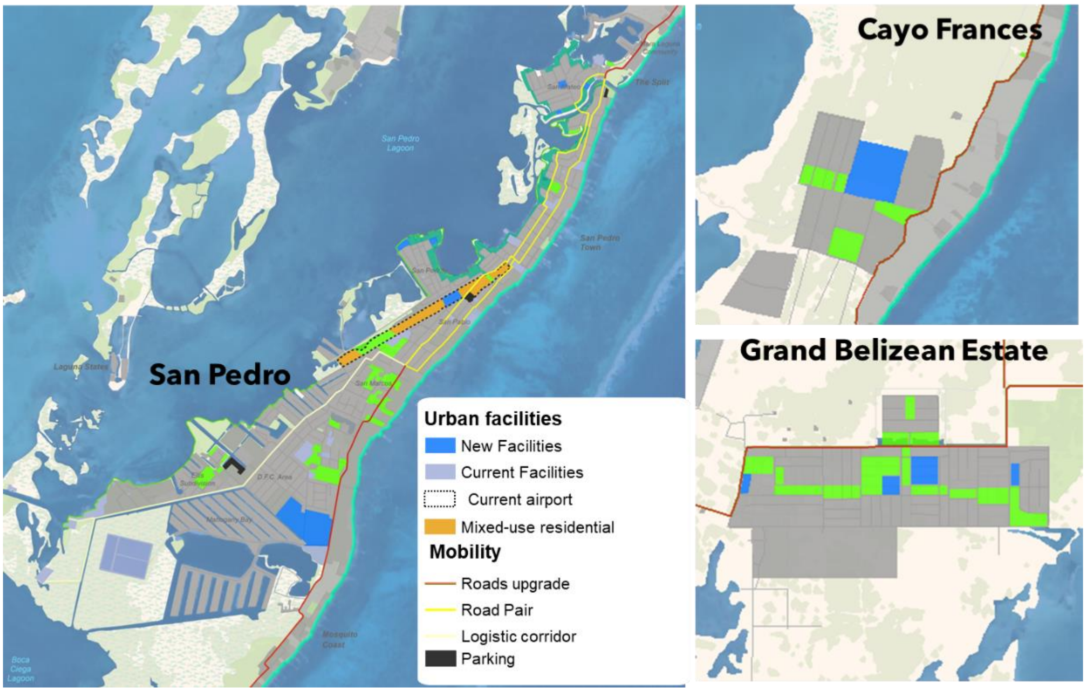
Source: IDOM, 2023

3.2.5. Mobility

The following approaches are proposed in Phase 2 for the Optimal Scenario:

- Implement a public transportation system based on water buses, which will allow an agile connection between different areas of San Pedro, through the inner lagoon.
- Designate 3 parking areas for cars and golf carts, in order to reduce on-street parking (1.2 acres)
- Restrict access of motor vehicles to the road parallel to the beach.
- Create safe pedestrian circulation spaces on the center's main streets, especially those with a high number of tourist-related, such as Barrier Reef Drive and Pescador Drive
- Create a "Road Pair" and a new vehicular bridge connecting San Mateo with San Juan, in order to reduce congestion over the current bridge in Boca del Rio.
- Reorganize the tourist docks, in order to free up the coastal strip currently saturated by piers. It is proposed to organize marinas and tourist ports strategically located.

Figure 212 - Scenario 2: Urban Facilities & Mobility. San Pedro



Source: IDOM, 2023

3.2.6. Public Services

Ensuring access and coverage of the wastewater system is one of the main challenges in the Optimal Scenario. A network that allows for efficient wastewater treatment should be considered, as well as promoting the use of rainwater. Considering services with coverage equivalent to urban and peri-urban areas, a 98% population coverage is achieved.

Similarly, the collection and management of solid waste should be a priority aspect to be considered, implementing policies to reduce waste generation and generate efficient recycling processes.

3.2.7. Summary of Optimal Scenario

A network of parks and green corridors is proposed in natural areas within the urban centers, along with the restoration of vegetated coastlines on the western side of the city of San Pedro, and a coastal protection mechanism along the entire eastern strip of the island, which has been heavily impacted by the ongoing development process. The system is structured through a network of green spaces that preserve and enhance the ecologically valuable areas of the island, supporting diversity and tourist appeal for visitors while providing a renaturalized environment as an integral part of the island's identity.

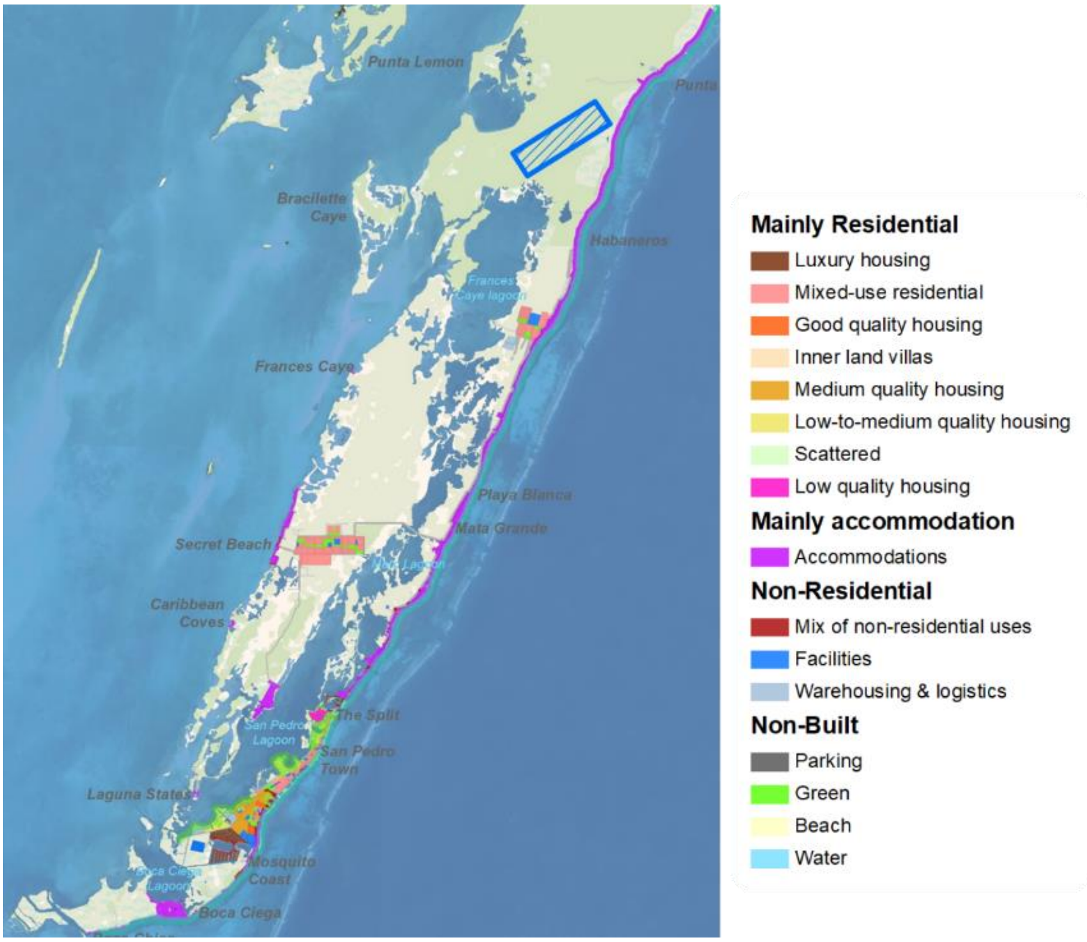
Residential land allocation optimally utilizes available spaces in the city center, with the capacity to accommodate over a third of the population corresponding to the 2022-2045 demographic growth, while also offering improved services and facilities. In low quality neighborhoods, urban improvement projects are implemented, addressing the precarity of poorly constructed housing, and preventing the construction of homes that do not meet quality standards.

Land designated for new tourist areas is concentrated, reducing pressure on the natural environment with new constructions primarily along the coastline.

Adequate health and education facilities are provided to the local population, distributed within development hubs, along with a hospital in San Pedro. The most impactful provision involves the construction of a new airport, offering approximately 30 acres for development in San Pedro. Additionally, the coverage of the water supply and sewage network is improved, reaching the entire population in urban and peri-urban areas.

In terms of mobility, pavement improvements are executed on main roads, and actions are designed to alleviate traffic congestion in downtown San Pedro and at the bridge connecting the north and south, while also offering a suitable logistics corridor for transporting supplies arriving by boat.

Figure 213 - Scenario 2: Optimal



Source: IDOM, 2023

Figure 214 - Optimal Scenario Indicators

MAIN DATA	**Population**	**30,877**
	Dwellings	**12,241**
	Acres	**1,863**
	Ha	**754**

Natural areas and public space	Protected area affected (acres)	47
	Mangrove affected (acres)	224
	Green area (sqm/inhab)	19.4
	Public Space (sqm/inhab)	19.4
	% Population at less than ten minutes walking distance from/to Public Space (total footprint)	60%

Residential growth	Net density	38
	Gross density	16.2
	Number of precarious dwellings	0

Accommodation growth	Land consumption (acres)	473
	Reserved Land (acres)	990

Urban facilities	% Population at less than ten minutes walking distance from/to Facilities (education & health)	85%

Public services	% Population with sewerage	98%
	% Population with water	98%

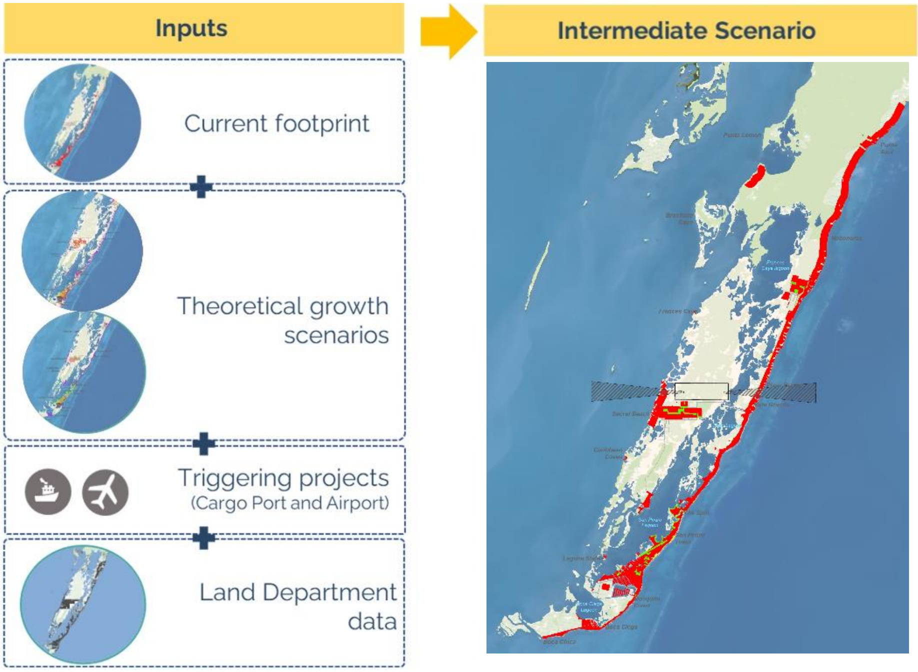
Source: IDOM, 2023

The optimal scenario offers an efficient and sustainable territorial system, halting the consumption of new land on the island by keeping the urban footprint below 2,000 acres. Concentrating residential development in 3 independent and interconnected hubs reduces dependency on the center, improving the quality of life and reducing commuting times. Simultaneously, relocating the airport provides better conditions for flight reception while distributing the influx of people and goods, thus reducing traffic congestion. The provision of public spaces reaches 19 sqm per inhabitant, and along with the regeneration and preservation of ecologically valuable areas, it supports diversity and tourist appeal while reclaiming the island's identity

3.3. Intermediate Scenario

Considering the theoretical scenarios, Vision 2045, and the General Objective for the territorial development of Ambergris Caye, the study crafted the Intermediate Scenario as the foundation for the Action Plan, Financial Plan, and Zoning Plan.

Figure 215 – Construction of Intermediate Scenario



Source: IDOM, 2023

This scenario upholds the guiding concepts outlined in the definition of the optimal scenario while also integrating new considerations that align the territory with current development expectations:

- Residential development pressure in the nodes of Grand Belizean Estates and Cayo Frances.
- Construction of a new Cargo Port in the north of the island.
- Construction of a new airport in in the projected new development in the north just below Bacalar Chico

3.3.1. Natural areas and public space

The proposals of the optimal scenario are maintained, which are summarized as follows:

- Establish 28 miles of public protection and public domain strip on the coastal edge.
- Protect the integrity of lagoons and native forests, including mangroves, and entail the restoration of up to 37 acres as part of the Urban Improvement Projects
- Ensure ecological connectivity between coastal zones and inland protected areas of the island with 83 acres of parks and networks of green corridors in the new development areas.
- Create 50 acres of urban green areas, equivalent to 23 sqm per inhabitant, to encourage use of mangrove and native species.
- Prohibit the construction of new walls on the coastal edge and encourage nature-based solutions.

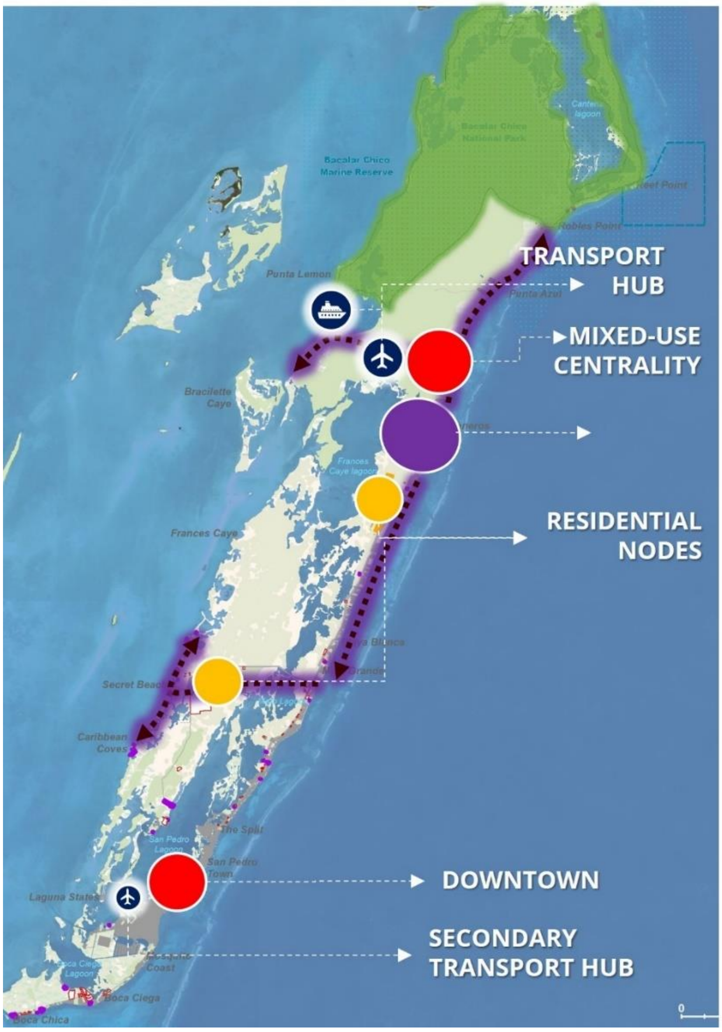
3.3.2. Residential growth

- Develop existing vacant land in the subdivisions of Grand Belizean Estates and Cayo Frances, through affordable housing programs that allow the local population to access quality housing.

The need to create space for 6,129 new homes is considered. To achieve this, the following findings are outlined to ensure the proper functionality of the island and the quality of life of its residents:

- San Pedro: Implement comprehensive improvement programs in the San Mateo, San Juan, and San Pedrito sectors, including the construction of housing with the current typologies in the city's interstitial properties, estimated at 110 acres. (1,140 new homes)
- Develop the existing vacant land in the Secret Beach (Grand Belizean Estates) areas, the subdivision known as Cayo Frances, and the projected development located in the north near Bacalar Chico. This will be done through affordable housing programs that enable the local population to access quality housing. The development of over 380 acres implies a medium density of 35 homes per hectare.
- Restrict the development of new land parcels, particularly in areas with mangrove or native forest cover.

Figure 216- Scenario 3: Indicative locations of residential and mixed uses



Source: IDOM, 2023

3.3.3. Accommodation growth

In line with the scenario's premise, compact tourist hubs are set up at Secret Beach, the north shore of San Pedro Lagoon, and a stretch of land along the east coast of the island. The projected expansion in these areas is anticipated to cover 24 acres, aligning with the demand for vacation destinations. However, there is a total available development area of 1,450 acres.

- To restrict the development of hotel complexes and resorts on the coastline, respecting an isolation that allows public use of the beaches and the conservation of native vegetation.
- To establish regulations that determine maximum occupancy rates in the lots to be developed, in order to avoid large deforestations.

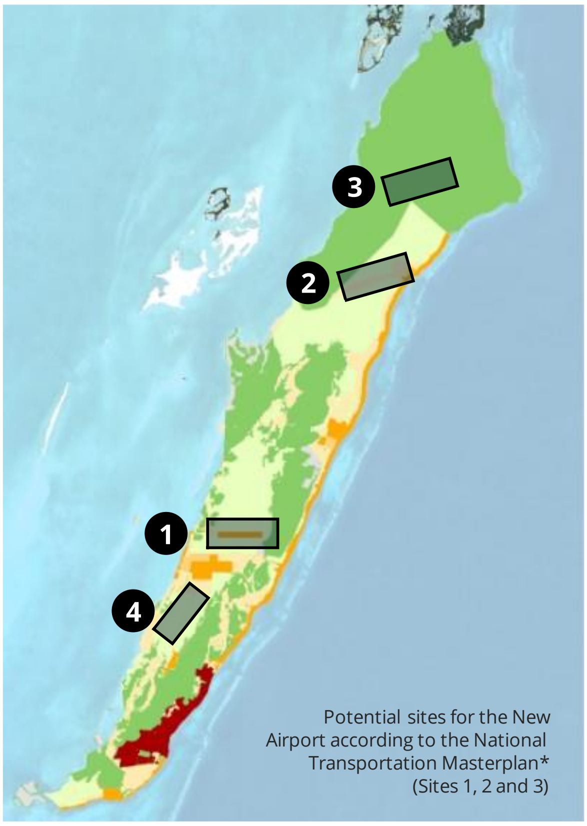
3.3.4. Urban Facilities

In this scenario, the projects developed include a new hospital in the urban core, and at least one health center and three Preschool and Elementary school in Grand Belizean Estates and one Preschool and Elementary school in Cayo Frances development. In total, 59 acres are earmarked for the construction of facilities.

3.3.4.1. New airport

The development of a new airport in the north of Ambergris Caye is a key point for the design of the scenario. The relocation of the San Pedro Airport allows infrastructure development with appropriate safety standards and improved capacity for air operations. According to the National Transportation Master Plan (NTMP) - 2018, there are three potential sites for locating the new airport: The following figure shows the three sites selected by the NTMP and the advantages and issues of each potential location.

Figure 217- Indicative locations for new Ambergris Caye airport according to NTMP



Source: IDOM, 2023

Site 1 is located near to Grand Belizean Estate and Secret Beach, being the closest location to the urban area of San Pedro Town. **Site 2** is situated north of the Cayo Frances lagoon, within the influence area of the tourist and resort corridor currently developing in the northern part of the island. Finally, **Site 3** is located within the Bacalar Chico protection area, being the farthest from the current developments on the Caye.

The potential locations for the new airport were evaluated using the following matrix, which considered the following variables:

- Location outside of nationally protected areas, as the development of airport infrastructure is incompatible with the environmental conservation purpose of these areas.
- Proximity to areas with tourist developments.
- Nearness to potential logistic hubs, considering land availability and proximity to other possible infrastructures such as ports.
- Potential conflicts with land ownership identified.

Table 85 Assessment matrix of potential airport sites

SITE	LOCATION NEAR URBAN CENTERS OR URBAN GROWTH	LOCATION OUTSIDE NATIONAL PROTECTED AREAS	CLOSE LOCATION TO TOURISTIC DEVELOPMENTS (CURRENT AND FUTURE)	PROXIMITY TO LOGISTIC HUBS	MOBILITY AND CONECTION
1 Secret Beach	✓	✓	✓	–	✓
2 Cayo Francés	✓	✓	–	–	–
3 Bacalar Chico	✗	✗	✗	✗	✗
4 West San Pedro Lagoon	✓	✓	✓	–	–

Source: IDOM, 2023

Based on the criteria, Site 3 (Bacalar Chico) is considered unsuitable for airport development. On the other hand, Site 1 (Secret Beach). It has the advantage of being close to future and current touristic developments. However, the lot belongs to the Social Security Board, site 4 (west San Pedro Lagoon) is located nearby urban areas, but road infrastructure is deficient for the airport and there is no record of the owners of the land. Therefore, the Study recommends that the new airport be developed at Site 2 (Cayo Francés), was dismissed because its location requires additional infrastructure costs and increases travel time to downtown San Pedro.

The potential airport location is projected to have a polygon of 494 acres (200 hectares) on which a runway exceeding 6,500 ft. (2,000 m) in length could be built for the eventual use of medium-sized passenger aircraft. The final decision for the location and size of the new airport will be subject to detailed pre-feasibility and feasibility studies.

3.3.4.2. New cargo port

Although the San Pedro South Cargo Port will maintain its current location and established use, according to the projected infrastructure of National Interest it is proposed a New Northern Cargo Port, which will be located at the entrance of Santa Cruz Bay, considering to information provided by San Pedro Town Council. This new port will allow a more agile access to goods and services from the mainland to the north of Ambergris Caye.

The determination of the final location and size of the new Cargo Port in the North requires detailed feasibility studies. For illustrative purposes, it has been outlined on the southern cape of the bay, complemented by infrastructure to accommodate logistics services and mixed-use facilities associated with the operations, which also need to be determined.

3.3.5. Mobility

For proper mobility in the Intermediate Scenario, the proposals from the optimal scenario are retained, and necessary connections to the north of the island are added to serve the new Cargo Port and the new airport.

3.3.6. Public Services

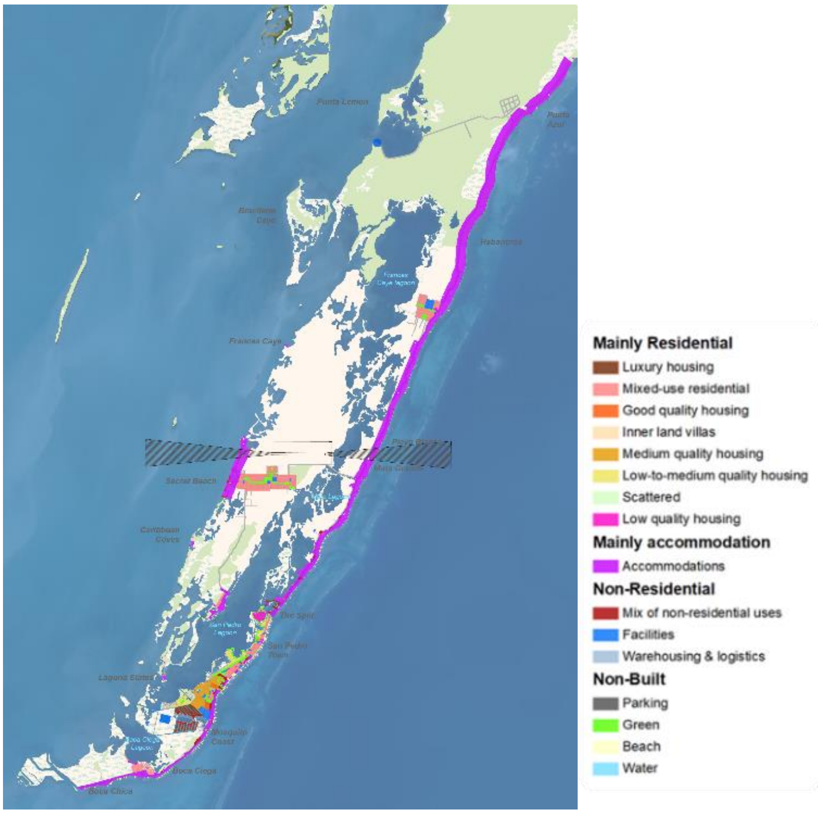
In the Intermediate Scenario, a key challenge is ensuring widespread access to the wastewater system. This involves establishing an efficient network for wastewater treatment and encouraging the use of rainwater. With a focus on achieving a 98% population coverage comparable to urban and peri-urban areas, these measures aim to address this challenge. Additionally, prioritizing the collection and management of solid waste is emphasized, with the implementation of policies to reduce waste generation and establish efficient recycling processes.

3.3.7. Summary of Intermediate Scenario

The Intermediate Scenario balances the island's natural functionality with the development pressures inherent in the current territorial reality. Efforts are made to contain development within natural and protected spaces, ensuring the proper provision of public spaces and recreational areas integrated with the natural environment. Simultaneously, residential and tourist development exceeds estimated demand to protect the island's potential economic growth, providing high-quality spaces and enhancing the living conditions of its inhabitants.

Adequate health and education facilities are strategically distributed within development hubs, complemented by a hospital in San Pedro. Furthermore, improvements are made to the water supply and sewage network, extending coverage to the entire population in urban and peri-urban areas. Mobility is enhanced, making the island more accessible with improved connections in terms of infrastructure extension and pavement.

Figure 218 - Scenario 3: Intermediate



Source: IDOM, 2023

Figure 219 - Intermediate Scenario Indicators

MAIN DATA	**Population**	**30,877**
	Dwelling	**12,241**
	Acres	**3,829**
	Ha	**1,549**

Natural areas and public space	Protected area affected (acres)	47
	Mangrove affected (acres)	420
	Green area (sqm/inhab)	23
	Public Space (sqm/inhab)	23
	% Population at less than ten minutes walking distance from/to Public Space (total footprint)	60%

Residential growth	Net density	34.4
	Gross density	7.9
	Number of precarious dwellings	0

Accommodation growth	Reserved Land (acres)	1,450

Urban facilities	% Population at less than ten minutes walking distance from/to Facilities (education & health)	85%

Public services	% Population with sewerage	98%
	% Population with water	98%

Source: IDOM, 2023

The Intermediate Scenario integrates the needs of economic development and conservation of the island, balancing the impact of tourist and residential activities with the recovery and enhancement of its ecological systems. It provides a connected, functional, and enjoyable island for both its visitors and residents.

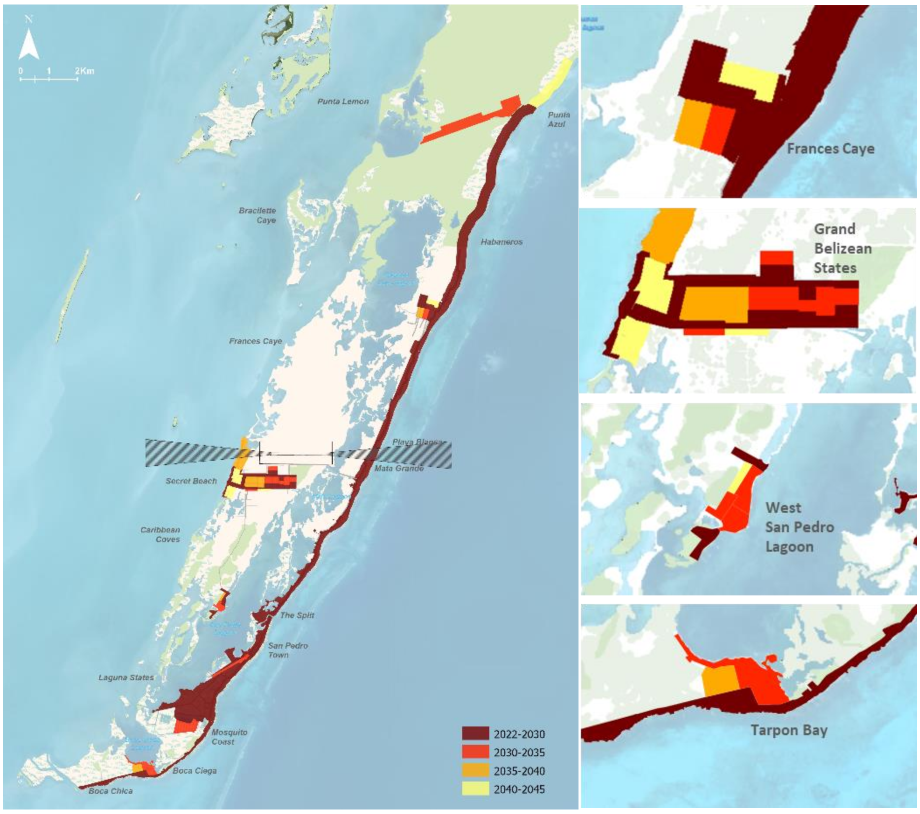
3.3.8. Stages of Intermediate Scenario

The prioritized stages of the Scenario development are established from 2022 to 2045, encompassing a total of four periods: an initial stage until 2030, followed by intervals of every 5 years until 2045. These stages are in response to the need for the provision of infrastructure, housing, and facilities, considering the carrying capacity.

However, there are circumstances in the island's characteristics that do not allow for a direct correlation between carrying capacity and demand in the years. This correlation is evident in the design of expansion zones, where the phases and demand for infrastructure are clear and well-defined in their stages. Nevertheless, in Ambergris, development occurs simultaneously in distant points of the island: San Pedro, Secret Beach/Gran Belizean Estates, Cayo Francés, and triggering projects such as the Cargo Port and the airport.

Thus, the need for infrastructure networks, such as the supply of potable water or sewage, occurs simultaneously and is not directly related to the short-term increase in population, although it is considered in its design and coverage objectives by 2045. Therefore, these stages on the map illustrates the enabling phases on the island in relation to the carrying capacity of infrastructure networks.

Figure 220 – Infrastructure investment priority 2022-2045 for Development Land



Source: IDOM, 2023

Infrastructure that operates in a centralized manner, such as educational facilities, does respond to population growth and is distributed in the territory according to the Future Carrying Capacity.

Table 86 Future needs Education

	2022	2030	2035	2040	2045
Preschool and Elementary school	-	One in Gran Belizean Estates	One in Gran Belizean Estates	One in Cayo Francés	One in Gran Belizean Estates
High School					One in San Pedro Town

Source: IDOM 2023

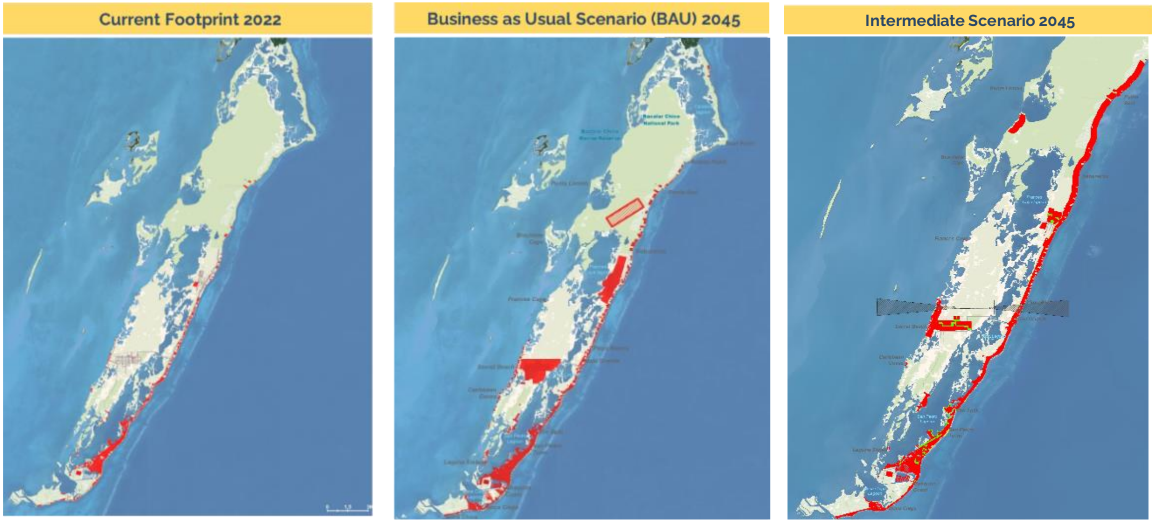
3.4. Comparison of growth urban scenarios

3.4.1. Comparison of basic parameters from the Growth Scenarios

Following the design of the scenarios, a comparison is made between the indicators obtained in each of them and the corresponding data in the current model to quantitatively assess the impact of the actions in the scenarios.

The next figures show the result of the comparison between the current model and the scenarios graphically and quantitatively. Note that the Optimal and Intermediate scenarios have the same data for most of the indicators due to similar criteria used to define them.

Figure 221 - Comparison of the 2022 Current footprint with the Scenarios 2045

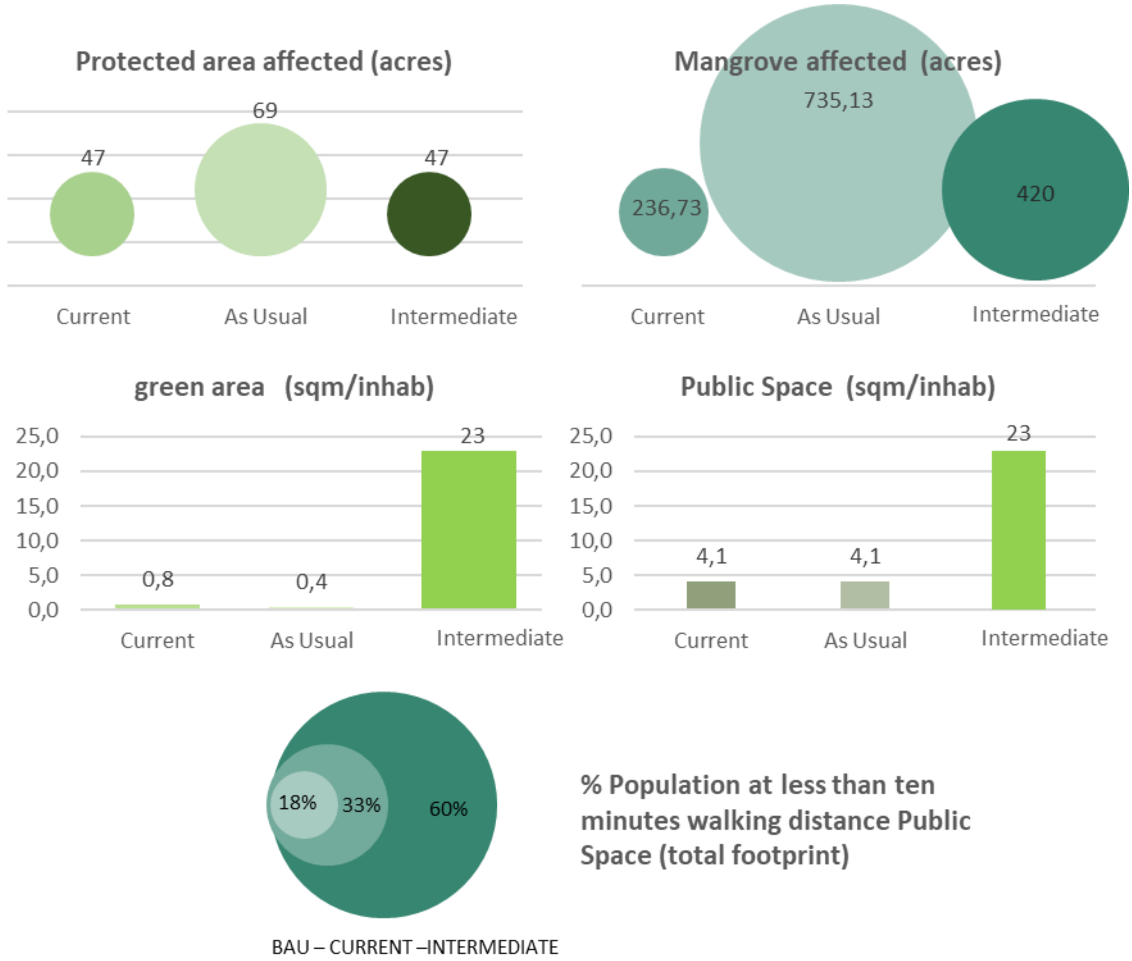


Source: IDOM, 2023

The "As Usual" scenario has a much greater impact on the natural environment, affecting protected areas 1.5 times greater than in the current or Intermediate Scenario. Something similar happens with the deforested mangrove area that is multiplied by 1.8 in the trend with respect to the intermediate.

Regarding the provision of green areas and public space, in both cases the indicators of the optimal/Intermediate scenario are the only ones that reaches the WHO recommendation of 10sqm/inhab.

Figure 222 - Comparison of Natural Areas & Public Space Indicators



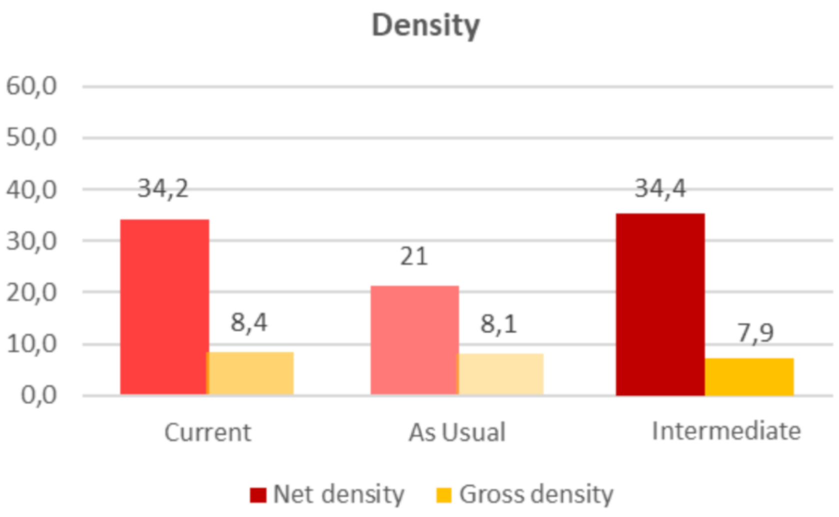
Source: IDOM, 2023

The population indicator less than 10 minutes' walk from a public space is 3 times higher in intermediate than in the trend and double that in the current one.

As regards residential growth, the trend scenario with a more extensive expansion presents lower gross and net density data than the current model, while in the intermediate scenario land consumption is optimized. The intermediate scenario presents a higher density in the footprint, although its gross density is lower, due to a wide land supply required to mitigate restrictions in areas with higher urban development pressure.

Precarious housing doubles in 2045 following current trends and can be reduced to 0 through optimal/intermediate housing regeneration actions.

Figure 223 - Comparison of Residential growth indicators

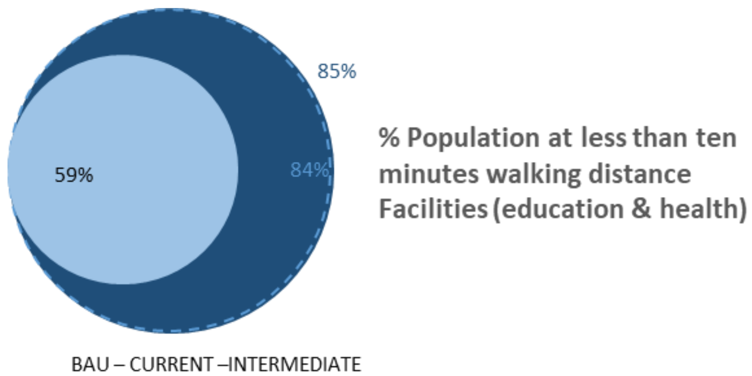


Source: IDOM, 2023

The land used for tourist accommodation increases in both scenarios, however in the Intermediate scenario the consumption of new land is half of the land consumption in the trend. Thus, of the 407 acres in the current model, 540 acres are reached in the trend model and 470 acres in the intermediate.

The facilities indicator shows that the distribution of equipment remains above 80% in the Optimal Scenario thanks to an adequate supply in the northern development poles, while the deficit in the business-as-usual scenario reduces coverage to 59%.

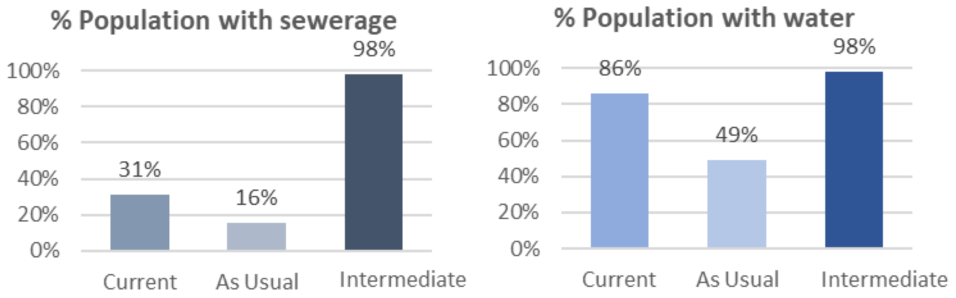
Figure 224 - Comparison of urban facilities indicators



Source: IDOM, 2023

The lack of coverage of sanitation and supply services is already shown as a problem at present, which increases in the Trend Scenario (BAU). In the Optimal/Intermediate scenarios, full coverage is considered in the 3 residential development poles: San Pedro, Grand Belizean Estates and Cayo Frances, reaching 98% of the population served.

Figure 225 - Comparison of public services indicators



Source: IDOM, 2023

3.4.2. Costs of basic infrastructure

This chapter analyzes and compares the investment costs for providing basic infrastructure to accommodate growth in the different scenarios. A simple methodology has been implemented to roughly estimate the costs of the new territory prepared to accommodate a city, based on the prices of different components of basic infrastructure, which serve as multiplier values for the areas involved in the scenarios, thus obtaining the cost of land served per acres or miles, with basic services and infrastructure.

The costs presented in this analysis are the estimated costs for the urban infrastructure development of the area under study and are based on local prices obtained from similar projects on the island or in the country. The data is shown in the following table.

To avoid duplicity in the costs of green areas, it has been generalized. Thus, "Housing" and "Housing projects" do not consider the cost of green areas within their boundaries. The cost of all green areas is included in the costs of "Green & Natural areas". The cost of roads is divided as follows: urban roads are considered within the 'New Residential Land' category, while Mobility refers to the construction of new connecting roads.

Table 87 - Unit prices

HOUSING*	**Units**	**USD*/acres**
New residential land	acres	$101,751
Integral Urban improvement projects	acres	$287,279
		USD*/dwelling
Intervention on precarious housing	dwellings	$10,000
HOUSING PROJECTS*		**USD**
Urban Improvement San Mateo, San Juan, San Pedrito	TOT	$16,000,000
	Units	**USD/acres**
Land Under development	acres	$47,947
GREEN & NATURAL AREAS	**Units**	**USD/acres**
Green area	acres	$200,000
FACILITIES		**USD**

New airport	TOT	$31,000,000
Optimization of current Cargo Port	TOT	$3,600,000
New Northern Cargo Port	TOT	$11,000,000
Health point	TOT	$1,100,000
School	TOT	$880,000

MOBILITY**	**Units**	**USD/mile**
New roads	miles	$745,029

** Not considering green areas*
*** Not considering urban roads*

Source: IDOM, 2023

For the analysis, three scenarios are considered: the 'As Usual' scenario, the 'Optimal' scenario, and the 'Intermediate' scenario. As a comparison measure**, it is going to be analyze a BAU scenario with a qualification of the infrastructure that improves the quality of life of the population, it is called 'Business as Usual - Qualified'**, ad corresponds to the assumptions of the trend scenario in which, subsequently, the qualification actions of Optimal Scenario are proposed.

This 'Business as Usual - Qualified' analysis addresses the need to quantify three scenarios in the same terms, since the 'As Usual' scenario will appear more economically profitable with less investment in infrastructure, but it will be socially and environmentally less favorable."

Some basic assumptions are established upon which the calculations are developed:

- The construction costs of the 'Business as Usual - Qualified' analysis, both in urban and suburban areas, only show the cost of pavement, in order to match the current trend. It will be in the qualified BAU scenario where a complete provision of the urbanized space will be accounted for.
- As other actions are proposed in the scenario aimed at improving the quality of life in the city, the associated costs for each of them will be established, such as providing facilities, housing resettlement, or comprehensive neighborhood improvement proposals.
- The qualification costs of the third scenario, "Business as usual qualified," refer to all those expenses that contribute to the quality of life for the population, such as the relocation of homes at risk, neighborhood improvements, and the provision of facilities, public spaces, and new communication infrastructure.

The values of each variable are shown in the following table. This table collects the data regarding the area or length of actions in the scenarios, as well as specific projects for which a detailed budget has already been prepared, and these enter with their own data rather than a unit of surface (for example, the development of a large vacant space in the urban area called "Housing Alaia" or the neighborhood improvement in San Mateo). For BAU, "BAU Qualified" is shown in parentheses when the data is different.

Table 88 - Assumed variables in each economic scenario.

NEW LAND	**Units**	**BAU & (Qualified BAU)**	**OPTIMAL**	**INTERMEDIATE**
Urban/Periurban	acres	155.6	123.0	123.0
Housing	Num. of projects	0	1	1

External developments	acres	1622.9	605.0	1,207
Intervention on non-permanent housing	dwellings	0 *(3,126 QBAU)*	670	670
Urban Improvement	Num. of projects	0 *(1 QBAU)*	1	1
Land Under Development	acres	851.7	0	
Green areas	acres	0 *(83 QBAU)*	83	83
Facilities				
New Airport	Num. of projects	0 *(1 QBAU)*	1	1
Cargo ports (Optimization and New Port in the North)		1 *(2 QBAU)*	2	2
Health point		0 *(1 QBAU)*	1	1
School		1 *(5 QBAU)*	5	5
Mobility				
New roads	miles	0 *(13.5 QBAU)*	4.5	5.5

Source: IDOM, 2023

Based on the two previous tables, the multipliers are applied, and the cost is obtained for each of the variables considered in the three economic scenarios. The cost is expressed in total USD, millions of USD and USD per inhabitant.

Table 89 - Summary of cost calculation.

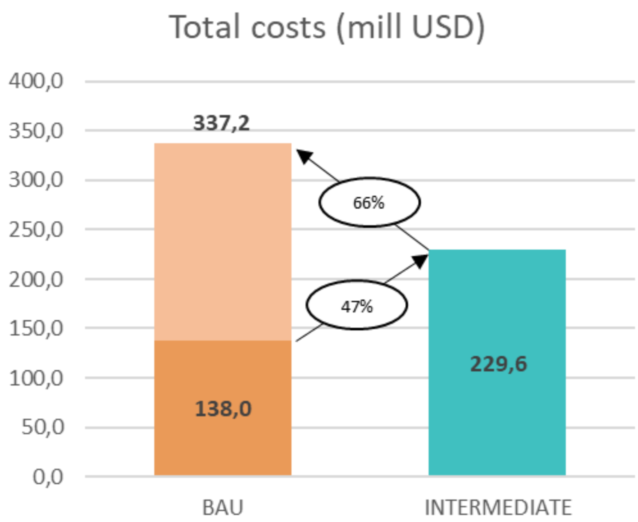
	BAU	OPTIMAL	INTERMEDIATE
Urban/Periurban	$7,461,644 *($15,775,461 QBAU)*	$10,104,037	$10,104,037
External developments	$77,815,127 ($164,517,295 QBAU)	$49,701,163	$133,986,469
Intervention on precarious housing	$0 ($31,258,411 QBAU)	$6,700,000	$6,700,000
Urban Improvement Projects	$0 ($7,050,000 QBAU)	$7,050,000	$7,050,000
Land Under Development	$40,835,382	$0	$0
New Green areas (out of New Land)	$0 ($16,600,000 QBAU)	$16,600,000	$16,600,000
Facilities	$11,880,000 ($51,100,000 QBAU)	$51,100,000	$51,100,000
Mobility	$0 ($10,057,892 QBAU)	$3,352,631	$4,091,660
Total costs (USD)	$137,992,152 ($337,194,439 QBAU)	$144,607,831	$229,638,165

Total costs Mill USD	**138,0** **(337,2 QBAU)**	**144,6**	**229.6**
USD/Inhab	$4,469 ($10,921 QBAU)	$4,683	$7,437

Source: IDOM, 2023

- In total costs the BAU scenario appears as the most economical solution but develops a similar infrastructure and urban empowerment deficit model to the current one. Further action on the BAU model would increase the costs of the scenario by 2.4 times (138 mill USD BAU and 337 mill USD QBAU).
- Urban development in existing and newly developed areas in a QBAU scenario would cost more 180 million compared to 60 million in optimal scenario or 140 million in intermediate scenario.
- In terms of mobility, the dispersion of the QBAU scenario is close to 10 million, compared to 3 million in an optimal or 4 million in an intermediate scenario of greater compactness and use of the territory.
- In terms of total costs, the BAU scenario involves an expenditure per inhabitant of almost 4,500 USD while the cost in an optimal design increase by around 4,700 USD and 7,400 USD in intermediate scenario. However, an ex-post qualification of the BAU scenario would mean an increase of more than 11,000 USD per inhabitant.

Figure 226 - Comparison of basic infrastructure costs



Source: IDOM, 2023

The intermediate scenario presents a 47% increase in urbanization costs compared to the estimated costs in the BAU scenario, while the hypothetical qualified BAU scenario represents an expenditure increase of 66% compared to the intermediate scenario.

The Business as Usual (BAU) scenario initially appears as the most cost-effective option but results in infrastructure and urban development deficits similar to the current situation. Further action within the BAU model would escalate costs almost fourfold, from 138 million USD to 337 million USD. Development in a planned scenario with proper design can result in a savings of 1.5 times the expenditure on infrastructure provision and equipment compared to a continuity option (BAU) with the current situation that may later be improved (QBAU).

FUTURE CARRYING CAPACITY

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4. Future Carrying Capacity

This chapter will detail the analysis and proposal of the Carrying Capacity model for Ambergris Caye. This model has been developed based on the inputs from the Diagnostic and the agreements reached with stakeholders.

The following sections will detail the definitions and basic data identified for the 6 variables of the proposed model. Finally, a synthesis of the results and a list of recommendations for managing the carrying capacity are included.

As previously mentioned, carrying capacity is a very useful indicator for isolated territories with scarce resources (land), but it must be linked to concrete planning, management, and investment measures.

4.1. Definitions and Basic Data for each Variable

During the previous phase of the consultancy, the focus of the Model was defined. (non-integrate and focused on Human Need Variables).

4.1.1. Freshwater

The estimation of potential consumption was made with the projection of inhabitants and the maximum number of daily tourists expected.

Table 90 Fresh Water Demand and Gaps Projections

Unit	2022	2030	2035	2040	2045
Population	18,319	22,687	25,417	28,147	30,877
Average Daily Tourists	1,272	1,982	2,530	3,229	4,121
TOTAL Fresh Water Demand (liter/seg)	58.83	74.08	83.93	94.22	105.10
TOTAL Fresh Water Production Gap (liter/seg)	15.88	20.00	22.66	25.44	28.38

Source: IDOM, 2023

According to estimates, the demand for fresh water will increase by almost 60% by 2045, reaching more than 2 million gallons per day. To meet this demand, the current production capacity will need to be at least double. In addition, the coverage of the distribution networks will have to be increased.

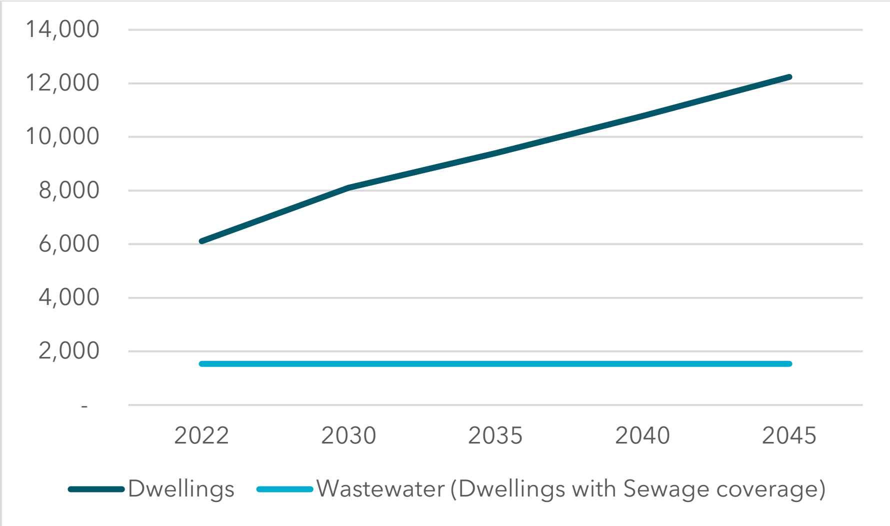
4.1.2. Wastewater

Wastewater infrastructure is one of the most critical issues with respect to the environmental impacts of urban occupation in the Caye.

By projecting the demand for coverage and treatment up to 2045 (using the agreed population and housing projections), we can estimate the need for new infrastructure to be implemented in these 20 years.

As for the sewerage network coverage variable, the current deficit is approximately 20%. If no investment is made in new networks, this deficit will reach 90% by 2045.

Figure 227 Sewage Coverage Gap Projection



Source: IDOM, 2023

Related to Wastewater is the Treatment Capacity. The current infrastructure capacity is about 41.18 liter per second, which corresponds to the wastewater of approximately 1,205 people. This translates into a current treatment infrastructure deficit of approximately 80%.

Projected demand up to 2045 would require infrastructure to treat approximately 1.5 million gallons per day, i.e., 10 times the current capacity.

4.1.3. Solid Waste

Using projected population and visitor data, we have estimated the amount of solid waste that will be generated at Ambergris annually.

Table 91 Solid Waste projected Future situation.

	Unit	2022	2030	2035	2040	2045
Population	Total Inhabitants	18.319	22.687	25.417	28.147	30.877
Total number of projected overnight stays	Tourists/year	464.120	723.608	923.528	1.178.681	1.504.329
Waste production inhabitants	Kg/day	6.686.435	8.280.755	9.277.205	10.273.655	11.270.105
Waste production inhabitants	Kg/year	2.440.548.775	3.022.475.575	3.386.179.825	3.749.884.075	4.113.588.325
Waste production tourists	Kg/year	338.807.600	528.233.840	674.175.111	860.437.264	1.098.160.215
Waste production total	Kg/year	345.494.035	536.514.595	683.452.316	870.710.919	1.109.430.320
Waste production total	Tons/year	345.494	536.515	683.452	870.711	1.109.430

Required capacity increase	Tons/year	-	191.021	337.958	525.217	763.936

Source: IDOM, 2023

As for the capacity of the transfer station, it is estimated that it will need to triple its capacity by 2045.

But this need could be considerably reduced if recycling programs, which currently do not formally exist, are implemented.

4.1.4. Housing

According to the population projection developed, by the year 2045 there would be about 30 thousand people living in Ambergris. If we also consider that the number of inhabitants per dwelling should drop to 2.5, the demand for housing in this period would be about 6 thousand additional dwellings.

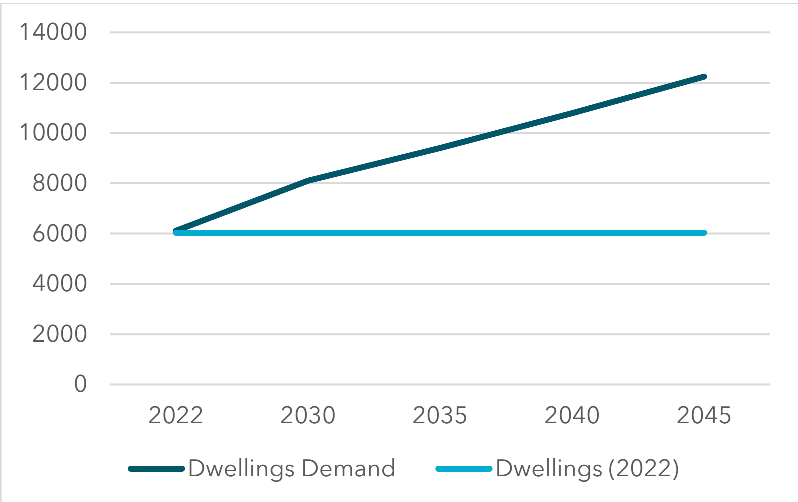
Table 92 Current and projected Housing demand

	2022	2030	2035	2040	2045
Population	18,319	22,687	25,417	28,147	30,877
Ratio of # people per house	3.0	2.8	2.7	2.6	2.5
Dwellings Demand	6,112	8,104	9,396	10,784	12,241
Dwellings	6,032	6,032	6,032	6,032	6,032
Gap	80	2,072	3,364	4,752	6,209

Source: IDOM, 2023

According to this calculation, i 280 houses will have to be built every year for the next 20 years, which means a significant demand for land, basic infrastructure, facilities, and public space.

Figure 228 Graphic of Housing projected demand.



Source: IDOM, 2023

This indicates that the housing variable is one of the most critical in relation to carrying capacity. If affordable housing programs are not implemented, problems of overcrowding, informal housing construction, invasion of natural areas and increased vulnerability to natural disasters will continue to be generated.

Given that tourism is the main economic activity and generator of jobs, it is necessary to implement measures associated with tourism developers (hotels, service companies, or real estate developers), who are responsible for solving this issue.

4.1.5. Education: Preschool, Elementary and Secondary

Based on the analysis of the current carrying capacity, projections were made for the future carrying capacity for education services from preschool to high school.

Thus, the following is the distribution according to the 2010 census for people inside groups between 0 and 9 years old and between 10 and 19 years old.

Table 93 Population projected for groups of people between 0 and 19 years.

	2022	2023	2035	2040	2045
Population projected	**18,319**	**22,687**	**25,417**	**28,174**	**30,877**
Group 0-9 years	4,397	5,445	6,100	6,755	7,410
Group 10-19 years	4,030	4,991	5,592	6,192	6,793

Source: IDOM 2023

Therefore, based on the current capacity, a ratio was made with the number of children and adolescents to whom education services are currently being provided and the number of active schools that this consultancy was able to find, and with this, the projections of the need for expansion were made.

Thus, for 2022, approximately 4,397 children between 0 and 9 years of age are being educated distributed in 7 educational institutions, so there is a capacity of 628 students distributed in two school sessions.

$$Carrying\ capacity\ for\ basic\ and\ elementary\ education = \frac{4{,}397}{7} = 628\ students.$$

Likewise, by 2022, approximately 4,030 children between 10 and 19 years old are currently enrolled in 1 high education institution, so there is a capacity of 4,030 students spread over two school sessions.

$$Carrying\ capacity\ for\ high\ School = \frac{4{,}030}{1} = 4{,}030\ students.$$

Given this calculated current capacity and the defined population projection, the increases of the population groups that have been worked on for each calculation period were determined. It is important to clarify that the trend value of the increase calculated from the selected model is taken. Calculated requirement for preschool and elementary school

Table 94 Increase for people between 0 and 9 years.

	2022	2023	2035	2040	2045
Population projected	**18.319**	**22.687**	**25.417**	**28.174**	**30.877**
Group 0-9 years	4.397	5.445	6.100	6.755	7.410
Increase		655.20	655.20	655.20	655.20

Source: IDOM 2023

Table 95 Increase for people between 10 and 19 years.

	2022	2023	2035	2040	2045
Projected population	**18.319**	**22.687**	**25.417**	**28.174**	**30.877**
Groups 10 19 years	4.030	4.991	5.592	6.192	6.793
Increase		601	601	601	601

Source: IDOM 2023

With these values it was calculated the future needs. Thus, it was projected that for the future carrying capacity it is necessary to build 4 schools for preschool and elementary education and 1 school for secondary education as follows.

Table 96 Future needs for carrying capacity

	2022	2023	2035	2040	2045
Preschool and Elementary school	**-**	**1**	**1**	**1**	**1**
High School					1

Source: IDOM 2023

4.2. Conclusions

As explained above, a matrix has been generated to summarize the variables analyzed, based on a "traffic light" system with 3 categories associated with the estimated deficit:

- **GREEN: ACCEPTABLE DEFICIT** The deficit identified in the variable is less than 15%.
- **YELLOW: WARNING CONDITION** The deficit identified in the variable is between 15% and 35%.
- **RED: CRITICAL DEFICIT** The deficit identified in the variable is more than 35%.

Table 97 Current and Future Carrying Capacity Results for Ambergris Caye: Estimated deficit for each variable.

	2022	2030	2035	2040	2045
Production Capacity of Fresh Water	27%	45%	52%	58%	63%
Wastewater Treatment	83%	87%	88%	89%	90%
Wastewater (Sewage coverage)	75%	81%	84%	86%	87%
Solid Waste Transfer Station Capacity	0%	36%	49%	60%	69%
Recycled Solid Waste	100%	100%	100%	100%	100%
Housing	1%	26%	36%	44%	51%
Preschool and Elementary Education	0%	19%	28%	35%	41%
High schools Education	0%	0%	0%	0%	41%

Source: IDOM, 2023

Based on this categorization, it can be clearly visualized that there are enormous challenges for the coming years in Ambergris related to carrying capacity, which will be essential to generate an investment program that will anticipate and finance the needs showed before.

In relation to the projected carring capacity for the economic and social future of the Caye, it was found that currently, for fresh water there is a deficit of 27%, a deficit of 80% for wastewater treatment and 75% for sewage coverage. Therefore, these three variables become the most important variables that requireda quick action to ensure optimal population growth.

the data incorporated in this initial Carrying Capacity model require revision with more precise data. In some cases, the variables can be updated with data from the 2022 Census, but in other cases they require data from other local or national sources.

4.3. Possible corrective actions

The usefulness of carrying capacity measurement tools is to identify gaps and subsequently actions to address them.

It is essential that these measures are aligned with a consensual development vision, since it is the local stakeholders who must define how much and what type of development they are seeking for their territory. Based on these definitions, the strategy (Action Plan) can be generated, and actions can be defined to address the priority gaps.

The actions can be both investment and management actions. Management actions include planning instruments and territorial management tools.

Table 98 Synthesis of gaps and possible actions identified for each variable.

	Identified Gap	Possible corrective Actions
Production Capacity of Fresh Water	Currently there is a deficit of about 15.88 liters per seg and by 2045 this deficit will be 28.4 liters per second	The current freshwater production capacity needs to be more doubled. Given the urban expansion, it will be necessary to build new plants towards the north of the island.
Wastewater Treatment	The current wastewater treatment deficit is estimated at 32.9 liters per day. By the year 2045 this deficit will be 58.9 liter per second	The current treatment capacity needs to be increased by 8 times. In addition, the system needs to be upgraded to one that ensures that water discharges will not cause environmental impact.
Wastewater (Sewage coverage)	Currently, 80% of the homes in Ambergris do not have sewage coverage (some 4.5 thousand homes); this will increase to an 90% deficit if no new investments are made.	Investments are currently required to connect some 5,000 homes to the wastewater system. By 2045, an additional 11,000 homes will need to be connected.
Solid Waste Transfer Station Capacity	Assuming that today the transfer station has sufficient capacity for the current demand, the identified gap is related to the increase in population and tourists.	The estimate is that the current capacity of the transfer station should triple by 2045, reaching a capacity of about 3,000 tons per day, or approximately 1.1 million tons per year. This number can be significantly reduced if recycling plans are implemented in the Caye.
Recycled Solid Waste	Currently, no solid waste recycling programs have been identified in Ambergris.	The incorporation of recycling programs and systems will reduce the impact on the environment and

	Identified Gap	Possible corrective Actions
		the need to unnecessarily increase the transfer plant.
Housing	Housing is one of the most sensitive issues at present, given the high demand, cost and low supply for workers migrating to Ambergris. However, it is not possible to accurately estimate the current deficit, which can be calculated with detailed census data.	About 300 homes will need to be built each year. In order to achieve this, different types of programs and typologies will have to be implemented, with the active collaboration of the companies related to the tourist activity.
Preschool and Elementary Education	Based on the available data, it is estimated that the current coverage is sufficient. However, this should be corroborated with detailed data from the 2022 Census.	At least 5 new primary schools and a preschool will need to be built.
High schools Education	Based on the available data, it is estimated that the current coverage is sufficient. However, this should be corroborated with detailed data from the 2022 Census.	It is estimated that 1 new secondary school needs to be built.

Source: IDOM, 2023

The corrective actions that can be identified from a carrying capacity analysis can be of different types. Some relate to investments but others to management measures. The following is an overview of the types of measures that could be implemented, many of which will be detailed both in the Action Plan and later in the Zoning proposal.

4.3.1. Investments

The proposed Action Plan details investment measures associated with some of the gaps identified in the carrying capacity analysis. However there some identify variables with more gaps than the other, which are:

- Fresh Water
- Wastewater Treatment
- Solid Waste Management
- Housing
- Education

These variables exhibit greater needs and deficits. Therefore, this consultancy proposes projects and actions aligned with Strategic Line 3 (SL3) - Neighborhood Improvement and Housing Access, Strategic Line 4 (SL4) - Public Space and Urban Facilities, and Strategic Line 5 (SL5) - Public Services. These initiatives, detailed in the following chapters, aim to reduce these gaps and enhance the quality of life for the raizal people.

4.3.2. Territorial Planning

Another category of actions pertains to Urban and Territorial Planning. The anticipated expansion of Ambergris necessitates an instrument for fostering sustainable development while preserving vulnerable natural areas and promoting efficient urban layouts, particularly regarding transportation.

- Amount of land available for tourism development
- Amount of land available for new housing

- Forecast of location of facilities (education, health)
- Forecast location of critical infrastructure (Fresh water, wastewater, and solid waste treatment).

These elements will be developed in the Zoning proposal, which will be worked on in this and the next phase.

4.3.3. Territorial Management

As mentioned above, it is essential for Ambergris to have a rigorous, updated, and mandatory planning instrument.

But it will also be key to incorporate territorial management tools, mainly associated with carrying capacity.

As has been explained, projections of future carrying capacity indicate that most of the variables will present critical levels in the coming years, which will require significant investments and management measures to address them.

In this sense, a fundamental principle that should be incorporated into the island's future comprehensive planning is to move forward with new developments (tourism or housing) only if the carrying capacity indicators allow it. And the way to do this is to develop investments in a planned manner so as not to generate deficit situations.

A possible tool to be used and that will be deepened in the next phase of the consultancy, is to relate urban planning with the carrying capacity. Specifically, the proposal is to generate development phases based on "land parcels to be developed". These parcels will only be activated (i.e., development will be authorized) if the carrying capacity conditions allow it. In other words, it is proposed that urban planning will allow the development of new projects as investment (or management) measures are implemented to ensure carrying capacity.

This phased activation will require specific regulations and a management system. Within this management system, deadlines should be established for updating the model and the phasing of zoning (3 or 5 years minimum).

4.3.4. Tourism Activity Management

A fourth type of tools to manage carrying capacity are those directly related to tourism activity. Since tourism is the main driver of the Caye's economy, there is a direct relationship between the future growth of this activity and the demand for housing, urban land, facilities, and associated infrastructure.

A large part of the current deficits is related to the accelerated and unplanned growth of this activity in recent years.

It is therefore urgent to establish specific management measures that allow for sustainable tourism development in Ambergris. In the analysis of references included in this study, several cases in which this has been addressed have been reviewed. In all these cases, the incorporation of specific regulations and the participation of public and private actors in the decision making and design of measures have been key.

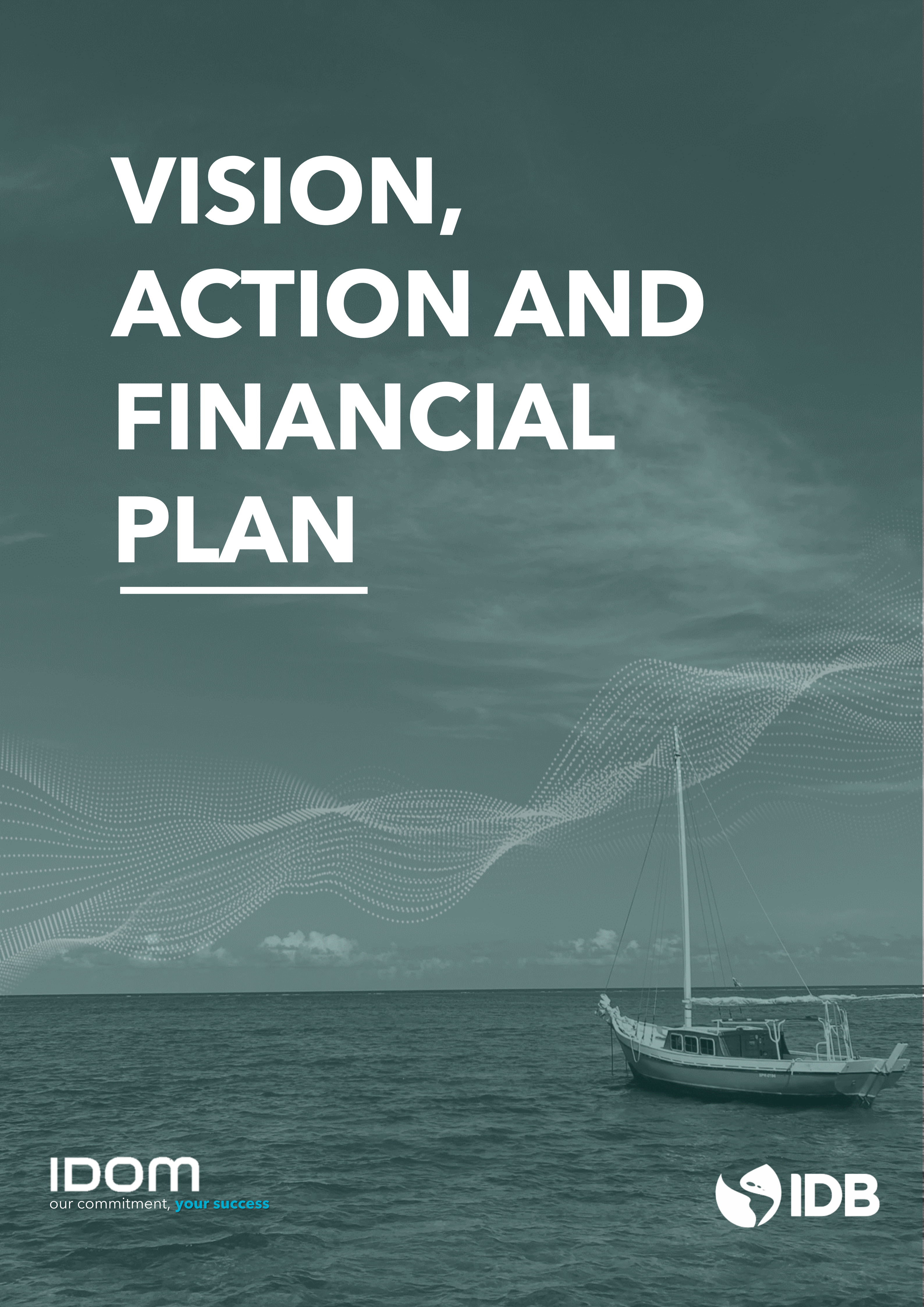
Among the possible measures to be applied, the following can be mentioned:

- Restriction of the number of tourists (establishment of maximum simultaneous number of visitors in the Caye).
- Authorization of new hotels associated with compliance with carrying capacity indicators.

- Requirement that new tourism projects incorporate housing solutions for their workers (construction or rental).

The implementation of such measures will probably require (national) legal modifications, the creation of clear regulations and the strengthening of (planning and supervisory) institutions.

VISION, ACTION AND FINANCIAL PLAN



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5. Vision, action, and financial plan

The construction of a Vision and Action Plan is a key process for the sustainable and integral development of the Ambergris Caye territory. The Vision 2045 takes as a starting point the results found in the previous phases of the Consultancy, as well as the conclusions of the participatory process and the contrast with the findings of the consultancy being developed by the firm Pacifico.

Figure 229 - Vision Structure for Ambergris Caye 2045

Source: IDOM, 2023

To develop the Vision for 2045, the Consultancy integrated different inputs from previous chapters "Multisectoral Diagnosis", "Development Scenarios", including its main conclusions and the current and futures carrying capacity of the island. Additionally, other factors such as the outcomes from the participatory workshops, key findings from the Benchmark, and insights from Pacifico Consultancy on effective communication of future policies and community engagement were considered.

The vision defines the long-term shared image of the territory, providing an idea of the development planned in a sustainable way, respectful of the environment, promoting tourism and the identity of the place; from this input the general objective and the specific objectives are derived, which are related to the project indicators required to fulfill the vision.

One of the tools that provides information between the current capacity and the achievement of the Vision for Ambergris Caye is the calculation of the Future Carrying Capacity, estimated by 2045. In this section, calculations are made and the needs of the Caye are quantitatively defined to fulfill the vision and the Intermediate Scenario.

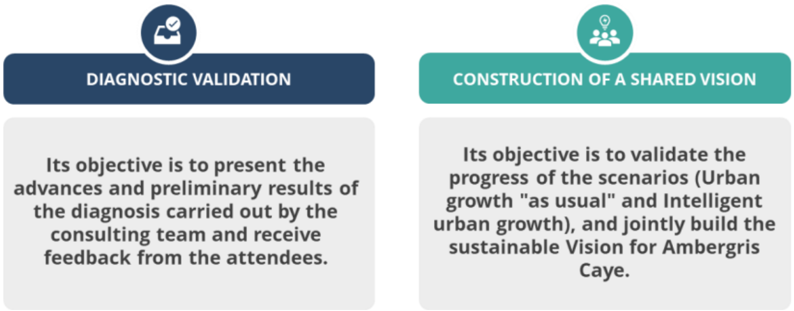
The last two sections contain: The Action Plan and the Financing Plan. In relation to the action plan, "investment sheets" are developed for each of the projects, which provide the necessary information for decision makers to act in the territory: Pre-investment and investment costs, execution time, funding sources, responsible stakeholders, challenges to address, expected results and future benefits. In relation to the financial plan, contains information to develop the mentioned initiatives and their prioritization.

For a better understanding, main results of the **Workshops, the Communication aspects by pacific consultancy and the Investment climate and business environment (ICR Facility)** are mentioned below. Inputs that are products of other consultations and participatory processes in the development of the strategic plan, which yield the following results.

- **Workshop Outcomes**

In line with the participatory process, the opinions of the different stakeholders are integrated, to understand the problems, opportunities, weaknesses, and different opinions to define the Vision and the Action Plan.

Figure 230 - Components of the Workshop



Source: IDOM, 2023

– **Diagnostic Validation**

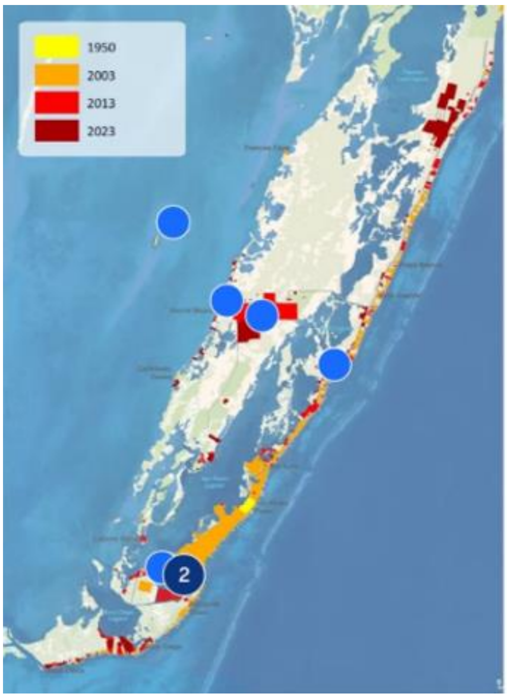
The purpose of the diagnostic workshops was to validate the information analyzed and build the basis for the vision and formulation of a better territory. Among others, the following questions were answered:

- In which part(s) of the Caye do you consider the greatest urban growth is happening?
- What type of development is being generated in the preview sector(s) indicated?
- According to the following options, which sector(s) has (have) a lack of construction quality and urban infrastructure?
- Based on the following options, what are the main urban needs in Ambergris Caye?

The main outcomes:

1. Generally, agree with the analysis and results presented by the Consulting.
2. In relation to which part of the Caye presents greater urban growth: The greatest urban growth has happened in the southern zone where Mahogany Bay is located and in the northern zone, specifically in the Grand Belizean Estates area near Secret Beach.

Figure 231 - Location map of major urban growth, developed by institutional stakeholders



Source IDOM, 2023

3. According to the responses collected, the projected developments in the aforementioned zones are Accommodation, Residential and Commercial uses.

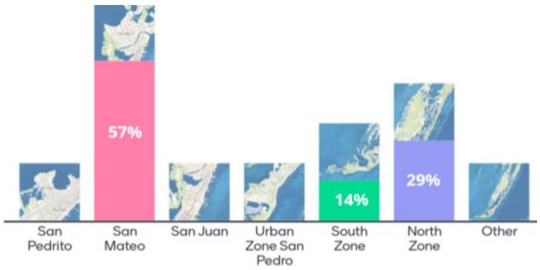
Figure 232 - Type of development generated in the previous sectors, developed by institutional stakeholders

Source IDOM, 2023

4. Sectors lacking quality in construction and urban infrastructure are:

   San Mateo neighborhood and the northern area; With the following data: 57% of the attendees voted that the San Mateo neighborhood is the area with the greatest deficit in construction quality and infrastructure of the entire island, followed by the northern area, which has 29% of responses.

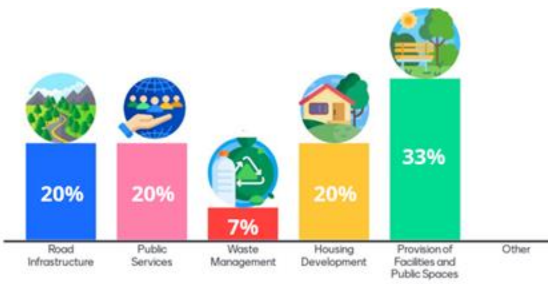
Figure 233 - Which sector has a lack of construction quality and urban infrastructure graph, developed by institutional stakeholders



Source IDOM, 2023

5. In relation with the main urban needs, among the five options, Provision of Facilities and Public Spaces, was the most representative with 33% of responses, followed by Road Infrastructure, Public Services and Housing Development each have 20% of responses.

Figure 234 - Main urban needs in Ambergris Caye graph, developed by institutional stakeholders



Source IDOM, 2023

– **Construction of a Shared Vision**

The main outcomes:

1. On how to see Ambergris Caye in 2045

   - *"Kind of the way India looks (overcrowded, increased social inequality, shanty and dilapidated infrastructure, barren coral reefs)"*
   - *"Very unplanned, impossible to move around in any type of transportation. (If we continue the same path we are heading)."*
   - *"Mass population due to growth in the tourism industry."*

- *"Highly overpopulated."*

2. Some ideas for a better development along the Caye:

- Restrict the growth of the urban footprint on protected areas.
- Take advantage of vacant land and abandoned hotel developments.
- Decentralize the urban facilities, generating new schools and health centers in areas outside the Center of San Pedro.
- Restrict the development of industrial and logistic areas.
- Limit the number of floors in new housing and accommodation developments up to 4 stories.
- Change the development paradigm on the coastline.
- Importance of the urban image and public space enchantment for tourism purposes.
- Establish effective controls on new real estate developments.
- Participation of local actors in the management of Protected Areas such as Bacalar Chico.

3. Some ideas for a better development on San Pedro and the foundational center:

- Restrict the location of new piers in the Center and reorganize the existing ones.
- San Mateo was identified as a priority urban sector to carry out improvement actions.
- Restrict the number of golf cars and establish public parking areas.
- Implement a public transportation system.
- Improve pedestrian traffic in the center.
- Take advantage of the current Airport land to develop an urban project with public space and mixed uses.
- Involve the community and enhance local values in sustainable tourism development.

Photo 31 - Island Scale Share Vision Map, developed by institutional stakeholders.

Source Institutional Actors & IDOM, 2023

About the diagnostic workshop: 1.The greatest urban growth is on the south and north of the Caye; 2.Accommodations is what has developed the most; 3.San Mateo is the neighborhood with the highest deficit in urban infrastructure and construction quality; 4.In general, the most relevant urban need are: Facilities and Public Space

Abput the shared vision were: 1.In general, there is a perception of a disorderly and uncontrolled development, which could exceed the installed capacity; 2.The ideas provided

to achieve a better development are focused on controlling urban development for residents and the tourism industry, as well as providing supporting infrastructure to ensure quality of life in the growth process.

- **Communication aspects by Pacifico Consultancy**

Pacifico and the IDB developed a consultancy in Ambergris Caye to promote communication aspects on social, urban, environmental, and natural risk issues. This consultancy was aligned with the development of the project "Support to the Sustainable Development of Ambergris Caye - Belize". The following were the most relevant results included in this consultancy:

The following are the four most relevant pillars of Pacifico's consulting work in Ambergris Caye.

Figure 235 - Pillars of Pacifico Consultancy for Ambergris Caye

Cultural identity

- Fastest growing community in Belize.
- Strong feeling of unity.
- Identity based on cultural diversity.

Future Opportunities

- Creation of future job opportunities for new generations.

Infrastructure

- Demand of improved infrastructure and services for the growing population.
- Infrastructure for the sustainable future of Ambergris Caye.

Climate and resilience

- Ambergris Caye as vulnerable place to climate change.
- Planning must consider resilient infrastructure.

Source: Pacifico.la

The vision developed with different stakeholders.

Figure 236 - Shared Vision Pacifico

SHARED VISION PACIFICO

Ambergris is growing. We must **support that growth** with a **well-thought-out plan** to create **opportunities for everyone, build the necessary infrastructure**, and **ensure a sustainable future** for our island.

Source: Pacifico.la

The most relevant messages that were identified with the different stakeholders:

- *Survey: strategic questions to understand perceptions and online distribution*
- *Demographic Sample Representativeness*
- (For business-oriented groups) *"The sustainable development plan for Ambergris will help consolidate tourism growth and drive opportunities for our local businesses, tackling challenges like energy, services, and mobility.*
- (For environmentalists) *"The sustainable development plan for Ambergris will foster sustainable tourism practices, support nature-based solutions and create necessary climate-resilient infrastructure."*

- (For families) *"The sustainable development plan for Ambergris addresses the immediate challenges we are facing today and prioritizes the infrastructure we need for tomorrow, including schools, hospitals, roads, as well as water and waste management."*
- (For People with less education) *"The sustainable development plan for Ambergris will help create new jobs. More schools and hospitals will improve access to health and education. And by supporting the development of a strong tourism sector, it will help create better jobs and improve transportation."*

Likewise, an analysis was made of the target population on which Pacifico's consulting firm places most emphasis. This to understand what they are betting on for the future and specifically to which populations they want to provide solutions. The following list frames the groups or stakeholders that can be perceived as the most relevant of the study developed by Pacifico.

- Business groups
- Environmentalists
- Families
- Younger generations
- Religious communities
- Tourists
- Hierarchizes

The results of Pacifico consulting firm are key inputs for this consultancy on cultural identity, future opportunities, infrastructure and climate and resilience; these results ratify and/or complement the main conclusions or findings of this consultancy and are integrated into this project.

The main inputs are related to the identification of stakeholders, the main messages of the community, their needs and their vision of the territory.

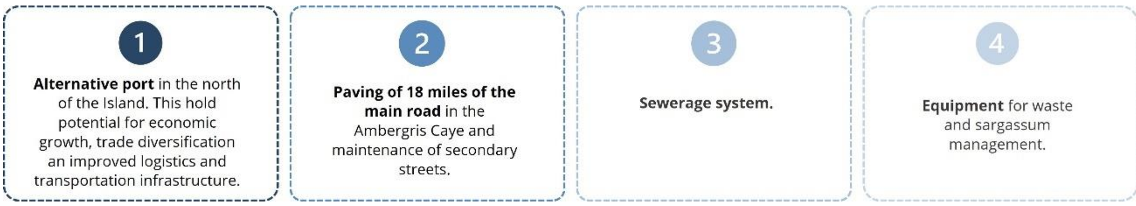
- **Investment climate and business environment (ICR facility)**

The ICR Facility seeks to provide technical assistance to the Ministry of Finance (MoF) of Belize to promote the sustainable development of the tourism sector on the island by identifying factors impacting the region's businesses development.

The Assessment of the investment climate and business environment for the tourism industry in Ambergris Caye, Belize focuses on creating better conditions for businesses to thrive and for women's economic empowerment and inclusion.

Main result which gathers information to shape a joint vision for the region's development. Related to tourism, it identifies the need to develop an alternative port, increase the length of paved roads, sewerage system and equipment.

Figure 237 - Needs for correct development for tourism.



Source: IDOM, 2023

Figure 238 - Prioritization of infrastructure

Water and Sanitation	The island needs access to clean and safe water. The areas that need to be strengthened are water conservation, **wastewater treatment, and improved sanitation facilities.**
Transportation	The business sector acknowledges the importance of investing in reliable and sustainable **transportation** infrastructure provides economic growth (roads, railways, and an additional port).
Energy	Access to reliable and affordable energy is essential for businesses to thrive. The business sector recognizes the importance of **investing in clean and renewable energy sources**, as well as improving energy efficiency
Community Hospital	**To meet the demand for primary and emergency care for both locals and tourists.** Ambergris Caye currently only has one high-cost private clinic.
Waste Management	A clean and healthy environment through management practices such as **recycling, waste reduction, and proper disposal methods**, helps reduce pollution, conserve resources, and promote a sustainable and circular economy.
Sargassum Mitigation	**This invasive species has increased significantly in recent years, leading to a variety of issues**. Esthetic appeal, foul odors due to algae's decomposition, disruption of waste management efforts, barriers that hinder the natural flow of water and trap marine debris.

Source: IDOM, 2023

The investment climate and business environment assessment for the tourism industry in Ambergris Caye identifies, through data collected in workshops, fieldwork and research, that the island has a need for key infrastructure that should be prioritized by the public and private sectors.

In these terms, to create the suitable conditions for attracting investments, the development of an alternative cargo port is identified, as well as the increase in miles of paved roads, the construction of a sanitation system, the development of new urban facilities, investments in energy efficiency and strategies for sargassum mitigation.

5.1. Vision 2045 and Action Plan Structure

The 2045 vision responds to the inputs received and the constraints provided by the future carrying capacity and the population and tourism projection of the Caye. These are structured through a general objective and specific SMART objectives, which respond to the strategic lines of a sustainable territory.

The following figure shows the relationship between each of the elements and the proposed action plan, which contains plans and projects necessary to achieve the development of the Caye and its future carrying capacity.

Figure 239 – Vision and action plan Structure for Ambergris Caye 2045

Source: IDOM, 2023

At the end of this chapter there is a description of each plan and project and its relationship with the Strategic Line. These are organized by tables, which define if it is Pre-investment or Investment; and contains: Execution time, Funding sources, suggestion of responsible stakeholders, Challenges to be addressed, Expected result (Proposal Concept) and benefits.

Finally, a prioritization of projects is strategically defined, according to the contribution to the quality of life, the regulatory and governance framework, economic level and opportunity, level of importance, and time of execution.

5.2. Vision 2045

Vision can be defined as the projected image of a territory in the long term, based on how it is expected to develop in the future. It is an ideal expectation that will serve as a guide for an integrated planning, from which common and transversal objectives will be defined, directed towards the sustainable development of the territory and the well-being of the population. In summary, the Vision should answer the following question:

What is the future image we seek for Ambergris Caye?

The defined horizon for the construction of the vision is the year 2045, considering that the growth scenarios and the carrying capacity have been projected for a 20-year term. Considering the above, the following vision is formulated for Ambergris Caye:

By 2045, Ambergris Caye will be a sustainable territory, by building resilient-natural sensitive infrastructure, and the generation of economic opportunities, promoting cultural identity in a productive, inclusive, and equitable environment

In this way, the Vision 2045 conceives a future image for Ambergris Caye, in which sustainability, resilience and economic opportunities are the basic pillars for the construction of a territory with its own identity and a better quality of life for its population.

5.2.1. General Objective

In order to achieve the projected Vision 2045, it is necessary to establish a series of guidelines that demarcate a path to follow for the next 20 years. In this sense, the General Objective will serve as a roadmap for the territorial development of Ambergris Caye:

To implement strategies in Ambergris Caye that promote an integrated territorial development, based on harmonious relations with the natural heritage, the improvement of education, the qualification of urban spaces, the adaptation to climate risks, and the strengthening of the tourism sector; that reduce current inequality gaps, generating an attractive, resilient, sustainable territory with a high quality of life.

5.3. Action Plan

The Action Plan is the organized set of specific steps intended to outline a realistic path or strategy for the achievement of the Vision 2045 for Ambergris Caye. In this way, it provides clear and detailed guidelines on how the necessary activities will be implemented to accomplish a sustainable and comprehensive territorial development for the island, in accordance with the principles established in the formulated General Objective.

The Action Plan for Ambergris Caye is organized through the following components:

Thematic Axes (TA)

Thematic Axes are the structuring cores that gather related contents. They cover the key issues developed during the consultancy (urban growth, environment, resilience, economic development) and are directly linked to Vision 2045. The following are the Thematic Axes that constitute the Action Plan:

TA1: Sustainable and integrated urban development.
TA2: Natural heritage and environmental conservation.
TA3: Competitive and sustainable economy.

Strategic Lines (SL)

Strategic Lines are the conceptual dimensions that address in detail the components of the Thematic Axes. They help to organize the specific objectives by concrete themes, establishing clear action routes for the development of programs and projects. The Strategic Lines proposed by Thematic Axis are the following:

Table 99 – Strategic Lines (SL) in the Action Plan

THEMATIC AXE	STRATEGIC LINES	
TA1: Sustainable and integrated Urban Development	SL1	Sustainable territory
	SL2	Sustainable mobility
	SL3	Neighborhood improvement and housing access
	SL4	Public space and urban facilities
	SL5	Public services
TA2: Natural heritage and environmental conservation	SL6	Protection and restauration of high value ecosystems and adaptation to climate change

TA3: Competitive and sustainable economy	SL7	Inclusive, competitive, and sustainable tourism
	SL8	Local economy and opportunities

Source: IDOM, 2023

Specific Objectives (SO)

Specific Objectives represent the expected goals to be achieved for each Strategic Line. These are directly related to the General Objective and represent the ways to reach the projected purposes in the Vision 2045. In the Ambergris Caye Action Plan, the specific objectives are described as follows:

Table 100 – Specific Objects (SO) in the Action Plan

THEMATIC AXE (TA)	STRATEGIC LINE (SL)		SPECIFIC OBJECTIVE (SO)	
TA1 Sustainable and integrated Urban Development	SL1	Sustainable territory	SO1	To develop a compact and efficient territory, controlling urban growth.
	SL2	Sustainable mobility	SO2	To optimize connectivity and diversify modes of transportation on the island.
	SL3	Neighborhood improvement and housing access	SO3	To qualify housing conditions, improving deficient sectors, and implementing housing projects.
	SL4	Public space and urban facilities	SO4	To expand the coverage of public spaces and qualified urban facilities on the island.
	SL5	Public services	SO5	To extend and optimize the coverage of public services.
TA2 Natural heritage and environmental conservation	SL6	Protection and restauration of high value ecosystems and adaptation to climate change	SO6	To develop local capacity for the protection and restoration of ecosystems of high heritage and ecological value in the Caye.
			SO7	To promote initiatives to adapt to the risks derived from climate hazards.
TA3 Competitive and sustainable economy	SL7	Inclusive and sustainable tourism	SO8	To strengthen and diversify tourism activities, including attractions for high-end tourists.
	SL8	Local economy and opportunities	SO9	To strengthen the local economy associated with tourism and its value chain through sustainable processes.

Source: IDOM, 2023

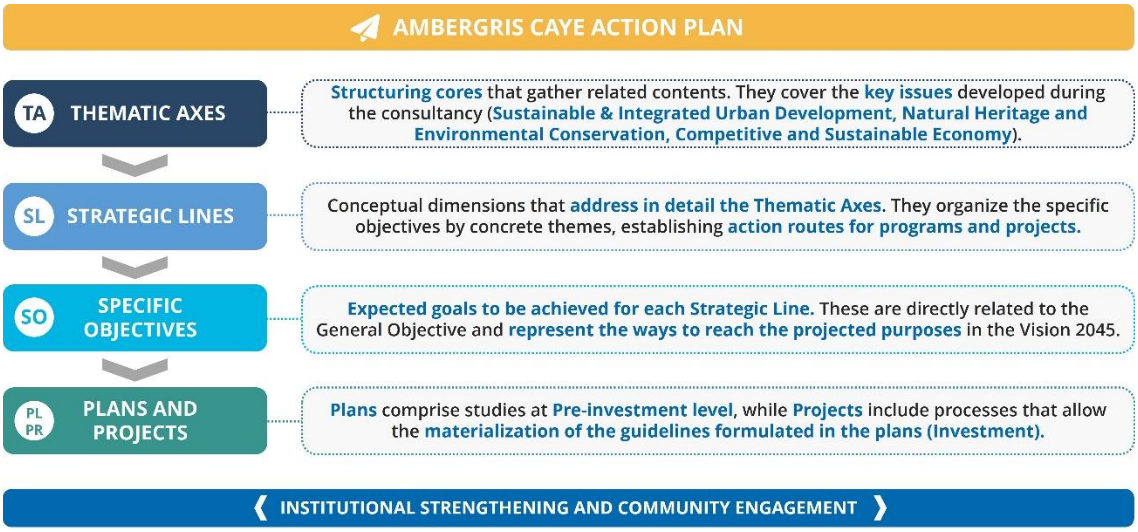
Plans and Projects

Plans and Projects represent the concrete actions to be developed in a specific time frame to meet the defined objectives. Plans comprise the preparation of studies, outlines, and consultancies at the Pre-investment level, with the purpose of establishing a technical, strategic, and financial framework for the planning of specific tasks. Projects, on the other hand, comprise the set of processes that allow the materialization of the guidelines formulated in the plans, including activities such as infrastructure works, environmental restoration and economic strengthening and social investment processes.

Institutional Strengthening and Community Engagement

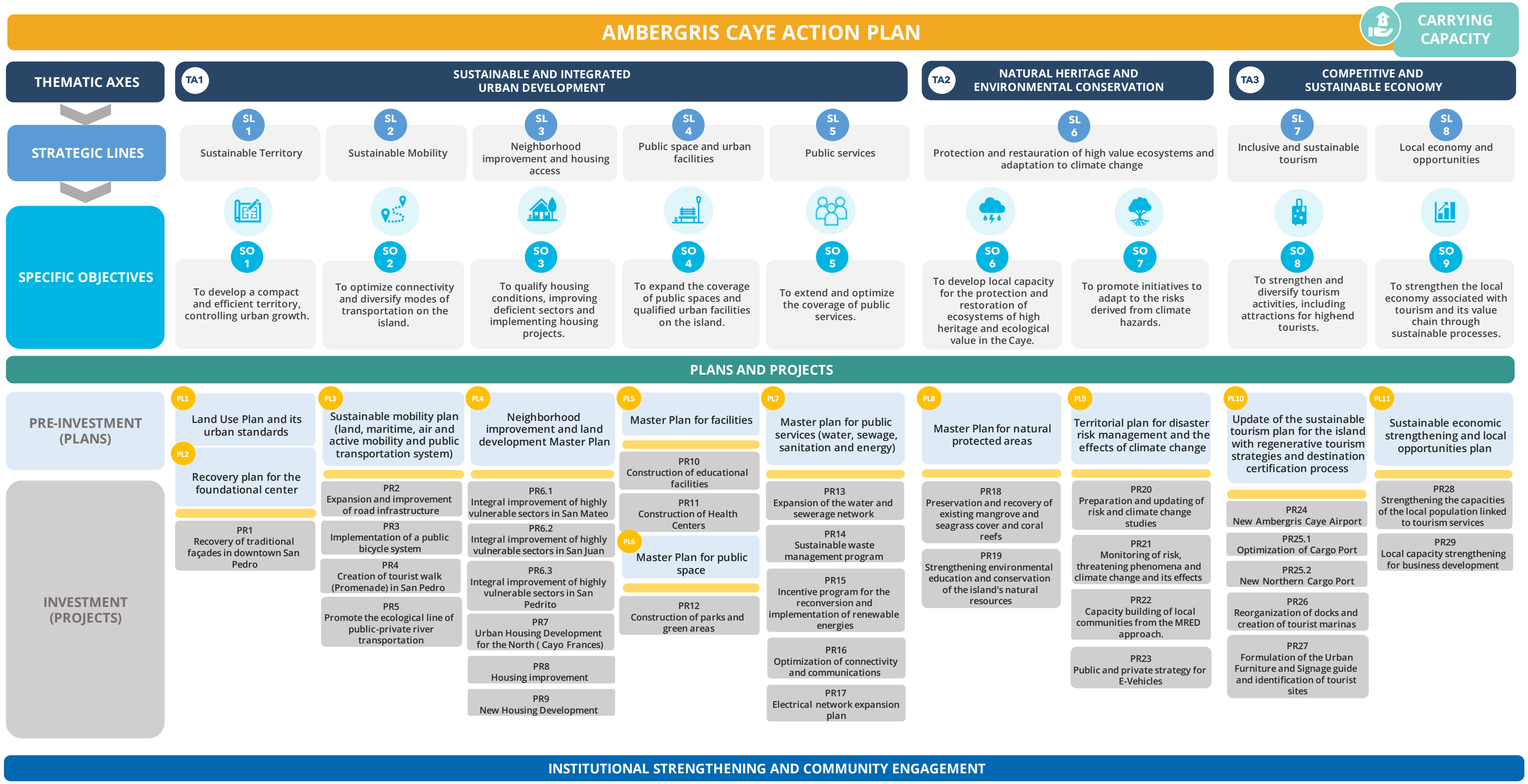
As a transversal component of the Action Plan, a process of Institutional Strengthening and Community Engagement is proposed, for which the Consultancy formulates recommendations for an integrated and participative management for the Plans and Projects.

Figure 240 – Ambergris Caye - Action Plan summary



Source: IDOM, 2023

Figure 241 – Ambergris Caye Action Plan



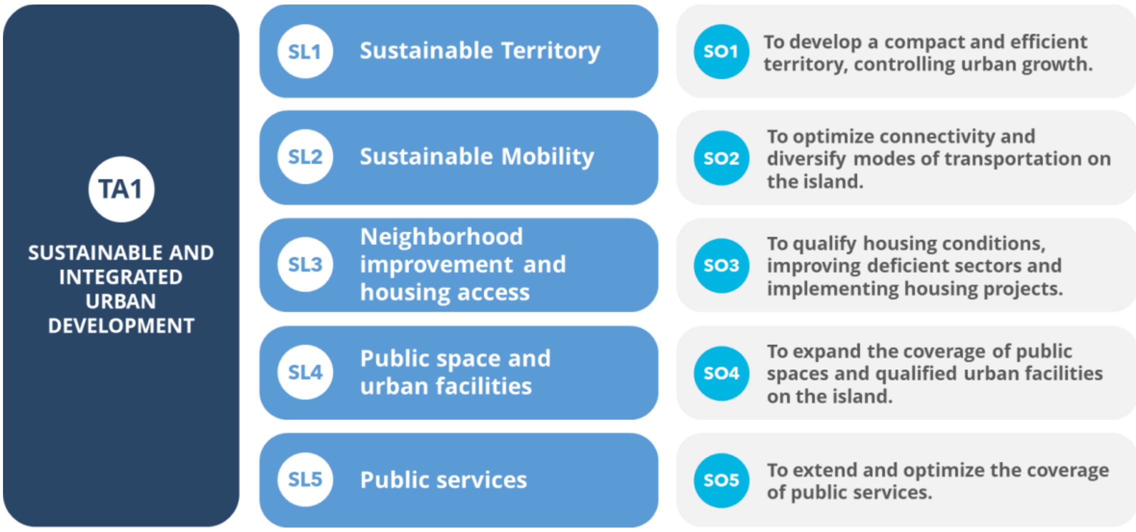
Source: IDOM, 2023

Each of the Thematic Axes and their respective components are described in detail below:

5.3.1. TA1: Sustainable and integrated urban development

The purpose of this Axis is to provide solutions to the problems that have resulted from the expansive, segregated, and unsustainable development of the territory of Ambergris Caye. To this end, the Strategic Lines are oriented to comprehensively address the most critical areas analyzed in the Consultancy's diagnosis, through strategies that contribute to improving the quality of life of the population.

Figure 242 – Components of Thematic Axe 1 (TA1)



Source: IDOM, 2023

5.3.1.1. Strategic Line 1 (SL1): Sustainable Territory

The accelerated urban growth, the absence of current regulatory instruments and the low use of vacant land are some of the most critical elements identified in the territorial development of Ambergris Caye. According to the analysis presented in the Sectorial Diagnosis, the Island has an annual urban footprint growth rate of 3.10%, which is higher than the recommended rate according to the ICES methodology. Additionally, 38.3% of the footprint is constituted by vacant land, while non-consolidated peri-urban land represents 236.1% of the footprint surface. All the above, in the context of a territory that does not have updated and current planning instruments, makes urban management limited and insufficient.

Specific Objective - SO1: To develop a compact and efficient territory, controlling urban growth.

This Objective seeks to redirect urban development in Ambergris Caye from an expansive and unbalanced growth to a more efficient and compact model, through the application of a regulatory instrument and urban development standards in accordance with the reality and needs of the Island, facilitating a balanced and sustainable territorial development. In this sense, the following programs and projects are proposed.

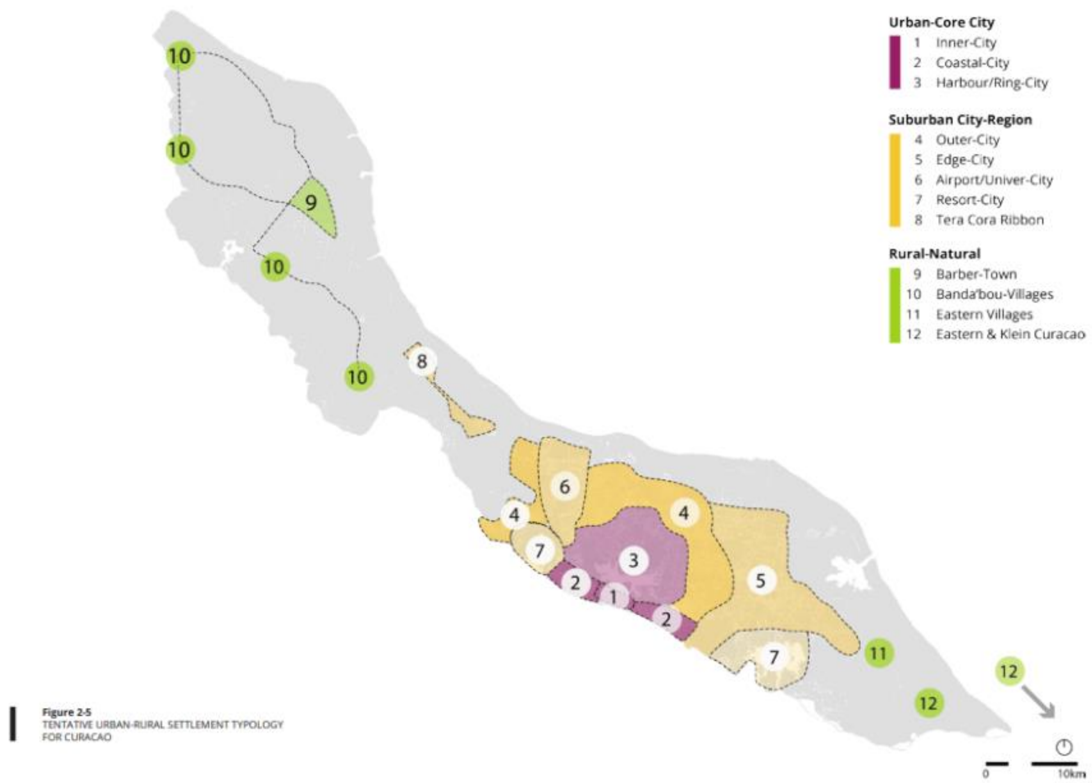
Table 101 – Plans and Projects in the Strategic Line 1 (SL1)

STRATEGIC LINE 1 (SL1): Sustainable Territory		Estimated Costs (USD)	
		Pre-investment	Investment
PL1	Land Use Plan and its urban standards	$150,000	N/A
PL2	Recovery Plan for the foundational center	$200,000	N/A
PR1	Recovery of traditional facades in San Pedro Center	N/A	$130,000

Source: IDOM, 2023

Based on the strategic line in mention, the organization of Willemstad, Curacao serves as a notable reference. A model is being implemented here to manage urban growth in targeted areas focusing on tourism, cultural infrastructure, healthcare, housing, and hotel facilities. This directly aligns with the objective of cultivating a compact and efficient territory while regulating urban expansion. Moreover, initiative include the formulation of a Land Use Plan along with urban regulations, a Recovery Plan for the historic center, and the restoration of traditional facades in San Pedro Center. There endeavors collectively contribute to establishing a consolidated and sustainable territory, as illustrated in the figure bellow.

Figure 243 – Reference compact and efficient territory, controlling urban growth City of Willemstad, Curacao



Source: Investinwellemstad.com

5.3.1.2. Strategic Line 2 (SL2): Sustainable Mobility

Ambergris Caye has significant sustainable mobility issues: The high dependence on private motorized vehicles (mainly golf carts) and the lack of infrastructure for active mobility modes (pedestrian and bicycle) pose a considerable challenge that needs to be addressed as a priority. In addition, the precarious state of the traffic network (only 8% of roads are paved) and the limited conditions of the John Greif II Airport and the current Cargo Port represent obstacles to improving the island's economic and tourism competitiveness.

Specific Objective – SO2: To optimize connectivity and diversify modes of transportation on the Island.

Through this Objective, the Action Plan proposes to comprehensively restructure the mobility system in Ambergris Caye, in order to improve accessibility and connectivity both inside the island and at the regional and national level. This will be based on the development of a general plan, which will organize a multimodal system with priority to active mobility modes and low environmental impact, generating guidelines for the implementation of infrastructure projects listed in the following table.

Table 102 – Plans and Projects in the Strategic Line 2 (SL2)

STRATEGIC LINE 2 (SL2): Sustainable Mobility		Estimated Costs (USD)	
		Pre-investment	Investment
PL3	Sustainable Mobility Plan (land, maritime, air and active mobility and public transportation system)	$250,000	N/A
PR2	Expansion and improvement of road infrastructure	$440,000	$43,940,000
PR3	Implementation of a public bicycle system, including bike lines.	$60,000	$5,150,000
PR4	Creation of tourist walk (Promenade) in San Pedro	N/A	$1,900,000

PR5	Promote the ecological line of public-private water transportation	$26,000	$2,600,000

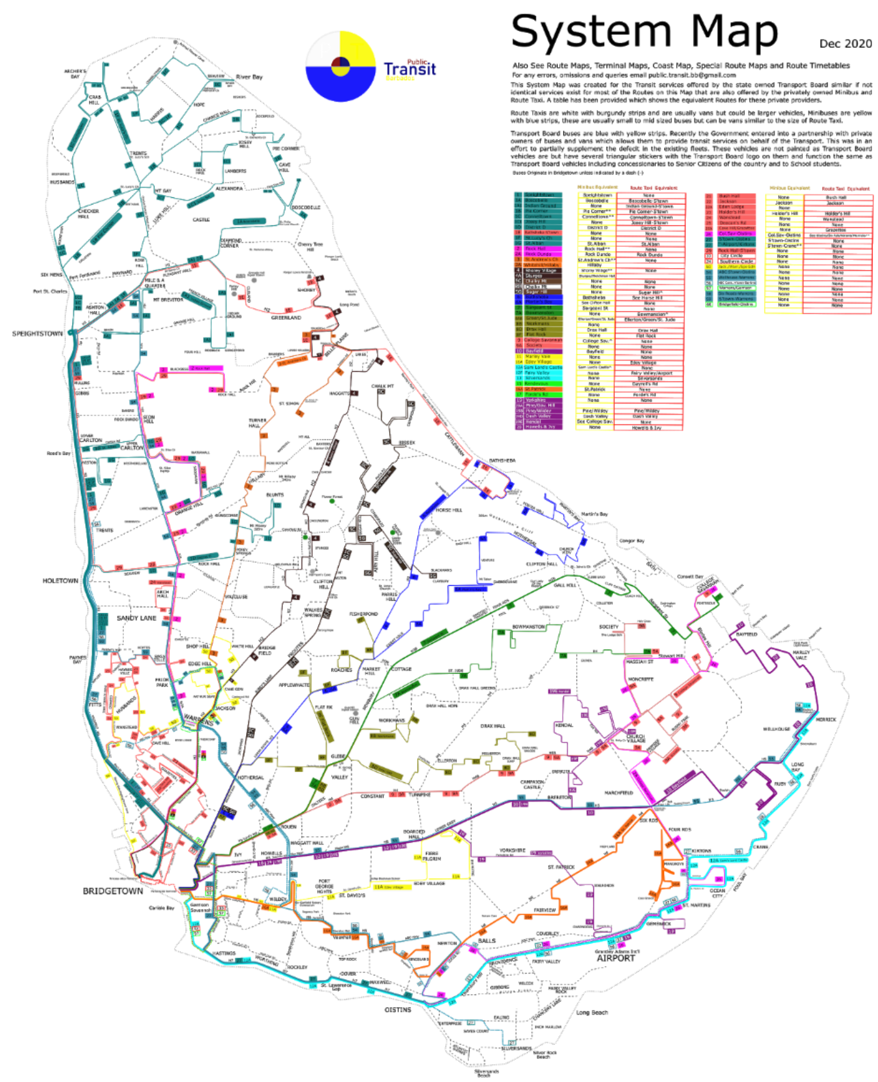
Source: IDOM, 2023

Drawing from the mentioned strategic line, Barbados is embarking on a project to establish an integrated mobility plan connecting the entire island. This initiative involves developing a network of roads linking the Grantley Adams International Airport with all parts of the country, including its main ports.

Specifically, in Bridgetown, a sustainable mobility plan is underway, incorporating initiatives such as electric public transportation corridors, promoting bicycle usage, and prioritizing pedestrian access. These efforts contribute to improving roads, sidewalks, and major mobility corridors comprehensively, aligning directly with the goal of enhancing connectivity and diversifying transportation modes on the island.

Similar plans and projects are also being considered for Ambergris Caye, as depicted in the figures below.

Figure 244 – Reference optimize connectivity and diversify modes of transportation Bridgetown, Barbados



Source: Superrask.xyz

5.3.1.3. Strategic Line 3 (SL3): Neighborhood improvement and housing access

According to the multisectoral diagnostic, 25.5% of houses in Ambergris Caye do not meet the minimum standards of habitability and 11.7% of the island's population lives in low-quality or non-permanent buildings (slums). These precarious constructions are mostly located in the sector of San Mateo and to a minor extent in San Juan and San Pedrito areas, where a low quality of the urban environment is also identified (unpaved roads, absence of public services infrastructure and lack of public spaces and qualified green areas).

Specific Objective – SO3: To qualify housing conditions, improving deficient sectors, and implementing housing projects.

This objective focuses on integrally improving urban and habitability conditions in the most priority sectors of Ambergris Caye, where investments in housing and infrastructure are required to ensure a better quality of life for the population through a compact footprint. To achieve this, a Master Plan for Neighborhood Improvement is proposed, which will generate guidelines for the development of specific infrastructure works. In addition, it is important to implement social or affordable housing development programs, facilitating access to low-income households.

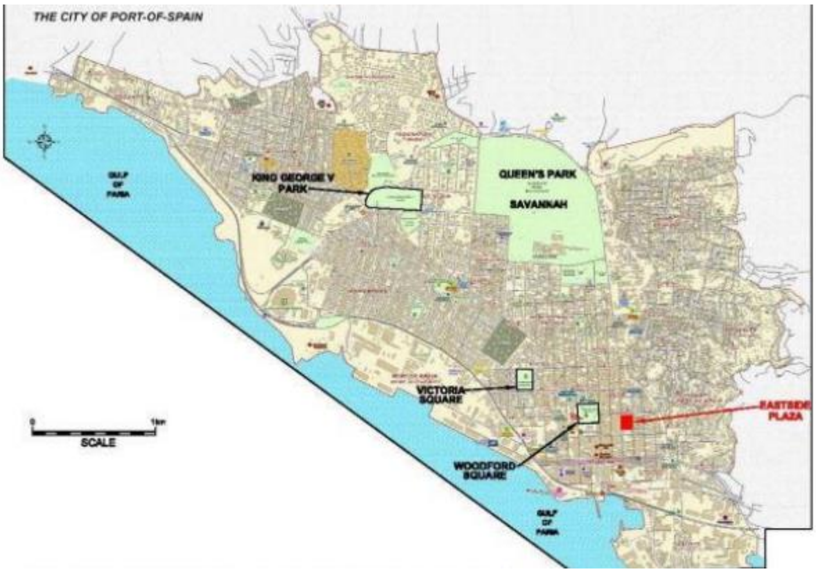
Table 103 – Plans and Projects in the Strategic Line 3 (SL3)

STRATEGIC LINE 3 (SL3): Neighborhood improvement and housing access		Estimated Costs (USD)	
		Pre-investment	Investment
PL4	Neighborhood Improvement and land development Master Plan	$150,000	N/A
PR6.1	Integral improvement of highly vulnerable sectors in San Mateo	N/A	$7,150,000
PR6.2	Integral improvement of highly vulnerable sectors in San Juan	$125,000	$4,500,00
PR6.3	Integral improvement of highly vulnerable sectors in San Pedrito	$125,000	$6,900,000
PR7	Urban Housing Development for the North (Cayo Frances)	$150,000	$9,800,000
PR8	Housing improvement	$70,000	$5,700,000
PR9	New Housing Development	$3,000,000	$152,700,000

Source: IDOM, 2023

In line with the strategic direction mentioned, the city of Port of Spain, Trinidad and Tobago, has implemented a comprehensive neighborhood improvement plan. This initiative aims to enhance both existing housing and the development of new housing, with the overarching goal of elevating the quality of life for the city's residents. This effort directly aligns with the objective of improving housing conditions, revitalizing underserved areas, and executing housing projects. It seeks to devise new strategic plans to enrich the quality of life for residents, as illustrated in the figure below.

Figure 245 – Reference qualify housing conditions, improving deficient sectors, and implementing housing Port Spain , Trinidad y Tobago



Source: ewsdata.rightsindevelopment.org

5.3.1.4. Strategic Line 4 (SL4): Public space and urban facilities

One of the most critical indicators identified in Ambergris Caye is access to qualified public spaces (parks and plazas) for the use and enjoyment of the population. According to the Consultancy's diagnosis, the ratio of public spaces per inhabitant on the island is only 8.6 square feet per inhabitant (0.8 square meters), while only 12.4% of the population is located within a 10-minute walking distance of a qualified green area. On the other hand, although the coverage of urban facilities is currently acceptable (84% of the population is located within walking distance of them), the population and prospective projections of the Optimal Scenario suggest the need to generate new facilities that guarantee the population adequate access to health and education services in the future.

Specific Objective – SO4: To expand the coverage of public spaces and qualified urban facilities on the island.

To improve the conditions described in this Strategic Line, the Action Plan proposes the formulation of a Master Plan for public space and facilities, which will establish guidelines for the generation of new parks and green areas, as well as areas of opportunity for the construction of facilities, which will be part of the investment projects.

Table 104 – Plans and Projects in the Strategic Line 4 (SL4)

STRATEGIC LINE 4 (SL4): Public space and urban facilities		Estimated Costs (USD)	
		Pre-investment	Investment
PL5	Master plan for facilities	$110,000	N/A
PR10	Construction of educational facilities	N/A	$4,440,000
PR11	Construction of Health Centers	$100,000	$18,600,00
PL6	Master plan for public space	$90,000	N/A
PR12	Construction of parks and green areas	N/A	$13,802,000

Source: IDOM, 2023

Based on the strategic direction outlined, the city of Montego Bay, Jamaica, has initiated the development of the Waterfront Park. This endeavor aims to comprehensively enhance neighborhoods, upgrade infrastructure and building conditions, and provide new housing opportunities for the local populace. Additionally, it seeks to establish a tourist attraction and stimulate the local economy by facilitating the development of new housing and the enhancement of existing structures. These endeavors directly align with the objective of expanding public spaces and improving urban amenities. Achieving this necessitates regulatory adjustments to formulate new master plans, revitalize neighborhoods comprehensively, and initiate accessible housing projects for the community, as depicted in the accompanying figure.

Figure 246 – Reference qualify expand the coverage of public spaces and qualified urban facilities Montego Bay, Jamaica

Source: blogs,iadb.org

5.3.1.5. Strategic Line 5 (SL5): Public services

One of the most important challenges in terms of urban development is to improve the population's access to basic public services. According to the multisectoral diagnosis, approximately 17% of the inhabitants of Ambergris Caye have no basic potable water service, while 71% do not have access to the sanitation network. In addition, the Island has deficiencies in solid waste management, as there are currently no efficient recycling and reutilization processes. Finally, Ambergris Caye is highly dependent on Belize's mainland for energy, which makes it necessary to develop processes aimed at self-sufficient and sustainable electricity production for internal consumption.

Specific Objective – SO5: To extend and optimize the coverage of public services.

Considering the aforementioned factors, the specific objective of the Action Plan aims to enhance access to public services in Ambergris Caye, addressing the fundamental needs of most of the population regarding water, sanitation, and electricity. To achieve this goal, it is imperative to develop a Master Plan for Public Services outlining guidelines for expanding the freshwater, sewage, storm sewer, and energy networks.

Additionally, future infrastructure development must be planned to ensure the network functions effectively, in accordance with the Island's carrying capacity requirements. The plan also advocates for the adoption of alternative energy generation methods to reduce reliance on the mainland of Belize and capitalize on sustainable energy resources. Finally, the Action Plan recommends optimizing the communication network to enhance coverage and accessibility to cellular telephony and the internet, thereby bolstering the technological competitiveness of the Caye.

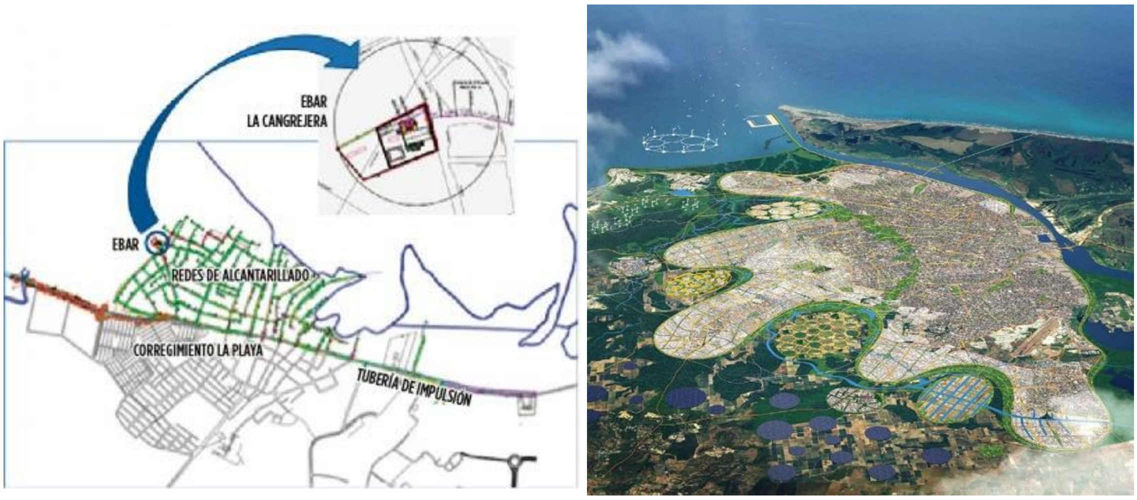
Table 105 – Plans and Projects in the Strategic Line 5 (SL5

STRATEGIC LINE 5 (SL5): Public services		Estimated Costs (USD)	
		Pre-investment	Investment
PL7	Master plan for public services (water, sewage, sanitation, and energy)	$1,500,000	N/A
PR13	Expansion of the water and sewerage network	N/A	$33,450,000
PR14	Sustainable waste management program	$203,000	$8,934,500
PR15	Incentive program for the reconversion and implementation of renewable energies	N/A	$1,250,00
PR16	Optimization of connectivity and communications	N/A	$1,680,00
PR17	Electrical network expansion plan	$700,000	36,565,500

Source: IDOM, 2023

Based on the strategic direction mentioned, the city of Barranquilla, Colombia, is undertaking efforts to expand the sewerage network and improve wastewater management, along with enhancing the supply of drinking water to the La Cangrejera neighborhood. This initiative aims to address the current lack of an adequate sanitation system in this area, directly contributing to the goal of expanding and enhancing public service coverage to ensure basic amenities for the population. Moreover, this project aligns with Barranquilla's 2050 development plan, which emphasizes the implementation of renewable and clean energy sources, as well as the establishment of an efficient communication network befitting a city of its scale, as illustrated in the figure below.

Figure 247 – Reference extend and optimize the coverage of public services Barranquilla, Colombia

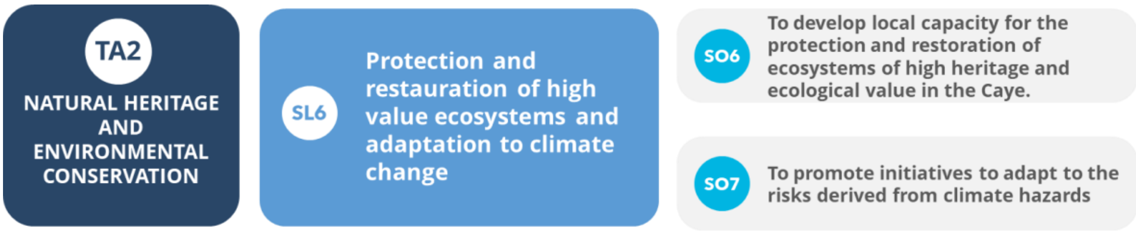


Source: https:www.elheraldo.co/

5.3.2. TA2: Natural heritage and environmental conservation

The purpose of this Axis is to provide solutions to the problems that have been identified thorough the diagnosis for vulnerability to natural hazards and GHG inventory for Ambergris Caye. To this end, the Strategic Lines are oriented to comprehensively address the most critical areas analyzed in the Consultancy's diagnosis, through strategies that contribute to improving the quality of life of the population.

Figure 248 - Components of Thematic Axe 2 (TA2)



Source: IDOM, 2023

5.3.2.1. Strategic Line 6 (SL6): Protection and Restauration of high value ecosystems and adaptation to climate change

Based on the results obtained in the diagnosis, it was identified that due to the accelerated population growth and without the proper planning, the natural endogenous ecosystems of the Caye have been widely affected. For this reason, a strategic line is proposed to promote plans and actions oriented to protect and restore the high natural value and cultural importance as heritage ecosystems in the island.

Climate change is a global phenomenon that cannot be denied. Likewise, the Caye is in the intertropical confluence zone where tropical storms and hurricanes typically occur. This leads to large volumes of rainfall. Thus, both the recurrence and intensity of these phenomena have been affected by climate change and it is crucial that the Caye initiates its adaptation and resilience processes in the face of these changes. This is why this strategic line proposes to promote initiatives that help to formalize adaptation and knowledge actions in the presence of the natural risks presented.

Specific Objective – SO6: To develop local capacity for the protection and restoration of ecosystems of high heritage and ecological value in the Caye.

Specific Objective – SO7: To promote initiatives to adapt to the risks derived from climate hazards.

Ambergris Caye has a vision of growth to 2045 that involves the increase of tourism on the island. This will lead to higher stress on the ecosystem given the large number of people that will be coexisting with the mangroves and the natural reef. Therefore, this objective promotes actions to protect and restore the ecosystems using planning and governance instruments that will define protected areas, natural corridors, and training programs.

This objective is aligned with the initiatives proposed from the strategic line regarding the generation of knowledge about the natural risks identified in the Caye through the implementation of a master plan where actions for monitoring, planning and resilience of the Ambergris Caye community can be generated.

Table 106 - Plans and Projects in the Strategic Line 6 (SL6)

STRATEGIC LINE 6 (SL6): Protection and restauration of high value ecosystems and adaptation to climate change		Estimated Costs (USD)	
		Pre-investment	Investment
PL8	Master Plan for natural protected areas	$350,000	N/A
PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	N/A	$8,452,000

PR19	Strengthening environmental education and conservation of the island's natural resources	N/A	$120,000
PL9	Territorial plan for disaster risk management and the effects of climate change	$250,000	N/A
PR20	Preparation and updating of risk and climate change studies.	N/A	$325,000
PR21	Monitoring of risk, threatening phenomena and climate change and its effects.	N/A	$850,000
PR22	Capacity building of local communities from the MRED approach.	N/A	$1,050,000
PR23	Public and private strategy for E-Vehicles	$30,000	$37,980,000

Source: IDOM, 2023

Drawing from this strategic line, the conservation initiatives in Hawaii serve as a noteworthy reference point. These initiatives involve collaboration among various conservation organizations, government agencies, and indigenous communities to actively protect the islands' ecosystems. Efforts include conserving native forests by designating them as protected areas, restoring watersheds, managing invasive species, restoring habitats, promoting sustainable tourism, and fishing practices, implementing measures to reduce urban pollution, and implementing regulations on coastal development. These endeavors aim to preserve the biodiversity and cultural heritage of the islands.

Investment initiatives aimed at climate change adaptation in Caribbean islands include stormwater management infrastructure in Trinidad and Tobago and natural habitat protection in Jamaica. The former involves constructing flood control channels and detention basins to mitigate the risk of urban flooding during heavy rainfall events in Trinidad and Tobago. Meanwhile, Jamaica's natural habitat protection program involves establishing marine protected areas and implementing mangrove restoration projects to bolster coastal resilience and provide natural defenses against the impacts of hurricanes, heavy rainfall, and storms.

Figure 249 – Mangrove restoration in Jamaica

Source: cityadapt.com

5.3.3. TA3: Competitive and sustainable economy

The purpose of this Axis is to provide solutions to the problems that have resulted from the lack of competitiveness and sustainable related assets which are related to the need of making efforts towards promoting inclusive and sustainable tourism and the development of local economy sources and opportunities.

Figure 250 - Components of Thematic Axe 3 (TA3)

Source: IDOM, 2023

5.3.3.1. Strategic Line 7 (SL7): Inclusive, competitive, and sustainable tourism

The purpose of this strategic line is to provide solutions to the problems that have been identified regarding the lack of participation of community members in sustainable tourism products involving historic, cultural, gastronomic, local traditions and natural assets.

Specific Objective – SO8: To strengthen and diversify tourism activities, including attractions for high-end tourists.

Integrating the public and private sectors is a crucial challenge in turning Ambergris Caye into a successful model of Destination Management Organization (DMO). This includes the participation of tourists and those involved in tourism businesses or services, regardless of age, gender, or physical ability, or those who take part of the tourism businesses and / or services with the implementation of competitive and good sustainable tourism practices focused on Sustainable Management, Socioeconomic, Cultural and Environmental Sustainability. The last includes the needs of upgrading Management Plans and the elaboration of low ecotourism Public Use Plans for protected areas located in or its surroundings.

The last also includes the concentration of impacts and aquatic transportation services in a specific one space by the reorganization of docks and creation of tourist marinas and transforming current live hoods regarding urban signature and signage guide, including current charging capacity and ways to develop tourism in protected areas.

Table 107 – Plans and Projects in the Strategic Line 7 (SL7)

STRATEGIC LINE 7 (SL7): Inclusive, competitive and sustainable tourism		Estimated Costs (USD)	
		Pre-investment	Investment
PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$180,000	N/A
PR24	New Ambergris Caye Airport	$5,000,000	$30,000,000
PR25.1	Optimization of Cargo Port	$400,000	$3,200,000
PR25.2	New Northen Cargo Port	$1,500,000	$9,000,000
PR26	Reorganization of docks and creation of tourist marinas.	N/A	$5,300,000
PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	$20,000	$140,000

Source: IDOM, 2023

For instance, a prime example of inclusive and sustainable tourism in the Caribbean is the Ecotourism in Samaná, Dominican Republic. Here, ecotourism initiatives have been established, wherein local guides lead tours that prioritize environmental conservation and offer insights into the region's biodiversity and cultural heritage. These initiatives promote responsible whale-watching tours, hiking expeditions, and island visits. Moreover, they actively engage local communities in coastal monitoring, sustainable fishing practices, and providing environmental education for tourists.

5.3.3.2. Strategic Line 8 (SL8): Local economy and opportunities

Opportunities most likely found for generating more green related type of jobs to the destination within taking steps towards obtaining a destination sustainable certification for Ambergris Caye and to its local tourism businesses and services.

Specific Objective – SO9: To strengthen the local economy associated with tourism and its value chain through sustainable processes.

Most of the island's tourism services are related to the presence of tour guides, followed by hotels and tour operators. Ambergris Caye´s tourism value chain current situation requires the elaboration of sustainable tourism businesses plans for future high end and current initiatives (business and services – tour operators, guides, and hotels among them), including circular economy concepts in its operations.

It also implies the need to make a comprehensive diagnosis of training needs and training plan for tourism businesses and services providers. The monitoring of the implementation of developed competencies and skills is also considered needed through the establishment of a baseline profile of each of trained people.

Table 108 – Plans and Projects in the Strategic Line 9 (SL9)

STRATEGIC LINE 8 (SL8): Local Economy and opportunities		Estimated Costs (USD)	
		Pre-investment	Investment
PL11	Sustainable economic strengthening and local opportunities plan	$250,000	N/A
PR28	Strengthening the capacities of the local population linked to tourism services	N/A	$80,000
PR29	Local capacity strengthening for business development	N/A	$80,000

Source: IDOM, 2023

5.3.4. Institutional Strengthening and Community Engagement

5.3.4.1. To establish a multi-stakeholder advisory committee that can provide guidance, expertise, and recommendations for the implementation of the sustainable development plan for the island.

This committee will serve as a platform for collaboration among key stakeholders, ensuring that the interests of the community are represented, and decisions are made in a transparent and inclusive manner. The committee should consist of representatives from key stakeholder groups, including but not limited to:

- **Local Government:** Representatives from the local municipality, including elected officials and planning department staff, who can provide insights into existing policies, regulations, and development plans.
- **Community Organizations:** Representatives from non-governmental organizations, community-based groups, and environmental organizations that have a vested interest in the sustainable development of San Pedro Ambergris Caye.

- **Business Community:** Representatives from the tourism sector, real estate developers, business owners, and entrepreneurs who can contribute their expertise in balancing economic growth with sustainability.
- **Residents:** Representatives from various residential areas of San Pedro Ambergris Caye, ensuring diverse perspectives and community representation.
- **Environmental Experts:** Experts in environmental science, marine biology, ecology, and other related fields who can provide technical knowledge and guidance on sustainable practices and conservation efforts.

5.3.4.2. Lobby for the sustainable development plan to be legislated.

By legislating the plan, it becomes a legally binding document that provides a framework for guiding and regulating development activities within Ambergris Caye. This ensures that development occurs in a planned and organized manner, in line with the overall goals and objectives of the community. Overall, legislating the plan provides a formalized framework for guiding, regulating, and managing development activities, fostering public participation, and ensuring long-term vision and stability.

5.3.4.3. Conduct a skills-need assessment for the Town Council based on the sustainable development plan.

This assessment will help to identify the gap between the existing skills and the skills required by the council to lead the implementation of the sustainable development plan.

5.3.4.4. Pass legislation to extend the municipality to the north of the island beyond the Sir Barry Bowen bridge in Boca del Rio.

The Town Council's jurisdiction ends at the bridge. This limits the extent of the councils' ability to effectively conduct activities on the north side of the island and truly impact change.

5.3.4.5. Review and update building codes to align with the sustainable development plan.

Building codes serve as regulatory guidelines for construction projects, covering aspects such as safety, structural integrity, energy efficiency, and environmental impact. Once the building codes are aligned with the development plan, there is consistency and coherence in the goals and objectives of both documents which helps ensure that construction activities are in harmony with the broader vision and direction of the municipality. In summary, aligning building codes with a municipality's development plan helps pro mote sustainable development, ensure infrastructure planning, preserve aesthetics, enhance public safety, and streamline the construction permitting process. This alignment supports a well-planned and cohesive growth strategy, benefiting both the municipality and its residents.

5.3.5. Plans and Projects

The following section is divided into two parts. The first part provides an overview of all plans and projects, while the second part outlines the prioritization of the most urgent projects to be developed.

5.3.5.1. General framework of Plans and Projects

This section contains a detailed description of each plan and project that are part of the Strategic Lines in the Action Plan. These items are organized by tables, which contain the following information:

Pre-investment

This item comprises the incurred costs during the preparatory work before the investment. In the Action Plan, these expenditures are related to the different plans which precedes the projects.

Investment

This includes the necessary economic resources for the execution of the works and activities, which will allow the materialization of the projects within the time frame determined in the Action Plan.

Execution time

Refers to the number of years estimated for the development of plans and projects. In this item, the following phases are considered:

- **Formulation (F):** This includes the technical consulting stage in the plans, as well as the preparation of detailed designs for the projects.
- **Implementation (I):** Phase of operation of the formulated plan, which includes the development of its components and periodic reviews.
- **Execution (E):** Stage of development of the required activities to materialize the projects, where the necessary infrastructure works, and the environmental and social processes are included.

Funding sources

This item includes the possible financing alternatives proposed for the plans and projects, which include the implementation of Public-Private Collaboration (PPC), Traditional Public Works (TPW), Concessioned Resources, Blended Finance or Mixed Financing, among others. Each of these financing sources will be developed in greater detail in Chapter 5 (Financial Plan) of this document.

Responsible stakeholders

It comprises the institutional players at the national and local levels that will lead or play a key role in the development of the plans and projects. These stakeholders include ministries, national authorities, statutory bodies, among others.

Challenges to be addressed

It includes a summary description of the identified needs in the territory through the diagnosis phase.

Expected result (Proposal Concept)

General technical description of the plans and projects, specifying their components, location, and scope of the intervention.

Identified benefits

This item includes the expected outcomes from the execution and implementation of plans and projects, measured in terms of solving identified needs and improving critical indicators.

The following tables contain the detailed description of Plans and Projects, where the above-mentioned elements are included:

5.3.5.1.1. TA1: Sustainable and integrated urban development

Table 109 - Sustainable and Integrated Urban Development Plans and Projects

TA1 - SUSTAINABLE AND INTEGRATED URBAN DEVELOPMENT														
SL1 - SUSTAINABLE TERRITORY														
Specific Objective	Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Components									
					Execution time (Years)					Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
						2025-2029	2030-2034	2035-2039	2040-2045					
To develop a compact and efficient territory, controlling urban growth	PL1	Land Use Plan and its urban standards	$ 150,000.00	N/A	F	I	I	I	I	TP CBG	1. Lands Department 2. Central Building Authority 3. Town Council	Ambergris Caye does not currently have updated planning regulations that provide specific guidelines for the urban development of the territory. For this reason, the Action Plan proposes the formulation of a **Land Use Plan**, which will **generate standards that regulate growth** and offer guidelines for a **compact and qualified development of the territory.**	The Land Use Plan will be key to achieve a more equitable, sustainable, and efficient development of the territory in Ambergris Cay. Some of the main outcomes and concepts that would be considered for the Land Use Plan will be: -Definition of protected areas -Areas for natural conservation -Strategic sectors for touristic developments -Zoning delimitation -Density and building heights -Setbacks and green spaces -Parking and transportation guidelines -General architectural standards	The development of a Land Use Plan will generate important environmental, urban, economic, and social benefits in Ambergris Caye. In addition to establishing an effective control to the expansion of the urban footprint, the implementation of the Land Use Plan will lead to other advantages such as **facilitate a sustainable development of the territory**, provide clear guidelines for new constructions, and ensure an efficient use of resources. In addition, a well-designed Land Use Plan can create dynamic communities, stimulating economic growth and **fostering a healthier environment for residents and visitants.**
	PL2	Recovery Plan for the Foundational Center	$ 200,000.00	N/A	F	I				TP CBG	1. Town Council 2. Ministry of Education, Culture, Science and Technology 3. Central Building Authority 4. National Institute of Culture and History	Currently, Ambergris Caye has no regulatory plans to protect the traditional architecture of Town's Center and its own authentic character. In this sense, the **Recovery Plan for the Foundational Center of San Pedro** seeks to establish guidelines for the preservation of the typical architecture of the Caye.	The Recovery Plan will propose applicable standards for San Pedro Foundation Center, among which the following will be established: -Guidelines for decorative elements on facades. -Modifications to structures (balconies, overhangs, projections). -Standards for the restoration of original elements. -Guidelines for the installation of signs and advertising elements. -Regulations for public spaces and parking provision.	The implementation of a Recovery Plan for San Pedro's Foundational Center can help to **restore and enhance the historical and cultural heritage of the Town**, diversifying the touristic attractions in the Island and encouraging economic growth with more opportunities for local communities.
	PR1	Recovery of traditional facades in San Pedro Center	N/A	$ 130,000.00		E				TP	1. Ministry of Education, Culture, Science and Technology 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority	The consultancy identified, according to the field work and multisectoral diagnosis, the existence of traditional facades in the Town Center with deficient conditions of preservation.	The Consultancy proposes a facade restoration and improvement project, which will be aligned with the Recovery Plan for the Foundational Center of San Pedro. According to the preliminary information analyzed, the project estimates the **recovery and improvement of 16 facades located in San Pedro Center**. Among the works included for this project are: -Restoration of traditional architectural and decorative elements. -Reinforcement of pieces in a state of deterioration or susceptible to extreme natural events. -Refinishing of walls, facades and non-structural elements.	The recovering of traditional facades in San Pedro Center can offer several benefits, such as the **preservation of cultural heritage and legacy from the past**, as well as the attraction of more tourists, fostering a sense of community pride, and potentially boosting local businesses. On the other hand, the reinforcement of structural elements can also contribute to the overall safety and resilience of the buildings.
		TOTAL	**$ 350,000**	**$ 130,000**										

Source: IDOM, 2023

Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
To optimize connectivity and diversify modes of transportation on the Island.	PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility, and public transportation system)	$ 250,000.00	N/A	F		I		TP CBG TC	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Ministry of Blue Economy and Civil Aviation 4. Belize Port Authority	The high dependence on motorized vehicles, the lack of active mobility infrastructure, the precarious state of the traffic network and the limited conditions of the John Greif II Airport and the current Cargo Port represent important challenges to address in Ambergris Caye. In this way, the Sustainable Mobility Plan will organize a **multimodal system**, with special emphasis in **active and low environmental impact mobility modes.**	The Sustainable Mobility Plan will formulate guidelines for the different transportation modes in the Island, in order to get an **integral and efficient and sustainable mobility.** Some of the main expected outcomes for the development of the Sustainable Mobility Plan are, among others: -Technical diagnosis of the current mobility issues in the Caye. -Recommendations for road improvement and expansion. -Guidelines for pedestrian and cycling infrastructure. -Standards for active transport modes. -Maritime and air mobility. -Recommendations for low-carbon emissions related to transport. -Location of the new Airport -Recommendations for Cargo Port Optimization and the New Northern Cargo Port.	Developing a Sustainable Mobility Plan for Ambergris Caye can help to **reduce traffic congestion, enhance public transportation and active mobility** options like walking and cycling, contributing to healthier lifestyles and reducing emissions. On the other hand, efficient land, maritime, and air transportation can **promote tourism by making the island more accessible**, driving to economic growth, the creation of jobs, and increasing revenue.
	PR2	Expansion and improvement of road infrastructure	$ 440,000.00	$ 43,940,000.00	F		E		PPP TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing	According to the diagnosis, currently, **only 8% of the roads** in Ambergris Caye are paved. The aim of this project is to improve the quality of the road system around the Island.	This project seeks the **optimization (paving) of 85.5 miles (138 km) of roads in Ambergris Caye.** In this way, it is expected to achieve: -A more fluid vehicular mobility. -Improvement of road safety. -Reduction of dust pollution in residential areas. **This project includes two phases:** 1. Expansion and improvement of road infrastructure north zone. 2. Expansion and improvement of road infrastructure other urban growth areas.	In addition to fluency in mobility, the optimization of the road network can **improve the accessibility to essential services and local businesses**, facilitating tourism by providing easier attraction access. Also, paved roads can elevate property values and enhance safety in neighborhoods with better lighting and signage.
	PR3	Implementation of a public bicycle system, including bike lines	$ 60,000.00	$ 5,150,000.00	F E	F E	F E	F E	PPP TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Belize Tourism Board	Currently, **Ambergris Caye does not have any proper infrastructure for this mean of transportation.** The objective of this project is to develop a bicycle path system to **promote non-motorized mobility** and alternate connection methods.	The project includes the **construction of 26 miles (41.6 km) of exclusive bicycle lanes** and the implementation of the **public bicycle system**, which considers: -Installation of bike stands -Bicycle acquisition -Implementation of technologies for the system's operation	Implementing a Public Bicycle System in Ambergris Caye would help to alleviate traffic congestion for residents and tourists, **promote environmental sustainability by reducing carbon emissions and improving air quality**, encourage healthier lifestyles through increased physical activity, and enhance the island's tourism appeal by offering a convenient and eco-friendly mode of transportation.
	PR4	Creation of tourist walk (Promenade) in San Pedro	N/A	$ 1,900,000.00	F E				TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Belize Tourism Board	At the present, the pedestrian infrastructure in San Pedro Center consists of **small sidewalks in some sections and most people walk in the streets.** The aim of this project is to create a tourist promenade along the central seafront of San Pedro, with new areas for leisure and active uses.	The project seeks to build **1.2 miles (2 km) of a Touristic Promenade**, which includes: -Improvement of pedestrian and mixed traffic areas at the seafront. -Creation of areas for passive recreation and leisure -Implementation of street furniture -Landscaping with native species	The development of this project will bring important benefits in terms of infrastructure and tourism development. It will improve the image of the urban waterfront, **with a mobility focused on non-polluting modes**, where it will be possible to enjoy the spatial values of the area.

SL2 - SUSTAINABLE MOBILITY

Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components: Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
	PR5	Promote the ecological line of public-private water transportation	$ 26,000.00	$ 2,600,000.00	F E	E			PPP TP	1. Town Council 2. Ministry of Blue Economy and Civil Aviation 3. Coastal Zone Management Authority and Institute 4. Fisheries Department 5. Belize Port Authority	Currently, there is no public maritime transportation to move around the different areas of Ambergris Caye. The water taxis only operate for **connections from the Caye to other islands** or to the mainland of Belize (Belize City, Corozal) and Chetumal in Mexico.	The project seeks to **implement a public transportation system based on water buses**, which will allow an agile connection between different areas of San Pedro, through the Inner Lagoon. The project includes the construction of five (5) embarkment ports and the acquisition of water taxis for the operation of the system.	An ecological water transportation line in Ambergris Caye will bring benefits such as reduced traffic congestion, **improve accessibility to lagoon-front urban areas like San Mateo and San Pedrito** and stimulate economic growth, **fostering sustainable development and efficient mobility.**
		TOTAL	**$ 776,000**	**$ 53,590,000**									

Source: IDOM, 2023

SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS

Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components: Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
To qualify housing conditions, improving deficient sectors and implementing housing projects.	PL4	Neighborhood improvement and land development Master Plan	$ 150,000.00	N/A	F	I			CBG TC	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority 4. Coastal Zone Management Authority and Institute	Improving living conditions in vulnerable urban areas is one of the most important challenges within the framework of Vision 2045. In this sense, the Neighborhood Improvement Master Plan is proposed as a measure to **comprehensively qualify public spaces and service infrastructure in the most deficient areas of the Island** identified in the multisectoral diagnosis.	The Neighborhood Improvement Strategic Plan is an innovative and unprecedented proposal for implementation in Ambergris Caye. Some of the main results and concepts that would be taken into account for the development of the Neighborhood Strategic Plan are: -Generation of **guidelines for basic services infrastructure**. -Improvement of the road network. -**Recovery of deteriorated environmental areas**. -Generation of areas for economic development. -Strengthening of local community relations.	The Neighborhood Improvement Strategic Plan has the potential of enhancing the community livability and **fostering a sense of pride and belonging among residents**, **creating new economic opportunities and touristic attractions.** On the other hand, by incorporating sustainable practices, this plan can contribute to environmental conservation and restoration of native ecosystems.
	PR6.1	Integral improvement of highly vulnerable sectors in San Mateo	N/A	$ 7,150,000.00		E			TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority	According to diagnostic, **25.5% of houses in Ambergris Caye have low standards of habitability** and 11.7% of the island's population lives in low-quality or non-permanent buildings, **located mainly in San Mateo, San Pedrito and San Juan** areas.	The most vulnerable sectors of the island, such as San Mateo neighborhood, was taken into account for the integral **improvement of neighborhoods over 56 acres.** The objective is to **improve the urban conditions**, in terms of road system, public services, green areas and public spaces in order to **provide a better quality of life**. The project will also include guidelines on universal accessibility and considerations on gender equity, social inclusion, and migration.	The execution of this project has the potential of enhance the quality of life of vulnerable population by **providing access to essential services and creating new qualified spaces for community life in a inclusive and accessible environment.** These type of projects of play a key role in poverty alleviation, addressing the root causes of vulnerability and reducing dependence on social welfare systems.

SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS													
					Components								
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
	PR6. 2	Integral improvement of highly vulnerable sectors in San Juan	$ 125,000.00	$ 4,500,000.00	F	E			TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority		The most vulnerable sectors of the island, such as San Juan neighborhood, was taken into account for the integral **improvement of neighborhoods over 39.73 acres.** The objective is to i**mprove the urban conditions,** in terms of road system, public services, green areas and public spaces in order to provide a **better quality of life**. The project will also include guidelines on universal accessibility and considerations on gender equity, social inclusion, and migration.	
	PR6. 3	Integral improvement of highly vulnerable sectors in San Pedrito	$ 125,000.00	$ 6,900,000.00	F	E			TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority		The most vulnerable sectors of the island, such as San Pedrito neighborhood, was taken into account for the integral i**mprovement of neighborhoods over 46.6 acres.** The objective is to i**mprove the urban conditions**, in terms of road system, public services, green areas and public spaces in order to provide a **better quality of life**. The project will also include guidelines on universal accessibility and considerations on gender equity, social inclusion, and migration.	
	PR7	Urban Housing Development for the North (Cayo Frances)	$ 150,000.00	$ 9,800,000.00	F	E			TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority	Developing urban housing on **87 acres** will create a **central hub in the northern region**. Addressing these challenges necessitates a comprehensive strategy that integrates sustainability, community engagement, infrastructure planning, affordability measures, resilience strategies, and long-term maintenance planning to ensure successful development.	The project in Cayo Frances aims to transform the northern region into a vibrant hub, providing residential spaces for the local population and serving as a catalyst for development and empowerment. This initiative not only focuses on housing but also aims to boost economic and social growth in the area. It is designed to create a strong sense of community, prioritize sustainability, and improve residents' overall quality of life. By offering green spaces, facilities, and a mix of amenities, the project ensures a high standard of living for the population while also aligning with the concept of the "15-minute city," where essential services and facilities are within a short distance, promoting convenience and accessibility for all.	The development in Cayo Frances brings substantial benefits, including economic growth through job creation and heightened demand for goods and services. It enhances infrastructure, boosts property values, and delivers essential amenities for an improved quality of life. Sustainable practices are integrated to safeguard the environment and yield revenue for the local government. Moreover, there is significant support from individuals for the development of the tourist industry in the north, which enhances tourism potential and fosters economic diversification.
	PR8	Housing improvement	$ 70,000.00	$ 5,700,000.00	F E	E			TP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority	Currently **there are no projects aimed at generating housing for the population of lower economic capacity**, in which the only alternative is the national programs for loans and construction of individual housing.	The aim of this project is to **improve at least 589 low-quality buildings houses**, including structural reinforcement. These buildings must meet optimal construction quality standards and must consider sustainable and bioclimatic criteria.	Besides the generation of **safe and dignified housing** for the Caye's population, this project has a key role in the **promotion of community strengthening and social inclusion**, making it a vital component of the efforts to address housing inequality and **promote a more equitable society**.

SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS														
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components									
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)		Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045						
	PR9	New Housing Development	$ 3,000,000.00	$ 152,700,000.00	F	E			TP PPP	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Central Building Authority	The demographic growth in the following years will **require new housing and land use conditions**, for this reason, Ambergris should have an orderly and equivalent planning according to the carrying capacity of the Caye, considering its vision and new tourism objectives projected for the island in order to achieve the construction and development of different type of dwelling (affordable, workers and market classification) **guaranteeing accessibility and long-term stability** over different areas of the territory (Cayo Frances and the rest of the caye).	The objective of this project will help to create an organized urban growth with a total dwelling in 2045 of 12,241 (6,129 increase vs 2022) which **1,239** will be located in Cayo Frances and **4,890** un the rest of the Caye. **Cayo Francés Housing development:** Affordable housing units: 248 Worker's housing units: 372 Market housing units: 620	**Rest of the Caye Housing development:** Affordable housing units: 848 Worker's housing units: 1402 Market housing units: 2640	**New developments ordered on the territory** according to a planned model will provide access to housing for multiple people locating families close to their jobs, facilities and education and improve the quality of life.
		TOTAL*	**$ 620,000.00**	**$ 34,050,000**										

*Housing value is taken out of the total investment due to the distortion it generates for the integral improvement of the island.

Source: IDOM, 2023

SL4 - PUBLIC SPACE AND URBAN FACILITIES													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
To expand the coverage of public spaces and qualified urban facilities on the island.	PL5	Master plan for facilities	$ 110,000.00	N/A	F	I			CBG TC	1. Town Council 2. Ministry of Education, Culture, Science and Technology 3. Ministry of Infrastructure, Development and Housing 4. Belize Tourism Board	According to estimates of carrying capacity, the **development of new health and education facilities** will be necessary in the future in order to have, with an adequate infrastructure, a positive influence on school completion rates.	The formulation of the Equipment Master Plan has the purpose of establishing **guidelines for basic urban services**, determining among its scope the following elements: -Identification of **areas of opportunity for new facilities**. -**Detailed studies** on the demand for new health, education and other infrastructure.	The development of the Master Plan focused on enhancing educational facilities will help to **create a more dynamic and accessible environment**, contributing to generate a **more equitable territory**, with urban infrastructure that improves the **quality of life** of the population.
	PR10	Construction of educational facilities	N/A	$ 4,440,000.00	F	E			TP	1. Town Council 2. Ministry of Education, Culture, Science and Technology 3. Belize Social Investment Fund	According to the urban diagnosis, currently in Ambergris Caye there are **3 preschools, 4 elementary schools, and 1 high school,** which will be insufficient to serve the projected population of the Island by 2045.	The project seeks the **construction of 5 educational facilities over the next 20 years in Ambergris Caye.** According to the results of the Future Carrying Capacity and population projections, it is estimated that **4 preschool and elementary schools** will be built between 2023 and 2045, as well as **1 high school** by the year 2045. The location of these facilities will be determined in the Master Plan.	The new educational institutions will improve the coverage of facilities on the island, **providing better access to opportunities for the population**, closing **inequality gaps** in the territory.

Specific Objective		Specific Activities	Pre-investment ($USD)	Investment ($USD)	Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
SL4 - PUBLIC SPACE AND URBAN FACILITIES													
												This project includes three phases: 1. Preschool and elementary school in the north. 2. Preschool and elementary school in the rest of Ambergris Caye 3. Elementary school and high school (two facilities).	
	PR11	Construction of Health Centers	$ 100,000	$ 18,600,000.00	F E		F E	E	TP CBG	1. Town Council 2. Ministry of Health 3. Belize Social Investment Fund	Currently, **Ambergris Caye does not have adequate public health infrastructure** for its population. Although the construction of the new General Hospital, financed by Taiwan, will cover the needs of the current population, considering the growth projections to 2045, **it will be necessary to build another health center to cover future demand**.	The project also includes the development of a local health center aimed at delivering essential medical services to the island's population in the foreseeable future. The precise location and specific features of this facility will be meticulously determined in alignment with the Master Plan outlined within this strategic initiative. The health center will be strategically positioned to ensure accessibility for residents and visitors alike, prioritizing efficient healthcare delivery and addressing the island's evolving healthcare needs. Furthermore, the design and functionalities of the health center will be integrated into the broader framework of sustainable development, incorporating eco-friendly practices and resilience to natural hazards, thereby enhancing the overall well-being and quality of life for the community.	The development of a local medical center will **improve the future coverage of health services in Ambergris Caye**, contributing to **enhance the quality of life** of the local population, as well as the supply of medical services for potential tourists.
	PL6	Master plan for public space	$ 90,000.00	N/A	F		I			1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities	The access to qualified public spaces (parks and plazas) and the future coverage of facilities are aspects to be addressed in Ambergris Caye. According to the diagnosis, only 12.4% of the island's inhabitants live near an effective public space	The formulation of the Public Space has the purpose of establishing **guidelines for the generation of new qualified green areas and basic urban services**, in order to achieve this objective its required to develop studies and **proposed locations** for new parks, plazas and public recreational areas.	The development of the Master Plan focused on enhancing public spaces will help to **create a more dynamic and accessible environment**, contributing to generate a **more equitable territory**, with urban infrastructure that improves the **quality of life** of the population.
	PR12	Construction of parks and green areas	N/A	$ 13,802,000.00	F		E		TP	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities	According to the Consultancy's diagnosis, the ratio of **public spaces per inhabitant on the island is only 8.6 square feet per inhabitant (0.8 square meters)**, while only **12.4% of the population** is located within a **10-minute walking distance** of a qualified green area	To comply with the indicator provided by the World Health Organization for public space per inhabitant (107 - 161 square feet per inhabitant), It is planned to develop 83 acres of green areas and parks to reach a total of **118 sqf of public space per inhabitant by 2045.**	The generation of qualified green areas provides important benefits, including the creation of new areas for **active and passive recreation of the population**, as well as the provision of areas for **community inclusion and activation**. Likewise, the increase in green spaces **facilitates environmental recovery actions**, favoring the restoration of ecosystems.
		TOTAL	**$ 300,000**	**$ 36,842,000**									

Source: IDOM, 2023

SL5 - PUBLIC SERVICES													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
To extend and optimize the coverage of public services.	PL7	Master plan for public services (water, waste, sewage, sanitation, energy and communications)	$ 1,500,000.00	N/A	F		I		TP CBG TC	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Belize Water Services Limited 4. Belize Electricity Limited	Ambergris Caye currently has significant deficiencies in the **coverage of basic public services**, especially **potable water and sanitation**. The **current management of wastewater and solid waste in the caye favors the deterioration of the ecosystems** of beaches and mangroves, therefore it is important to **improve the coverage of sanitation systems, at least 98%,** to protect the current ecosystems through improvements in garbage collection systems, wastewater management, connectivity, and fresh water systems and the challenge of implementing alternative energy sources	The formulation of the Master Plan seeks to establish **guidelines for the expansion and future development of fresh water and sewage network**, as well as the **waste management**, **electricity and communications' infrastructure**. This Plan could include: **-Detail studies for new networks, desalination, water treatment and purification plants**. **- Action plan associate with solid waste management and separation.** -**Potential location of the required infrastructure.** -Roadmap and implementation plan for sustainable strategies for the development of the public utilities system. -Financing instruments for the implementation of the Plan. -Formulation of a sustainable waste management program.	Developing a Master Plan that covers water, sewage, sanitation, and energy, has numerous benefits. These include: - Public health, reduced environmental impact, boosted **tourism**, improved **living standards**, job creation, **disaster resilience**, and **long-term sustainability**. - Update some of the actual governanace plans.
	PR13	Expansion of the water and sewerage network	N/A	$ 33,450,000.00	F		E		TP	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Belize Water Services Limited	According to the multisectoral diagnosis, approximately 23% of the inhabitants of Ambergris Caye have **no basic potable water service**, while **83% do not have access to the sanitation network**. **- Implement water network in the projected 34.4 miles of roadways** for the intermediate scenario, covering the service deficits calculated through the carrying capacity analysis.	The main expected result of the implementation of this project is: -Detailed designs and execution of the necessary work for the expansion of water and sewage coverage for 98% of the island's population. -To **increase 4 times the water purification capacity** to provide service to the community, which includes the expansion of the wastewater treatment plant (Located in the north zone). -To **increase 6 times the capacity of wastewater treatment**, which include the expansion of the Desalinization treatment plant (Located in the north zone). **-Expansion of freshwater network in 34.4 miles accordi to intermediate scenario** **-Expansion of sewage network in 34.4 miles according to intermediate scenario**	Improving potable water and sanitation coverage will have a positive impact on the **quality of life** of the population of Ambergris Caye. Likewise, having a better infrastructure will allow for the promotion of new tourism developments and **improve the island's capabilities**. however, it also will impact: - The **access to potable water and sanitation** for the native population. - Will help to **decrease the disease rates by reducing the vectors of contamination** due to poor wastewater management. - Substantial improvement in the quality of life of the Raizal population.

SL5 - PUBLIC SERVICES														
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components									
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
	PR14	Sustainable waste management program	$ 203,000	$ 8,934,500.00	F	E			TP	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Ministry of Sustainable Development	The actual insufficiently solid waste management in Ambergris Caye, due to remaining spots of waste recollection and open lots that are being used as illicit dumpsites is causing environmental and health risks. The development of a sustainable waste management program will contribute to address the environmental, social, and economic impacts of waste. The challenges will include: -Landfill investment for an effective disposal in the solid waste transfer station would reduce the amount of toxic waste entering the environment. -Formulate and efficient sensibilization program that includes the separation of recyclable materials. - Implement the necessary equipment such as trash compactors in adequate working condition to meet the demand for garbage collection. -Extend the current coverage of garbage collection from the island to the north, anticipating future needs due to projected urban development. -Health care waste management plan.	The expected results of a sustainable waste management program will be: -**Ensure coverage of the entire Ambergris Caye waste collection system.** - Increased public awareness and participation in waste reduction and recycling efforts. - Strengthened community involvement in sustainable practices and local environmental initiatives. -Ensure that there is a clear, financially viable mechanism for providing solid waste services throughout the Caye. -**Waste policy development related to: (i) legislative and regulatory framework; (ii) institutional arrangements; (iii) operational issues; (iv) financial sustainability; (v) education awareness; and (vi) monitoring and enforcement**. -The expansion of the current sanitation and maintenance schedule to the North.	A sustainable waste management program can c**ontribute significantly to the overall well-being of society, promote environmental administration**, and drive economic growth while fostering a culture of sustainability. By addressing these objectives, a sustainable waste management program can promote and reduce costs of waste disposal and management through efficient processes and resource recovery. Considering the average MSW composition for LAC (WB source), where organic and garden waste correspond to more than 50% of the generation, while almost a third corresponds to dry recyclable waste, it is recommended to implement selective collection routes for at least three categories as follows: 1. Organic and gardening waste. 2. Recyclable waste (glass, metal, paper, cardboard and plastics). 3. Other Organic and garden waste can receive biological treatment, either for the production of soil improvers through a composting process, or for the production of biogas and biomethane through anaerobic digestion. In the case of recyclable waste, it can be stored and sold to companies specialized in the recycling industry. This would mean that about 80% of the waste generated on the island would stop going to the final disposal site, extending its lifespan considerably.

SL5 - PUBLIC SERVICES														
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components									
					Execution time (Years)					Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029		2030-2034	2035-2039	2040-2045					
	PR15	Incentive program for the reconversion and implementation of renewable energies	N/A	$1,250,000.00	F	E				TP CBG	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Belize Electricity Limited 4. Ministry of Sustainable Development	According to the information analyzed during the diagnostic phase, **only a few buildings on Ambergris Caye use alternative energy sources.** This poses an important challenge, considering the **Island's high dependence on mainland supply.** Therefore, **reduce energy demand from the mainland** by implementing alternative energy projects in the caye with the objective of s**upply basic needs,**in order to i**mprove the resilience and adaptation to climate change on Caye**. It is important to note that Belize's energy company does not currently have the technical capacity to receive the additional energy generated by alternative sources; therefore, **an incentive is contemplated to support the improvement of the technical capacity of Belize's energy company.**	The main expected result of this project is the **implementation of financing initiatives** that will allow the **deployment of alternative energies in Ambergris Caye**, which will supply part of the energy demand, especially oriented towards residential use. It is also expected that a **regulatory framework will be developed** to **provide tax incentives to the inhabitants who implement sustainable energy to meet their needs**.	The implementation of alternative energies can **reduce the reliance on fossil fuels**, **improving energy security** and **mitigating the environmental impact**. These alternative sources of energy improve **sustainable energy production**, fostering economic growth and local job creation. it is expected: - **Expansion of supply capacity with lower investments**. - Lower CO2 emissions **- Beginning the energy transition starting with the goverment buildings and the local houses.**
	PR16	Optimization of connectivity and communications	N/A	$ 1,680,000.00	F	E				TP	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Belize Telecommunications Limited	Currently the island does not have adequate **digital communications coverage**, affecting **local productivity and tourism experience** in Ambergris Caye. therefore, this project aims to **reduce connectivity difficulties in the Caye by at least 40% by strengthening the current telecommunications infrastructure with 3 telecommunications towers,** in order to improve the preparation to natural hazards	The main goal of this project is to boost the telecommunications infrastructure in Ambergris Caye. By targeting a 40% improvement in coverage and stability of wireless networks and services, residents and businesses will benefit from better connectivity. This upgrade will facilitate smoother communication, access to online resources, and improved reliability for businesses, especially during emergencies or natural disasters. Overall, the project aims to enhance digital connectivity and contribute to the island's development and resilience.	The optimization of connectivity and communications **helps to close the digital gap in the territory**, aiding the profit of businesses, enhancing tourism experiences and improving disaster readiness, it is expected: - Expansion of the **capacity to receive and send digital information.** - Increase in the ease of connection between the inhabitants of the island. - **Improvement in the ease of global connection** for the inhabitants of the island.

SL5 - PUBLIC SERVICES													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
	PR17	Electrical network expansion plan	$700,000	$36,565,500	F	E			TP	1. Town Council 2. Ministry of Finance, Labour, Local Government, Rural Development, Public Service, Energy and Public Utilities 3. Belize Electricity Limited 4. Ministry of Sustainable Development	The construction of the electrical network Expansion faces environmental challenges, requiring mitigation to protect marine ecosystems. Technical and engineering issues demand detailed seabed assessments and advanced installation methods. The project's high initial costs necessitate careful cost-benefit analysis and secure funding. Logistically, transporting materials and coordinating skilled labor within tight timelines is complex. Ensuring safety with stringent protocols and regular maintenance is critical.	The main goal aims to enhance power reliability, integrate renewable energy, create jobs, and attract investment. It will improve infrastructure with smart grid technology and energy storage solutions, benefiting the community by raising the quality of life and providing educational opportunities. The project also ensures long-term sustainability and resilience against extreme weather and future energy demands.	The electrical expansion plan for Ambergris Caye will boost the island's economy by enhancing the tourism sector, attracting businesses, and increasing property values. It will also promote environmental sustainability through the integration of renewable energy sources and improved energy efficiency, reducing the carbon footprint and preserving natural habitats. Socially, the plan will improve residents' quality of life by ensuring reliable power for homes, schools, and healthcare facilities, fostering community development, and enhancing safety. Additionally, it will strengthen the island's resilience to natural disasters, align with Belize's national energy policies, and support sustainable development goals.
		TOTAL	**$2,403,000**	**$81,880,000**									

* * It is important to notice that the investment in new housing (apart for social and workers) is not being considered in the total of the Action Plan/ the final price will depend in the approval of the power network project

Source: IDOM, 2023

5.3.5.1.2. TA2: Natural heritage and environmental conservation

Table 110 – Natural Heritage and Environmental Conservation Plans and Projects

TA2 - NATURAL HERITAGE AND ENVIROMENTAL CONSERVATION													
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
To develop local capacity for the protection and restoration of ecosystems of high heritage and ecological value in the Caye	PL8	Master Plan for natural protected areas	$ 350,000.00	N/A	F	I			TP TC	1. Town Council 2. IDB 3. Ministry of Natural Resources, and the Environment 4. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management	The Caye presented a **continued degradation process of natural ecosystems** which should be slowed down to protect the resilient natural ecosystems that the Caye still possesses. Thus**, it is important to restore the natural areas that have been deteriorated** by human intervention on the island and inform the native population about the natural treasures they possess and their importance in the	The main expected outcome of this project is: - Develop a **governance instrument that defines through laws or legislatives decrees the natural areas** that are public property and therefore should not be modify in terms of land use.	Define natural protected areas. Define and maintain the natural protective systems **Maintain and conserve the heritage and high value ecosystems on the Caye.** Update some of the actual governance plans.

TA2 - NATURAL HERITAGE AND ENVIROMENTAL CONSERVATION													
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
										Authority and Institute 6. Ministry of Blue Economy	resilience that its carry within the face of climate change adaptation. Also, is **important to update the Management Plan of Bacalar Chico National Park & Marine Reserve.**		
	PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	N/A	$ 8,452,000.00	F E				TP	1. Town Council 2. IDB 3. Ministry of Natural Resources, and the Environment 4. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	To **preserve and restore 271 hectares of mangroves located along the Caye.** Expand the **coverage of the barrier reef system.** **Reduce annual degradation of the barrier reef by 30%**, to protect the population of natural hazards. **Decrease the volume of sargassum present on the beaches,** through **periodic marine cleanup plans carried out by boat and netting to collect this species.**	The main expected result of the implementation of this project is: 1**. implementation of a restoration and protection plan for mangrove areas** containing: a. Long-term financing plan b. Action plan with defined milestones in the restoration of natural protection areas. This action plan includes activities such as: - **Identify the current state of the mangroves through sampling of roots and trunks.** **- Planting of mangroves of endogenous species in areas of high ecosystem and tourist value**. 2. **Action plan for the restoration of the barrier reef system.** - Definition of **nurcery zones for endogenous corals of the Caye,** and periodic planting of these and restoration of the coral reef. - Implementation of **a program to nurcering coral reef** 3. **Action plan for cleaning and maintenance of beaches, remission of sargassum.** - Monthly program for the collection of sargassum from the beaches by **means of boats and special nets**. 4. **Increase the areas defined to protect the population for natural hazards identified on the caye**	1. **Maintenance, protection, and restoration of the endogenous ecosystems of the Caye.** 2. **Lower CO2 emissions** **3. Increse protection to natural hazards** 4. improve beach's ecosystem.
	PR19	Strengthening environmental education and conservation of the island's natural resources	N/A	$ 120,000.00	F E		F E		TP	1. Town Council 2. IDB 3. Ministry of Natural Resources, and the Environment 4. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	To **educate the population on the importance of protecting and maintaining their natural ecosystems.**	The main expected result of this project is: Training and **knowledge transfer plan for the Raizal population regarding the importance of maintaining, protecting, and restoring the endogenous natural ecosystems of the caye**	1. Strengthening the **knowledge of the Raizal population about the importance of maintaining and caring their ecosystem.**

TA2 - NATURAL HERITAGE AND ENVIROMENTAL CONSERVATION													
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
To promote initiatives to adapt to the risks derived from climate hazards.	PL9	Territorial plan for disaster risk management and the effects of climate change	$ 250,000.00	N/A	F	I			TP CBG TC	1. Town Council 2. NEMO 3. Ministry of Sustainable Development, Climate Change and Disaster Risk Management Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	**Lack of knowledge and preparation of the population regarding the risks associated with the natural hazards identified in the cay.**	The main expected result of this project is: - the **definition of unmitigable high-risk zones for hurricane and flood hazards**. -The **response plan for natural disasters.** - The **establishment of territorial emergency funds** for disaster response. - **Education plan for risk awareness**.	1. Implementation of a **disaster action plan for the Caye**. 2. **Creation of a National Emergency Fund** 3. **Reduction of the risk associated with natural events through knowledge of them**.
	PR20	Preparation and updating of risk and climate change studies	N/A	$ 325,000.00			F E		CBG TC	1. Town Council 2. NEMO 3. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	**Zoning in high unmitigable, high, medium and low risk for natural hazards** such as hurricanes and floods identified for the Cayo. Detailed studies at a scale of 1:5000	The main expected result of this project is: - **Detailed studies (scale 1:5000) of hazard, vulnerability and risk** for hurricane and flood susceptibilities in the Caye. - **Construction regulation** that generates **guidelines to keep vulnerability low** as found in the studies conducted.	**Zoning around the island's risk, allowing the identification of areas where urbanization should not be developed,** which will reduce human losses in the event of a disaster, and will also reduce the number of people affected.
	PR21	Monitoring of risk, threatening phenomena and climate change and its effects	N/A	$ 850,000.00	F E		E		TP CBG TC	1. Town Council 2. NEMO 3. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	Lack of knowledge of the region's hydrological and climatological cycles due to the lack of monitoring of these variables. Therefore, it is expected that at least **5 stations will be installed along the Caye that have the capacity to monitor hydro climatological conditions.** Implement a **monitoring system for marine water quality and lagoons.** Implement a **soil quality monitoring system** to identify the proper management of solid waste and sewage.	The main expected result of this project is: - The implementation of an **early warning system for the Caye**	1. Constant monitoring of meteorological conditions. 2. **Knowledge of the climatological cycles of the region.** 3. Knowledge of the average values of meteorological variables and therefore, future i**dentification of the impact of climate change in the region.**

TA2 - NATURAL HERITAGE AND ENVIROMENTAL CONSERVATION													
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
	PR22	Capacity building of local communities from the MRED approach	N/A	$ 1,050,000.00	F E	E	E	E	TP TC	1. Town Council 2. NEMO 3. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	To **reduce the loss by the population of natural capital such as strategic ecosystems,** which in addition to supporting the increase of adaptive capacity, are the basis of economic development or entrepreneurship that constitutes the MRED (MANAGING RISK THROUGH ECONOMIC DEVELOPMENT - M-RED).	The main expected result of this project is: To **increase adaptive capacity while contributing to the strengthening of economic opportunities for locals** through guidelines on governance issues and identify the most relevant considerations associated with Climate Change.	1.I**ncrease in population residence in the face of the effects of climate change.** 2. Increased knowledge of the territory and its governance in the face of climate change. 3. T**erritorial organization to support actions to reduce the determinants of the effects of climate change.** 4. Sustainable economic opportunities which are the core of the MRED methodology. 5. **Improve the CO2 absorptions**
	PR23	Public and private strategy for E-Vehicles	$ 30,000.00	$ 37,980,000.00	F E	E			PPP TP TC	1. Town Council 2. Ministry of Infrastructure, Development & Housing 3. Belize Tourism Board	Fulfilling this challenge will help significantly, **transforming the high dependance on motorized vehicles and replacing it with environmentally friendly solutions,** pairing it with multiples uses and target population (educative, tourism, private). The e-vehicle program contemplates: -Electric golf cars. -Charging points for electric golf cars distributed over the island. -Public transport system (Electric). -Bus stations.	The integration of e-vehicles (private and public) in Ambergris Caye will allow to **transform their mobility system helping and promoting sustainable mobility methods** in different scenarios such as private use, tourism, public transportation, among others. The main expected results of this project are: -New planning and redesigning of their infrastructure needs. -Upgrade of approximately 2,000-3,000 electric golf cars. -Installation of 50 new charging points. -Acquisition and operation of 20 new electric public buses. -Construction of new public transport stations.	**The implementation of electric mobility will contribute to a series of benefits economic, social and environmental such as, the decarbonization**, improvement of the air pollution, economic savings due to their longer life cycle and maintenance in comparison to conventional vehicles, and resilience and adaptation to the climate change. In addition, E-Vehicles will transform Ambergris Caye into a smart territory focusing on innovative proposals, development, and sustainable future with an i**ntegrated electric mobility system, public transport stations and charging points for local and tourists evenly distributed, accessibility and improvement of the displacement along the key for locals and tourists.**
		TOTAL	**$ 630,000**	**$ 48,777,000**									

Source: IDOM, 2023

5.3.5.1.3. TA3: Competitive and sustainable economy

Table 111 – Competitive and Sustainable Economy Plans and Projects

TA3 - COMPETITIVE AND SUSTAINABLE ECONOMY													
SL7 - INCLUSIVE COMPETITIVE AND SUSTAINABLE TOURISM													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components								
					Execution time (Years)				Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
					2025-2029	2030-2034	2035-2039	2040-2045					
To strengthen and diversify tourism activities, including attractions for high-end tourists.	PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$ 180,000.00	N/A	F	I			CBG TC	1. Belize Tourism Board 2. Ministry of Tourism	Current tourism practices in Ambergris Caye are not aligned with **international conservation standards**, generating negative impacts on ecosystems. It is therefore important to **join efforts among the different stakeholders in the tourism value chain**, in order to enhance and redirect tourism practices on the island.	The formulation and implementation of this Plan will lead to the creation of a **Destination Management Organization (DMO)** with the purpose of becoming a **Certified Sustainable Destination**, with innovative approach to regenerative process for the ecosystems.	Through this project, **Ambergris Caye will become a certified and world-recognized sustainable tourist destination**, with access to new responsible tourism market segments.
	PR24	New Ambergris Caye Airport	$ 5,000,000.00	$ 30,000,000.00	F E		E	E	PPP TP	1. Town Council 2. Ministry of Blue Economy and Civil Aviation 3. Belize Airports Aunthority 4. Lands Department	John Greif II Airport currently has a **limited flight capacity** due to the extension of its runway, the area of its platform and the central area of San Pedro. This project seeks to develop a new airport with the latest technology and greater coverage of flights and services.	The project includes the construction of a new airport in the northwestern sector of the Caye. This infrastructure will cover an area of approximately 200 ha, **including the runway and taxiways, passenger terminal, control tower and auxiliary facilities for aeronautical operations**. The specific characteristics of the airport, as well as other additional infrastructure works (roads, public services, among others.) will be detailed through prefeasibility and feasibility studies.	A new airport in Ambergris Caye, Belize, would **boost tourism**, economic growth, and accessibility. It could **attract investments**, create jobs, reduce travel time, enhance regional connections, and generate revenue from airport services. In a future, it could be able to have **international flights** to different destinations such as the United States, Canada, Mexico, among others.
	PR25.1	Optimization of current Cargo Port	$ 400,000.00	$ 3,200,000.00	F E				PPP TP	1. Town Council 2. Ministry of Blue Economy and Civil Aviation 3. Coastal Zone Management Authority and Institute 4. Fisheries Department 5. Belize Port Authority	The San Pedro Cargo Port serves as the main hub for cargo shipments and should be optimized to **provide greater import and export services** and **greater coverage for large vessels.**	This project expects to **improve the operational capacity of the cargo port** at its current location in San Pedro through investments in infrastructure, which will allow for **more efficient handling of goods arriving to the Island.** The specific requirements and equipment for optimizing the operation (cranes, platforms, and facilities) will be determined through pre-feasibility and feasibility studies.	Optimizing the San Pedro Cargo Port in Ambergris Caye, Belize, improves trade efficiency, stimulates economic growth, creates jobs, lowers shipping costs, and **enhances the island's connectivity for tourism and investments.**
	PR25.2	New Northern Cargo Port	$ 1,500,000.00	$ 9,000,000.00	F	E			PPP TP	1. Town Council 2. Ministry of Blue Economy and Civil Aviation 3. Coastal Zone Management Authority and Institute 4. Fisheries Department 5. Belize Port Authority	The New Cargo Port to be located in the North of the Island will **provide new connections** to supply **new sectors** of the Caye and thus **promote appropriate growth to the north.**	The **New Northern Cargo Port** is preliminary planned to be located at the entrance of **Santa Cruz Lagoon**, according to information provided by San Pedro Town Council. This new port will allow a **more agile access to goods and services from the mainland to the north of Ambergris Caye.** The final location and extension of the New Cargo Port will be subject to demand analysis and feasibility and pre-feasibility studies.	The potential benefits of developing a **New Cargo Port** in Ambergris Caye could include improved **trade efficiency, increased economic activity, job creation, and enhanced transportation infrastructure**. Additionally, it might boost the region's connectivity and contribute to overall economic development.

TA3 - COMPETITIVE AND SUSTAINABLE ECONOMY													
SL7 - INCLUSIVE COMPETITIVE AND SUSTAINABLE TOURISM													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components: Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
	PR26	Reorganization of docks and creation of tourist marinas.	N/A	$ 5,300,000.00	F E		E		PPP TC	1. Belize Tourism Board 2. Ministry of Tourism 3. Ministry of Blue Economy and Civil Aviation 4. Coastal Zone Management Authority and Institute 5. Fisheries Department 6. Belize Port Authority 7. Lands Department 8. Town Council	The seafront of Ambergris Caye is currently **saturated by piers and docks** for the arrival and departure of tourist motorboats, **affecting the morphological conditions of the coast** and generating visual pollution in the area.	The project proposes the reorganization of the current piers through the **development of five (5) marinas**, which will be **strategically placed near tourist attractions, accommodation complexes and commercial areas**. The precise location of these marinas will depend on specific studies, which will take into account their impact on marine ecosystems.	The implementation of this project will generate positive impacts in **terms of landscape ordering**, as well as the concentration of aquatic transportation with recovering of seafront scenery of Ambergris Caye.
	PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	$ 20,000.00	$ 140,000.00	F	E			TP CBG	1. Belize Tourism Board 2. Ministry of Tourism 3. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 4. Town Council	Although Ambergris Caye currently has some elements of tourist signage, the **Island does not have an organized plan for their location**, as well as specific guidelines for the implementation of **urban furniture.**	The project seeks the formulation of a **guide for urban furniture and tourist signage**, with the purpose of providing elements in the public space that respond to a **standardized and visually attractive strategy**.	The implementation of way-finding strategies and the unification of urban design criteria will make it easier for **visitors to locate and move around**, generating an **attractive, coherent, and easily recognizable territorial image in Ambergris Caye**.
		TOTAL	**$ 7,100,000**	**$ 47,640,000**									

Source: IDOM, 2023

SL8 - LOCAL ECONOMY AND OPPORTUNITIES													
Specific Objective	Specific Activities		Pre-investment ($USD)	Investment ($USD)	Components: Execution time (Years) 2025-2029	2030-2034	2035-2039	2040-2045	Funding Sources	Responsible Stakeholders	Challenges to Address	Expected Result (Technical Concept Proposal)	Benefits Identification
To strengthen the local economy associated with tourism and its value chain through	PL11	Sustainable economic strengthening and local opportunities plan	$ 250,000.00	N/A	F	I			CBG TC	1. Belize Tourism Board 2. Ministry of Tourism 3. Ministry of Economic Development 4. Town Council	Ambergris Caye´s current tourism value chain requires the **formulation of sustainable businesses plans** for future high end and current initiatives (business and services – tour operators, guides, and hotels among them), including **circular economy concepts** in its operations.	The purpose of this plan is to establish guidelines for the **integral economic development** of Ambergris Caye, which allow the implementation of strategies to **enhance local enterprises** and establish specific actions for the stakeholders involved in the tourism value chain.	This plan is expected to improve the **quality of services associated with tourism** in Ambergris Caye, as well as generate **greater employment and economic development opportunities for the local population.** This will allow a better positioning of the Island as a **high-quality tourist destination**, where the communities are an **active part** of its development.

sustainable processes.	PR28	Strengthening the capacities of the local population linked to tourism services	N/A	$ 80,000.00		E		CBG TC	1. Town Council 2. IDB 3. Ministry of Natural Resources, and the Environment 4. Ministry of Sustainable Development, Climate Change and Disaster Risk Management 5. Coastal Zone Management Authority and Institute 6. Ministry of Blue Economy	Due to the importance of tourism within the economy of Ambergris Caye, it is necessary to **implement training processes** in order to train the population involved in the tourism value chain. Establish at least 15 km of nature trails along the beach's Caye to support the maintenance of natural protected areas.	The project seeks to implement **training programs for the local population in areas directly related to tourism**, including: -Accommodation services -Food establishments -Tourist guides and tour agencies -Maritime, land, and air transportation -Environmental protection and conservation -Implementation of 15km of nature trails on the caye, which will help in the preservation of natural areas.	Through this project, it is expected that the population could have **better employment and economic development opportunities**, at the same time that the Island consolidates itself as a **high-quality tourist destination,** Strengthen the interaction of the Raizal and tourist population regarding the natural treasures of the caye, Establishment of trails that support ecotourism on the Caye, Strengthen sustainable tourism and Lower CO2 emissions
	PR29	Local capacity strengthening for business development	N/A	$ 80,000.00		E		CBG TC	1. Belize Tourism Board 2. Ministry of Tourism 3. Belize Trade and Investment Development Service	In addition to tourism services, it is necessary to **strengthen the productive processes** corresponding to economic activities such as sustainable fishing and local entrepreneurship.	This project proposes the **implementation of training and support programs** for the local population, in order to improve their **development opportunities** by means of sustainable practices that generate added value.	By strengthening local productive activities, communities are expected to obtain social and economic benefits that will enable them to **improve their quality of life**. This project is also expected to recover tr**aditional forms of production**, contributing to the **strengthening of the Island's own identity**.
		TOTAL	**$ 250,000**	**$ 160,000**								

Source: IDOM, 2023

5.3.5.1.4. Investment plan for a general framework of Plans and Projects

This section outlines the Investment Plan for implementing the proposed projects over a 20-year timeframe, spanning from 2025 to 2045.

In general, the total expected budget of the projects over the 20 years is USD$ 270 million, of which 3% corresponds to the pre-investment phase and 97% to the investment phase. Divided by execution periods, periods 1 and 2 represent the largest amounts, requiring a total budget of USD$ 109 million and USD$ 85 million, respectively.

Table 112 –Investment timeline per period.

Phase	2025-2029	2030-2034	2035-2039	2040-2045	Total
Pre-Investment	$ 12,109,000	$200,000	$ 64,000	$ 56,000	$ 12,429,000
Investment	$ 147,498,000	$ 74,790,000	$ 59,359,000	$ 21,422,000	$ 303,069,000
Total*	$ 159,607,000	$ 74,990,000	$ 59,423,000	$ 21,478,0000	$ 315,498,000

*Housing value is taken out of the total investment due to the distortion it generates for the integral improvement of the island.

Source: IDOM, 2023

5.3.5.2. Project Prioritization

5.3.5.2.1. Pre-investment plans prioritization

In order to prioritize the pre-investment plans, the present study proposes to consider as analysis variables the existence of consultancies or studies previously developed on the topics addressed in the plans, as well as the execution costs formulated in the Action Plan.

In this regard, the following tables detail these variables for the respective pre-investment plans:

Table 113 – Pre-investment plans prioritization

	Axe	Plan	Detail of plans	Previous Studies	It has previous studies	Estimated costs (USD)
1	TA 1	PL1	Land Use Plan and its urban standards	Zoning Plan (2023)** Land Use Plan (2013) Revised Master Plan (2009)	YES	$150,000
2	TA 1	PL2	Recovery Plan for the Foundational Center	N/A	NO	$200,000
3	TA 1	PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility, and public transportation system)	National Transportation Master Plan (2018)	YES	$250,000
4	TA 1	PL4	Neighborhood improvement Master Plan	San Mateo Integral Improvement (2023)**	YES	$150,000
5	TA 1	PL5	Master plan for facilities	N/A	NO	$110,000
6	TA 1	PL6	Master plan for public space	N/A	NO	$90,000
7	TA 1	PL7	Master plan for public services (water, waste,	North Ambergris Caye Expansion (water &	YES	$1,500,000

	Axe	Plan	Detail of plans	Previous Studies	It has previous studies	Estimated costs (USD)
			sewage, sanitation, and energy)	wastewater); Caye Caulker South and Placencia Peninsula WWTP and collection System (2022) *		
8	TA 2	PL8	Master Plan for natural protected areas	Coastal Zone Management Guidelines (2016	YES	$350,000
9	TA 2	PL9	Territorial plan for disaster risk management and the effects of climate change	Coastal Zone Management Guidelines (2016)	YES	$250.000
10	TA 3	PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process	Research Analysis and Update of the National Sustainable Tourism Master Plan for Belize (2022) *	YES	$180.000
				National Sustainable Tourism Masterplan for Belize 2030 (2011)		
11	TA 3	PL11	Sustainable economic strengthening and local opportunities plan	Research Analysis and Update of the National Sustainable Tourism Master Plan for Belize (2022) *	YES	$250.000
				National Sustainable Tourism Masterplan for Belize 2030 (2011)		

Source: IDOM, 2023

*Ongoing study.
**As part of the present consultancy "Support for Ambergris Caye Sustainable Development".

5.3.5.2.2. Investment Projects Prioritization

To identify the prioritization of projects for the Caye, the consultancy proposes three criteria, according to the identified needs and alignment with the study:

- Prioritization of Infrastructure of National Interest

Infrastructure projects considered of High Interest by the National Government are prioritized due to their importance for the economic and tourism development of Ambergris Caye. These projects are listed in the following table:

Table 114 – Project prioritization according to Infrastructure of National Interest

Axe	Project	Detail project
TA 3	PR24	New Ambergris Caye Airport
TA 1	PR02	Expansion and improvement of road infrastructure
TA 1	PR13	Expansion of the water and sewerage network
TA 1	PR15	Incentive program for the reconversion and implementation of renewable energies
TA 3	PR25.1	Optimization of Cargo Port
TA 3	PR25.2	New Northern Cargo Port
TA 1	PR07	Urban Housing Development for the North (Cayo Fránces)
TA 1	PR05	Promote the ecological line of public private water transportation

Source: IDOM, 2023

- Timing and carrying capacity.

This criteria includes projects directly related to current and future carrying capacity variables. Projects PR13 and PR9 will be developed in stages, according to the deficit indicators and conditions established in the model. These projects are listed in the following table:

Table 115 – Project prioritization according to timing and carrying capacity.

Axe	Project	Detail project
TA 1	PR6.1	Integral improvement of highly vulnerable sectors San Mateo
TA 1	PR6.2	Integral improvement of highly vulnerable sectors San Juan
TA 1	PR6.3	Integral improvement of highly vulnerable sectors and San Pedrito
TA 1	PR13	Expansion of the water and sewerage network
TA 1	PR10	Construction of educational facilities

Source: IDOM, 2023

- Local sustainable development

This prioritization is based on weighted parameters, which were used to evaluate the final impact of the projects on sustainable development of the Caye. A linear mathematical process was established based on four weighted parameters, which were used to evaluate the final impact of the project on the urban and sustainable development of the Caye.

Thus, and aligning the development priorities identified in the diagnostics carried out, 4 fundamental axes were selected from which this impact evaluation will be carried out. These axes are:

Quality of Life / Carrying capacity: In this fundamental axis, were considered parameters that could transversally evaluate the impact of the project.

Therefore, among the quality-of-life issue it was considered whether the project to be evaluated improves:

- Access to public services
- The relationship and indexes of public facilities and spaces.
- Mobility.
- And as an additional parameter, it was considered whether the project includes sustainable or climate change adaptation actions.

Legal and Governance: In this fundamental axis, it was considered whether it required:

- If there are necessary planning instruments
- The number of entities proposed to be coordinated.
- If the project could be implemented immediately.

Economy and Opportunity: In this fundamental axis, it was considered:

- If the projects could count on sustainable financing,
- The amount required for their execution and
- If it is favored the local economy and tourism.

Timing of project execution: In this thematic axis, it was considered:

- If it could be executed in the short, medium, or long term.
- If it strengthened the carrying capacity
- If it's required immediate action.

Thus, each parameter was assigned scores that quantitatively classify the relationship of each parameter with its fundamental axis, so that each fundamental axis had a maximum score of 5 points and a minimum of 0 points.

Likewise, each fundamental axis was weighted according to an interdisciplinary meeting within the IDOM team, where it was identified that the most important fundamental axis for sustainable urban development in the Caye was to improve the quality of life, followed by temporality, economy and opportunity and the legal scope. Thus, the following is the order of the projects with their final score obtained.

Table 116 – Project prioritization

Axe	Project	Detail project	General Evaluation
TA 1	PR15	Incentive program for the reconversion and implementation of renewable energies	4.4
TA 1	PR8	Housing improvement	4.4
TA 1	PR11	Construction of Health Centers	3.5
TA 1	PR12	Construction of parks and green areas	3.4
TA 3	PR26	Reorganization of docks and creation of tourist marinas	3.3
TA 1	PR14	Sustainable waste management program	3.3
TA 1	PR17	Electrical network expansion plan	3.3
TA 2	PR19	Strengthening environmental education and conservation of the island's natural resources	3.2
TA 1	PR04	Creation of tourist walk (Promenade) in San Pedro	3.1
TA 2	PR20	Preparation and updating of risk and climate change studies	2.9
TA 2	PR21	Monitoring of risk, threatening phenomena and climate change and its effects.	2.9
TA 1	PR03	Implementation of a public bicycle system, including bike lines	2.8
TA 3	PR28	Strengthening the capacities of the local population linked to tourism services	2.8
TA 3	PR29	Local capacity strengthening for business development	2.8
TA 2	PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	2.7
TA 1	PR05	Promote the ecological line of public-private water transportation	2.6
TA 1	PR16	Optimization of connectivity and communications	2.5
TA 1	PR01	Recovery of traditional façades in downtown San Pedro	2.5
TA 2	PR22	Capacity building of local communities from the MRED approach	2.3
TA3	PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	2.3

Source: IDOM, 2023

The action plan is directly aligned with the 2045 vision, general objectives, the specific SMART objectives, as well as with the conditions such as the future carrying capacity and population and tourism growth of the Caye.

Plans and projects are prioritized according to their contribution to the quality of life, the regulatory and governance framework, economic level and opportunity, level of importance, and time of execution. This prioritization responds directly to the needs identified in the future carrying capacity and development of the island.

5.3.5.2.3. Pre-Investment & Investment PlanTimeline

The chart below offers an overview of the projects presented in this consultancy, providing a comprehensive summary of all discussed initiatives. It provides a holistic view of the various projects outlined in the document.

Table 117 Pre-Investment & Investment Plan Timeline

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution																				
				2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
TA1 - SUSTAINABLE AND INTEGRATED URBAN DEVELOPMENT																								
SL1 - SUSTAINABLE TERRITORY																								
PL1	Land Use Plan and its urban standards	$ 150,000	N/A	F	I																			
				$ 150,000																				
PL2	Recovery Plan for the Foundational Center	$ 200,000	N/A	F	I																			
				$ 200,000																				
PR1	Recovery of traditional facades in San Pedro Center	N/A	$ 130,000		E																			
				$ 130,000																				
SL2 - SUSTAINABLE MOBILITY																								
PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility and public transportation system)	$ 250,000	N/A	F	I																			
				$ 250,000																				
PR2	Expansion and improvement of road infrastructure	$ 440,000	$ 43,940,000	F		E																		
PR2 - F1	Expansion and improvement of road infrastructure greenfield north zone	$ 30,000	$ 3,490,000	$ 20,000		$ 1,120,000			$ 10,000	$ 900,000				$ 1,350,000					$ 120,000					
PR2 - F2	Expansion and improvement of road infrastructure footprint north zone	$ 150,000	$ 11,650,000	$ 110,000		$ 5,150,000			$ 40,000	$ 6,500,000														
PR2 - F3	Expansion and improvement of road infrastructure in existing urban areas	$ 260,000	$ 28,800,000	$ 130,000		$ 7,200,000			$ 130,000		$ 7,200,000			$ 7,200,000					$ 7,200,000					
PR3	Implementation of a public bicycle system, including bike lines	$ 60,000	$ 5,150,000	F	E				F	E				F	E				F		E			
PR3 - F1	Implementation of a public bicycle system, including bike lines in the north	$ 30,000	$ 2,950,000	$ 10,000	$ 1,500,000				$ 10,000	$ 600,000				$ 7,000	$ 600,000				$ 3,000		$ 250,000			
PR3 - F2	Implementation of a public bicycle system, other areas	$ 30,000	$ 2,200,000	$ 10,000	$ 550,000				$ 10,000	$ 550,000				$ 7,000	$ 550,000				$ 3,000		$ 550,000			
PR4	Creation of tourist walk (Promenade) in San Pedro	N/A	$ 1,900,000	F	E																			
				$ 1,900,000																				
PR5	Promote the ecological line of public private water transportation	$ 26,000	$ 2,600,000	F	E								E											
				$ 26,000		$ 1,300,000			$ 1,300,000															
SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS																								
PL4	Neighborhood improvement and land development Master Plan	$ 150,000	N/A	F	I																			
				$ 150,000																				
PR6.1	Integral improvement of higly vulnerable sectors in San Mateo	N/A	$ 7,150,000	E																				
				$ 2,450,000					$ 2,300,000					$ 2,400,000										

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution																				
				2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
PR6.2	Integral improvement of higly vulnerable sectors in San Juan	$ 125,000	$ 4,500,000	F	E																			
				$ 125,000		$ 1,500,000			$ 1,500,000					$ 1,500,000										
PR6.3	Integral improvement of highly vulnerable sectors in San Pedrito	$ 125,000	$ 6,900,000	F	E																			
				$ 125,000		$ 2,300,000			$ 2,300,000					$ 2,300,000										
PR7	Urban Housing Development for the North (Cayo Francés)	$ 150,000	$ 9,800,000	F	E																			
				$ 150,000		$ 2,800,000			$ 3,500,000					$ 3,500,000										
PR8	Housing improvement	$ 70,000	$ 5,700,000	F		E			E					E										
				$ 70,000		$ 1,900,000			$ 1,900,000					$ 1,900,000										
PR9	New Housing Development	$ 3,000,000	$ 152,700,000	F		E																		
PR9 - F1	Construction of new urban housing (Cayo Francés)	$ 2,500,000	$ 32,900,000	$ 2,500,000																				
PR9 - F1A	*New affordable housing (Cayo Francés)*	N/A	$ 10,500,000	$ 2,200,000					$ 2,100,000					$ 2,600,000					$ 3,600,000					
PR9 - F1B	*New workers housing (Cayo Francés)*	N/A	$ 22,400,000	$ 4,500,000					$ 4,500,000					$ 5,700,000					$ 7,700,000					
PR9 - F2	Construction of new urban housing (Rest of the Island)	$ 500,000	$ 119,800,000	$ 500,000																				
PR9- F2A	*New affordable housing (Rest of the Island)*	N/A	$ 35,600,000	$ 14,700,000					$ 7,800,000					$ 7,500,000					$ 5,600,000					
PR9- F2B	*New workers housing (Rest of the Island)*	N/A	$ 84,200,000	$ 31,500,000					$ 18,300,000					$ 18,400,000					$ 16,000,000					
SL4 - PUBLIC SPACE AND URBAN FACILITIES																								
PL5	Master plan for facilities	$ 110,000	N/A	F	I																			
				$ 110,000																				
PR10	Construction of educational facilities	N/A	$ 4,440,000	F	E																			
PR10 - F1	Preschool and elementary school North	N/A	$ 735,000	$ 735,000																				
PR10 - F2	Preschool and elementary school (Rest of Ambergris Caye)	N/A	$ 2,205,000	F		E																		
				$ 735,000					$ 735,000					$ 735,000										
PR10 - F3	Elementary school and high school (two facilities)	N/A	$ 1,500,000																F	E				
																			$ 1,500,000					
PR11	Construction of Health Centers	$ 100,000	$ 18,600,000	F	E														E					
PR11 - F1	San Pedro General Hospital	N/A	$ 16,500,000	$ 16,500,000																				
PR11 - F2	Cayo Francés Primary Care Center	$ 50,000	$ 1,050,000											F	E									
														$ 50,000	$ 1,050,000									
PR11 - F3	Grand Belizean Primary Care Center	$ 50,000	$ 1,050,000																F	E				
																			$ 50,000	$ 1,050,000				
PL6	Master plan for public space	$ 90,000	N/A	F	I																			
				$ 90,000																				
PR12	Construction of parks and green areas	N/A	$ 13,802,000	F	E																			

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
				Execution time (Years) Note: F: Formulation I:Implementation E:Execution																				
PR12 - F1	Construction of parks and green areas north zone	N/A	$ 3,800,000	$ 950,000					$ 950,000					$ 950,000					$ 950,000					
PR12 - F2	Construction of parks and green areas general	N/A	$ 10,002,000	$ 2,500,500					$ 2,500,500					$ 2,500,500					$ 2,500,500					
SL5 - PUBLIC SERVICES																								
PL7	Master plan for public services (water, waste, sewage, sanitation, energy and communications)	$ 1,500,000	N/A	F $ 1,500,000	I																			
PR13	Expansion of the water and sewerage network	N/A	$ 33,450,000		F		E																	
PR13 - F1	Main Water & Sewage lines (North)	N/A	$ 800,000	$ 200,000					$ 200,000					$ 200,000					$ 200,000					
PR13 - F2	Main Water & Sewage lines (Rest of ambergris)	N/A	$ 3,800,000	$ 950,000					$ 950,000					$ 950,000					$ 950,000					
PR13 - F3	Expansion of freshwater & Sewage network (North)	N/A	$ 2,350,000	$ 750,000					$ 700,000					$ 450,000					$ 450,000					
PR13- F4	Expansion of freshwater & Sewage network (Rest of Ambergris Cayo)	N/A	$ 9,575,000	$ 3,500,000					$ 3,200,000					$ 2,200,000					$ 675,000					
PR13 - F5	Expansion of wastewater treatment plant	N/A	$ 6,800,000	$ 5,200,000										$ 1,600,000										
PR13 - F6	Expansion of Desalinitation treatment plant	N/A	$ 10,125,000	$ 4,050,000										$ 6,075,000										
PR14	Sustainable waste management program	$ 203,000	$ 8,934,500	F		E																		
PR14 - F1	Detailed study to reuse, reduce and recycle solid wastes on Ambergris Caye	$ 200,000	$ 8,700,000	$ 200,000		$ 3,900,000			$ 1,600,000					$ 1,600,000					$ 1,600,000					
PR14 - F2	Sensibilization promotion of ecological practices in recylcing and waste management	N/A	$ 204,500	E $ 52,500					E $ 38,000					E $ 38,000					E $ 76,000					E
PR14 - F3	Ecological waste management pilot plan for Ambergris Caye	$ 3,000	$ 30,000	F $ 3,000	E $ 10,000					E $ 10,000					E $ 10,000									
PR15	Incentive program for the reconversion and implementation of renewable energies	N/A	$ 1,250,000	F $ 1,250,000	E																			
PR16	Optimization of connectivity and communications	N/A	$ 1,680,000	F $ 1,680,000	E																			
PR17	Electrical network expansion plan	$ 700,000	$ 36,565,500	F	E																			
PR17 - F1	Underwater electric pipeline	$ 250,000	$ 26,000,000	$ 250,000	$ 26,000,000																			
PR17 - F2	San Pedro power grid expansion (medium voltage)	N/A	$ 5,398,000						E $ 5,398,000															
PR17 - F3	Secret Beach power grid construction (medium voltage)	N/A	$ 1,535,000						E $ 5,398,000															
PR17 - F4	North power grid construction (high voltage)	$ 300,000	$ 3,600,000				F $ 300,000		E $ 1,200,000					$ 1,200,000					$ 1,200,000					
PR17 - F5	Electric sub-station				F	E																		

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution																				
				2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
		$ 150,000	$ 32,500		$ 150,000	$ 32,500																		
TA2 - NATURAL HERITAGE AND ENVIRONMENTAL CONSERVATION																								
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE																								
PL8	Master Plan for natural protected areas	$ 350,000	N/A	F	I																			
				$ 350,000																				
PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	N/A	$ 8,452,000	F	E																			
PR18 - F1	Preservation and recovery of existing mangrove and seagrass cover and coral reefs (Located in the north zone)	N/A	$ 1,350,000	$ 450,000					$ 450,000					$ 450,000										
PR18 - F2	Sargassum collection in the northern zone	N/A	$ 3,742,000	$ 935,500					$ 935,500					$ 935,500					$ 935,500					
PR18 - F3	Preservation and recovery of existing mangrove and seagrass cover and coral reefs and sargassum collection (rest of the caye)	N/A	$ 3,360,000	$ 840,000					$ 840,000					$ 840,000					$ 840,000					
PR19	Strengthening environmental education and conservation of the island's natural resources	N/A	$ 120,000	F		E								F	E									
				$ 40,000										$ 40,000					$ 40,000					
PL9	Territorial plan for disaster risk management and the effects of climate change	$ 250,000	N/A	F	I																			
				$ 250,000																				
PR20	Preparation and updating of risk and climate change studies.	N/A	$ 325,000												F	E								
														$ 325,000										
PR21	Monitoring of risk, threatening phenomena and climate change and its effects.	N/A	$ 850,000	F	E									E										
				$ 425,000										$ 425,000										
PR22	Capacity building of local communities from the MRED approach.	N/A	$ 1,050,000	F	E																			
				$ 265,000					$ 265,000					$ 260,000					$ 260,000					
PR23	Public and private strategy for E-Vehicles	$ 30,000	$ 37,980,000	F		E																		
				$ 30,000																				
PR23 - F1	Installation of electric golf cars charging point.	N/A	$ 30,000.00	$ 22,000					$ 8,000															
PR23 - F2	Upgrading of electric golf cars.	N/A	$ 27,800,000.00	$ 17,800,000					$ 10,000,000															
PR23 - F3	Implementation of an electric public transportation system.	N/A	$ 7,000,000.00						$ 4,500,000					$ 2,500,000										
PR23 - F4	Construction of electric public transport stations.	N/A	$ 3,150,000.00	$ 2,000,000					$ 1,150,000															
TA3- COMPETITIVE AND SUSTAINABLE ECONOMY																								
SL7 - INCLUSIVE, COMPETITIVE AND SUSTAINABLE TOURISM																								
PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$ 180,000	N/A	F	I																			
				$ 180,000																				
PR24	New Ambergris Caye Airport	$ 5,000,000	$ 30,000,000	F			E							E					E					
				$ 5,000,000			$20,000,000							$ 10,000,000										
PR25.1	Optimization of Cargo Port	$ 400,000	$ 3,200,000			F	E																	
						$ 400,000	$ 3,200,000																	

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution																				
				2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
PR25.2	New Northern Cargo Port	$ 1,500,000	$ 9,000,000					F	E															
				$ 1,500,000					$ 9,000,000															
PR26	Reorganization of docks and creation of tourist marinas.	N/A	$ 5,300,000			F	E									E								
				$ 2,650,000										$ 2,650,000										
PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	$ 20,000	$ 140,000		F	E																		
				$ 20,000		$ 35,000			$ 35,000					$ 35,000					$ 35,000					
SL8 - LOCAL ECONOMY AND OPPORTUNITIES																								
PL11	Sustainable economic strengthening and local opportunities plan	$ 250,000	N/A	F	I																			
				$ 250,000																				
PR28	Strengthening the capacities of the local population linked to tourism services	N/A	$ 80,000			E																		
				$ 20,000					$ 20,000					$ 20,000					$ 20,000					
PR29	Local capacity strengthening for business development	N/A	$ 80,000			E																		
				$ 20,000					$ 20,000					$ 20,000					$ 20,000					

			2025–2029	2030–2034	2035–2039	2040–2045
Total pre-invesment	$ 12,429,000		$ 12,109,000	$ 200,000	$ 64,000	$ 56,000
Total invesment		$ 303,069,000	$ 147,498,000	$ 74,790,000	59,359,000	$ 21,422,000
	Total*	**$ 315,498,000**	**$ 159,607,000**	**$ 74,990,000**	**$ 59,423,000**	**$ 21,478,000**

*Housing value is taken out of the total investment due to the distortion it generates for the integral improvement of the island.

* * It is important to notice that the investment in new housing (apart for social and workers) is not being considered in the total of the Action Plan/ the final price will depend in the approval of the power network project

Source: IDOM,2023

5.4. Financial Plan

The objective of this chapter is to develop a financial plan for the execution of the different initiatives and projects proposed in the Vision and Action Plan to 2045. The main purpose of this section is to propose how to finance the monetary and resource needs of the identified projects to be implemented in Ambergris Caye that have been presented in the previous section.

The chapter is divided in two sections:

- Funding sources: identification of different types of financial sources.
- Project development initiatives: which analyzes the different implementation and funding alternatives for each of the projects.

5.4.1. Funding sources

Financing sources serve as the way for obtaining monetary resources to enable the development and execution of the proposed projects. Specifically, there are multiple sources of financing at the international and national level, among which two categories stand out: public financing and private financing.

Public financing is composed of financing through state resources and resources from multilateral and/or bilateral entities. Traditional financing, i.e., with state resources, consists of the government directly financing the development of the project through public resources or external financing. For this, it would use tax revenues for the creation of investment budgets and could even create new taxes to increase revenues; or it would increase its level of debt to raise capital through banks, NGOs, and multilaterals.

In the case of multilateral agencies, this includes the participation of international organizations, such as the European Bank for Reconstruction and Development (EBRD) or the European Commission, the Inter-American Development Bank (IDB), the Andean Development Corporation (CAF) or the World Bank, which provide financing in the form of a non-reimbursable grant or through loans on preferential terms. In the following table there is a list of funding sources.

Table 118 – List of financing entities

Entity
1. InterAmerican Development Bank (IDB)
2. IDB Invest
3. World Bank (WB)
4. Green Finance for Latin America and the Caribbean (GFL)
5. Climate Investment Funds (CIF)
6. United Nations Environment Programme
7. Green Climate Fund (GCF)
8. Central American Bank for Economic Integration (CABEI)
9. International Finance Corporation (IFC)
10. Green Investment banks
11. Commercial Banks
12. Government (taxes)
13. Central American Infrastructure Facility (CAIF)
14. The Landscape Resilience Fund (LRF)

Entity
15. The Nature Conservancy (TNC) 16. Americas Climate Fund (ACA Fund) 17. Global Impact Investing Network (GIIN) 18. Convergence Blended Finance 19. Caribbean Development Bank (CDB) 20. International Development Association (IDA) 21. International Monetary Fund (IMF) 22. Global Environment Facility (GEF) 23. Fund for the Integration of Central American Development (FICODECO) 24. Kellogg Foundation 25. Inter-American Foundation (IAF) 26. Organization of American States (OAS) 27. United Nations Economic Commission for Latin America and the Caribbean (ECLAC) 28. United Nations Development Programme (UNDP) 29. Caribbean Community (CARICOM) 30. Association of Caribbean States (ACS) 31. United States Agency for International Development (USAID) 32. Canadian International Development Agency (CIDA) 33. World Wildlife Fund (WWF) 34. Pan American Development Foundation (PADF)

On the other hand, there are private financing sources. Among them is the Public-private collaboration (PPC) where the public entity procures resources to finance the construction and maintenance of the projects through availability payments to the private entity in charge of the infrastructure. The private entity may finance the construction of the project through capital raising or debt placement.

It should be noted that the central government, through its agencies and ministries, is a good source of financing for the projects, since they have investment budgets within their finances. For more information on the fiscal and financial situation of the state, see Annex A.

5.4.2. Projects and potential sources of financing

In this section, each of the programs and projects to be developed will be analyzed this assessment is done by previous experience of the consultant and international analysis of other projects. The table below is an assessment of each of the projects and the modalities by which they could be implemented. There it is presented the project with the entity that should be uncharged, the more likely development alternative and potential funding source. Among the alternatives, the implementation of Public-private collaboration (PPC), Traditional Procurement (TP), concessions, etc. will be considered.

Table 119 – Development alternatives Matrix.

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
PL1	Land Use Plan and its urban standard	$ 150,000	MSDCC D&RM	Blended Finance	Blended finance is commonly used to finance urban development projects.	IDB WB CAIF
PL3	Sustainable Mobility Plan (land,	$ 250,000	MIDH	Technical cooperation	The technical cooperation bring access to Global Best Practices, allowing to learn	IDB CARICOM CDB

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
	maritime and air system, active mobility, and public transportation system)				from successful sustainable mobility plans implemented elsewhere.	ECLAC
PR2	Expansion and improvement of road infrastructure	$ 44,380,000	MIDH	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PR7	Urban Housing Development for the North (Cayo Frances)	$ 9,950,000	MIDH	TP	It is proposed to be developed by TP because this type of initiatives at international level are generally executed by the public sector.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PL5 PL6	Master plan for public space and facilities	$ 110,000 $ 90,000	MIDH	Technical cooperation	Technical cooperation brings together planners and designers from various regions. This allows to learn from successful public space and facility master plans implemented elsewhere, incorporating the best practices identified.	CARICOM CDB IDB
PR10	Construction of educational facilities	$ 4,440,000	MECST	TP	It is proposed to be developed by TP because this type of initiatives at international level are generally executed by the public sector, it should be noted that although private participation has been seen in this type of projects, but the current level of development of the region indicates a greater ease of implementation by the public system.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR11	Construction of Health Centers	$ 18,700,000	MIDH	Blended Finance	The social impact of improved healthcare access can attract impact investors seeking positive social returns alongside financial gains. Their investment can contribute significantly to the project's overall funding.	CAF GIIN WB IDB AFD GIZ KFW JICA

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
PR12	Construction of parks and green areas	$ 13,802,000	MIDH	TP	It is proposed to be developed by TP because this type of initiatives at international level are generally executed by the public sector, it should be noted that although private participation has been seen in this type of projects, but the current level of development of the region indicates a greater ease of implementation by the public system.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PL7	Master plan for public services (water, sewage, sanitation, and energy)	$ 1,500,000	MIDH	Technical cooperation	Technical cooperation fosters collaboration between local authorities, planners, service providers, and external experts. This leads to a more inclusive plan that reflects the diverse needs and priorities of the community	UNPD CDB PADF
PR13	Expansion of the water and sewerage network	$ 33,450,000	MIDH	TP	It is proposed to be developed by TP because normally in this type of project there is no allocation or transfer of risks to a private entity, therefore it is more effective to carry it out from the public sector.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	$ 8,452,000	MSDCC D&RM	Concessional resources	Environmental restoration projects often struggle to secure sufficient funding through traditional channels. Concessional resources, with their preferential terms (low interest rates, long repayment periods, or even grants), can bridge the funding gap and make these projects financially viable	CAF GIIN WB IDB AFD GIZ KFW JICA
PR24	New Ambergris Caye Airport	$ 35,000,000	MBECA	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PL2	Recovery Plan for the Foundational Center	$ 200,000	MSDCC D&RM	Concessional resources	Concessional resources are typically used for a wide range of infrastructure projects focused on sectors that have a high impact on the social development	IDB WB CDB

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
PR1	Recovery of traditional façades in downtown San Pedro	$ 130,000	MSDCC D&RM	TP	The TP is more likely to be implemented because of the facility of quality control with a pre-defined design and specifications, traditional procurement offers greater control over quality. Also, because the amount is not significant, and it doesn't represent fiscal pressure.	Government through public spending
PR3	Implementation of a public bicycle system, including bike lines	$ 5,210,000	MIDH	TP	It is proposed that the implementation of the public bicycle system be the responsibility of the public sector. This decision is based on the success observed in international reference projects that have used this same modality.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR4	Creation of tourist walk (Promenade) in San Pedro	$ 1,900,000	MIDH	TP	It is proposed that the implementation of this project be the responsibility of the public sector. This decision is based on two main reasons: - Absence of similar projects internationally: No projects with similar characteristics to the present one have been found, which makes it difficult to estimate risks and attract private capital. - Low attractiveness for private investors: The total amount of the project does not make it an attractive investment for private entities, due to the uncertainty associated with its development.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR5	Promote the ecological line of public-private water transportation	$ 2,626,000	MIDH	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PL4	Neighborhood improvement Master Plan	$ 150,000	MIDH	Blended Finance	It allows to combine public funds (grants, subsidies) with private sector investment (loans, equity). Also, neighborhood improvement plans often involve multiple facets like infrastructure, housing, and social services. Blended finance can bridge	IDB CAIF WB

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
					the funding gap for such complex and comprehensive projects.	
PR6	Integral improvement of highly vulnerable sectors (San Mateo, San Juan, and San Pedrito)	$ 18,800,000	MIDH	TP	It is proposed to be developed by TP because this type of initiatives at international level are generally executed by the public sector.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR8	Housing Improvement	$ 5,770,000	MIDH	TP	It is proposed to be developed by TP because this type of initiatives at international level are generally executed by the public sector, it should be noted that although private participation has been seen in this type of projects, but the current level of development of the region indicates a greater ease of implementation by the public system.	Government through public spending CAF GIIN WB IDB AFD GIZ KFW JICA
PR15	Incentive program for the reconversion and implementation of renewable energies	$ 1,250,000	MSDCC D&RM	Green Finance	Green Finance instruments can mitigate risks associated with renewable energy projects, making them more attractive to private investors. This can involve loan guarantees, green bonds with tax benefits, or blended finance structures combining grants with private investment.	GLF CIF GCF CABEI
PR16	Optimization of connectivity and communications	$ 1,680,000	MIDH	TP	It is proposed that project development be the responsibility of the public sector (TP) for the following reasons: - Low attractiveness to private investors: projects with low economic amounts are usually unattractive to private investors, as they do not offer a sufficiently high return on investment. - Convenience for the public sector: The public sector has the capacity and resources to execute this type of project efficiently, which reduces the risks of errors or delays.	Government through public spending
PR17	Electrical network	$ 37,265,500	MSDCC D&RM	TP	The project crucial for supporting the island's economic growth and	Government through public spending

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
	expansion plan				enhancing the quality of life for its residents. As a premier tourist destination, Ambergris Caye relies heavily on a reliable power supply to accommodate the increasing demands of tourism-related businesses, ensuring they can provide high-quality services to visitors. By improving the electrical infrastructure, the expansion will facilitate other essential services, attract investment, and create job opportunities.	
PL8	Master Plan for natural protected areas	$ 350.000	MSDCC D&RM	Technical cooperation	Partnering with experienced organizations allows to learn from successful NPA management plans from around the world. This ensures to incorporate the best practices in conservation biology, ecological monitoring, and sustainable resource management.	IDB WB WWF TNC
PR19	Strengthening environmental education and conservation of the island's natural resources	$ 120,000	MSDCC D&RM	Technical cooperation	Technical cooperation fosters collaboration between government agencies, educators, local communities, and external experts. This leads to a more inclusive and culturally relevant project design that reflects the needs and aspirations of the population.	UNPD WWF TNC
PL9	Territorial plan for disaster risk management and the effects of climate change	$ 250,000	MSDCC D&RM	Technical cooperation	Partnering with experienced organizations can offer training and capacity building for local government officials, emergency responders, and community members. This empowers them to implement and maintain the DRM plan effectively in the long term.	UNPD WWF TNC
PR20	Preparation and updating of risk and climate change studies.	$ 325,000	MSDCC D&RM	Technical cooperation	Technical cooperation allows to connect with experienced organizations with expertise in conducting risk and climate change studies. Partners can share best practices in areas like data collection, risk modeling, and climate change scenario planning.	UNPD WWF TNC
PR21	Monitoring of risk, threatening phenomena and climate	$ 850,000	MSDCC D&RM	Green Finance	Green Finance supports projects that improve our understanding of environmental issues. Monitoring climate change and its effects falls squarely	GFL GCF

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
	change and its effects.				within this category. The data collected is crucial for informing future climate action and adaptation strategies	
PR22	Capacity building of local communities from the MRED approach.	$ 1,050,000	MSDCC D&RM	Technical cooperation	Technical cooperation allows to connect with experienced organizations with successful programs in community capacity building. They can share best practices tailored to different contexts, ensuring the project incorporates effective approaches.	IDB ECLAC WB UNPD
PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$ 180,000	MSDCC D&RM	Technical cooperation	Technical cooperation allows to learn from successful examples of destinations that have implemented regenerative tourism practices and achieved certification. Partners can share best practices in areas like community engagement, responsible waste management, and visitor education.	UNPD CARICOM CDB WWF
PR25.1	Optimization of current Cargo Port in South San Pedro	$ 3.600.000	MIDH	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PR25.2	New Northern Cargo Port	$ 10,500,000	MIDH	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PR26	Reorganization of docks and creation of tourist marinas.	$ 5,300,000	MIDH	Public-private collaboration	The PPCS attract private sector funding, supplementing the public resources. This allows for undertaking larger and more complex infrastructure projects that might not be feasible with public funds alone.	Government and private organization. IDB Invest and IFC supports the private and de IDB and WB de government.
PR27	Formulation of the Urban Furniture and Signage guide and identification of tourist sites.	$ 160,000	MIDH	Public-private collaboration	Consider a PPC if the project involves designing and installing the urban furniture and signage itself, leveraging private sector expertise for construction while the public	Government and private organization. IDB Invest and IFC supports the private and de

ID	Project	USD$	Lead Ministry	Development alternative	Justification	Funding source
					sector retains ownership and control.	IDB and WB de government.
PL11	Sustainable economic strengthening and local opportunities plan	$ 250,000	MSDCC D&RM	Technical cooperation	It allows to learn from successful projects in sustainable economic development implemented elsewhere. Partners can share best practices for fostering local businesses, green industries, and community-driven economic initiatives in areas like renewable energy, sustainable agriculture, ecotourism, and microfinance.	ECLAC UNPD CARICOM PADF
PR28	Strengthening the capacities of the local population linked to tourism services	$ 80,000	MAFE	Technical cooperation	It allows to gain access to experts with specific knowledge in areas like hospitality management, customer service, language skills development, and traditional crafts production. This ensures the project equips the local population with the skills most relevant to the tourism industry in the region.	IDB ECLAC ACS
PR29	Local capacity strengthening for business development	$ 80,000	MAFE	Technical cooperation	Technical cooperation allows to learn from successful programs in other regions that have fostered local entrepreneurship and business growth. It helps in areas such as business incubation, financial literacy, product development, and industry-specific skills training.	ECLAC UNPD CARICOM USAID

Source: IDOM, 2023

In consideration of the above, Public-private collaboration are a mechanism or instrument of private capital linkage that is materialized through a contract between a government entity and a private entity for the provision of a public good and its related services. This involves a transfer of risk between the parties and a payment mechanism based on the availability and level of service of the infrastructure.

Some examples of Public-private collaboration implementation are road concessions, contracts for the design, construction and operation and maintenance of schools and hospitals.

During the term of the contract, known as the concession period, the government commits to make periodic payments to the private sector for investment, operation, and maintenance costs, considering the resources the private sector receives for the concession right, such as tolls.

On the other hand, traditional procurement or provision is where the government assumes the entire cost of construction, operation, and maintenance of a public work, financed with its own resources or with debt, which has a fairly large fiscal impact. And it independently contracts a builder and an operator. For example, in the construction of a road, an entity is contracted to build the road and then an entity is contracted to operate and maintain the road.

Traditional procurement has been implemented internationally in the provision of public infrastructure such as: roads and highways, construction, government buildings, social infrastructure such as schools and hospitals, sewage systems, airports, parks, and others.

In terms of financial resources, there is a wide range of options. First, there is the option of concessional resources or financing, which involves funds provided through concession agreements or loans from international organizations, foreign governments, or NGOs. These loans offer several advantages, including low or zero interest rates, grace periods, and extended repayment terms. In addition, they come with flexible conditions for the use of the funds and a strong emphasis on promoting sustainable development.

Concessional resources are typically used for a wide range of infrastructure projects or development programs focused on sectors that have a high impact on economic and social development, including economic development programs, public health, environmental protection, and urban development, as well as infrastructure projects in the areas of transportation, energy, health, water, and sanitation, etc.

On the other hand, blended finance is a combination of public and private financial resources to finance development projects and programs. It uses donations, concessional instruments, and repayable financing to make projects more viable and financially sustainable.

Blended finance is used in the development of projects and programs for sustainable infrastructure, health, education, urban development, clean energy, environmental protection, and climate change.

In addition, there is green finance, which refers to financial investments in sustainable development projects and initiatives, particularly climate change mitigation and environmental adaptation. These funds are typically provided by multilateral institutions, NGOs, and governments.

Among the projects typically developed with green financing are those related to renewable energy, clean transportation, waste management, environmental and biodiversity conservation, green infrastructure, etc.

Finally, there is the option of technical cooperation, which consists of aid provided through the transfer of techniques, experience, or knowledge by a country or multilateral organization for the purpose of promoting development. It can be of two types: reimbursable, such as loans or financial credits, or non-reimbursable, such as donations with no obligation to repay.

Internationally, technical cooperation is implemented through programs and projects in education, health, infrastructure, environment, economic development, and climate change.

Seven projects can be developed through Public-private collaboration implementation. This alternative involves the private participation in the provision of public infrastructure in a cost-effective manner.

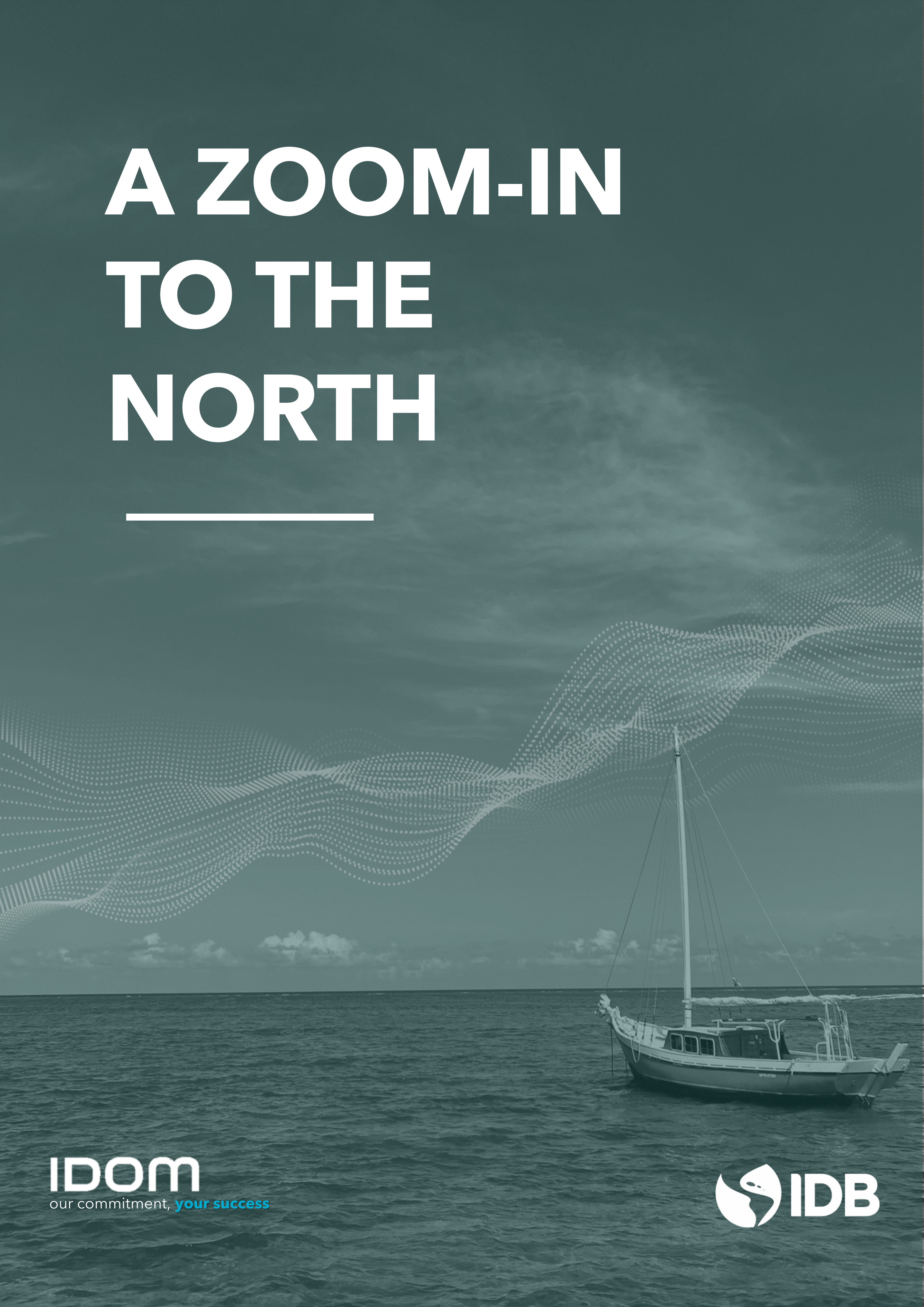
Thirteen projects can be implemented t reimbursable or non-reimbursable Technical Cooperation.

Seven projects could be developed through Concessional resources, non-reimbursable technical cooperation or green/blended financing. In the specific case of the construction of

the health center in Ambergris Caye, it could be implemented through the facilities provided by the Government of Taiwan, thanks to the good bilateral relationship.

Last, nine projects can be developed through a TP. For most of the projects, this procurement alternative is the most feasible option given the trajectory and the amount.

A ZOOM-IN TO THE NORTH



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our commitment, your success

IDB

6. A Zoom-in to the North

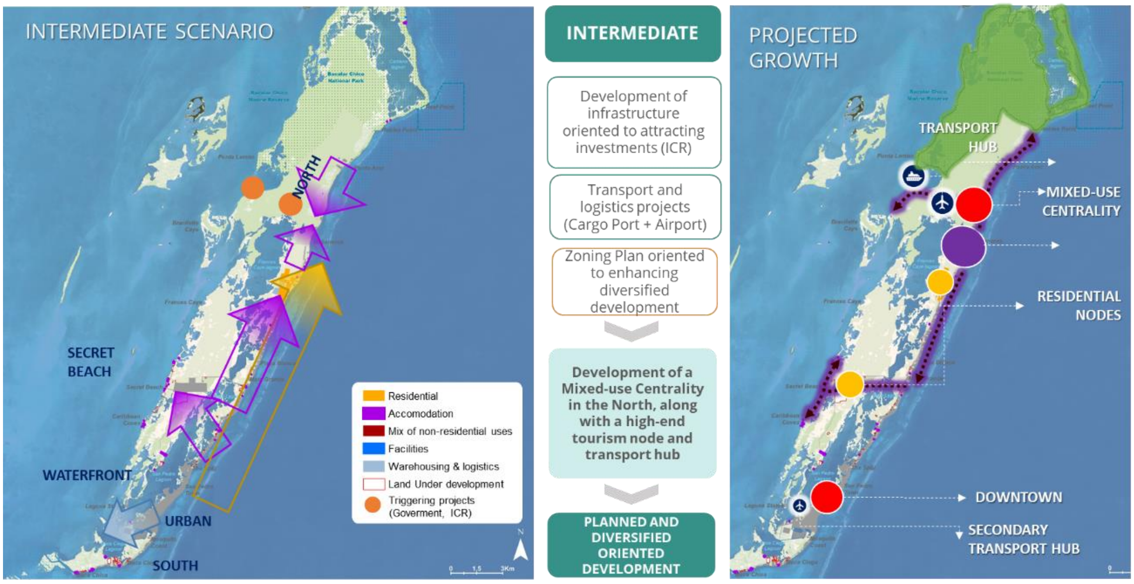
One of the main objectives of this **Strategic Plan** is to consolidate the sustainable growth of **Northern Ambergris**, through the execution of key projects directed to close the gaps in private investment and allow development to take place in a planned way. In this order, the analysis identified the main **triggering projects prioritized by the Task Force**, which were decisive assets that modified the growth vectors, as will be explained later in this chapter.

6.1. Growth vectors

In Ambergris Caye, through a multi-sector analysis, it was identified that the major organic growth trends are pointing towards the northern area, through predominantly linear developments along the coastline, mainly consisting of resorts and tourist housing. These dynamics will be significantly impacted by the execution of strategic projects of national interest, such as the new cargo port in Laguna Santa Cruz and the construction of a new International Airport in the surrounding area of Cayo Francés. This will represent a significant attractor factor for new developments, both for accommodations and residential and mixed-use developments to support these new infrastructures.

Taking the above into account, the consultancy has considered Northern Ambergris as an area of special focus in Ambergris Caye, for which, considering these triggering national investments and the infrastructure gaps identified by ICR, specific projects have been proposed in order to generate integral urban areas around the new tourist and logistical developments.

Figure 251 - Development Vectors



Source: IDOM, 2023

6.2. Tourism Growth Benchmark Analysis

Considering that Ambergris Caye is the most touristic destination in Belize, it is evident that the island has a growing number of visitors and tourism developments in its territory. Likewise, different investment gaps in the private sector were identified. Therefore, it is necessary to plan a high-level tourism development located in the developable areas of the north of the Caye that not only covers the different needs and activities of visitors, but also functions as a comparison between different types of investments that can be developed. In this way, a benchmarking of good tourism practices in destinations with similar characteristics to those of the Caye was carried out, in order to find the lessons learned from different places that have managed to promote tourism in a planned manner.

The following is the analysis carried out to compare cities such as Cancun and Punta Cana with Ambergris Caye as a high-level tourist destination.

As can be seen in the image below, the total surface of hotel infrastructure in Cancun reaches 1,241 acres. In this area, there are 1,129 large-scale hotels and an estimated beach extension of 110.90 acres. In Punta Cana, on the other hand, the total area of hotel infrastructure reaches 2,442 acres with a coastline distance of 8.6 miles. In this area, there are more than 700 large-scale hotels and a beach extension of 172.64 acres.

Considering the above, the proposal for Ambergris Caye sets an area of 1,372 acres for hotel infrastructure. Out of this designated area, a total of 1,163 acres are available for the development of a tourist corridor on the east coast, which is equivalent to 84.7% of the total area. This leads us to understand that a hotel infrastructure the size of Cancun or Punta Cana could perfectly adapt to the area designated in the east coast of the Caye.

Figure 252 - Scale analysis and comparison

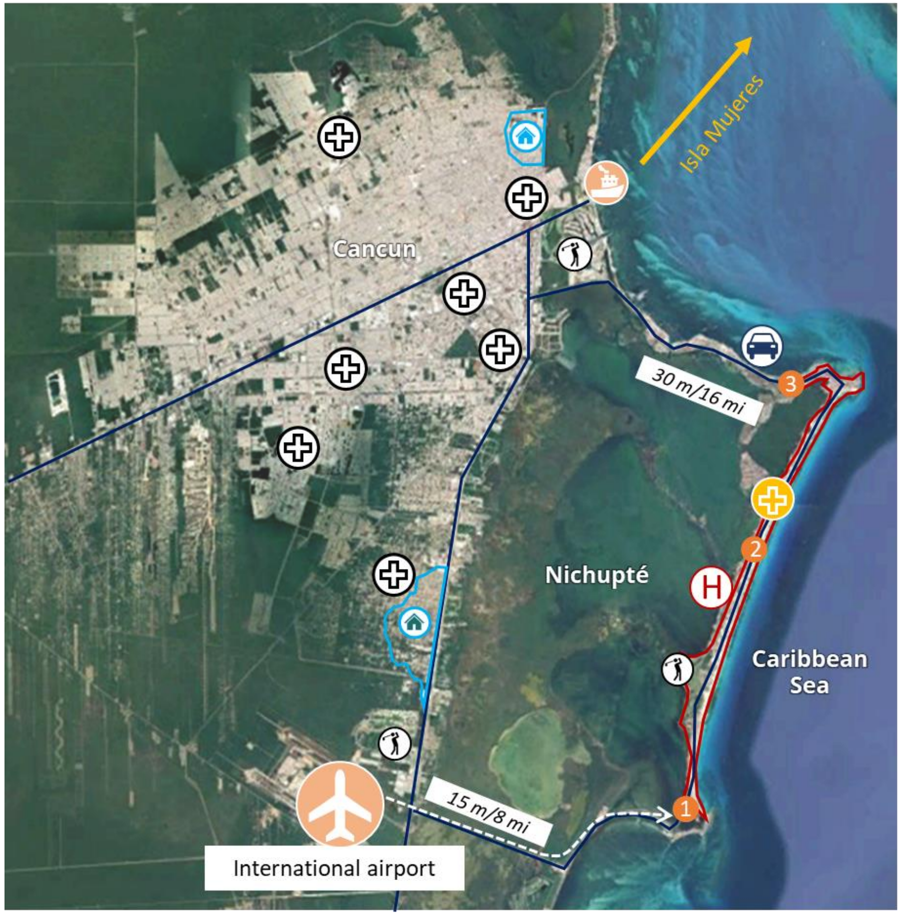
Source: IDOM, 2023

Once the scales of the analyzed cities were compared with Ambergris Caye. A detailed investigation was carried out on the different urban components necessary to cover an adequate high-level tourism development.

Figure 253 - City Context Cancún

BENCHMARK

CITY CONTEXT CANCUN (MEXICO)



SIZE & COMPOSITION	**452 mi2 – COASTAL CITY**
POPULATION	**777,615 inhabitants** (According to the 2020 census)

Distance and time mobilization analysis

POINT	Distance and Time	Port	Hospitals	International Airport	Employee´s Residence Zone	Employee´s Residence Zone
3	**Distance**	7 Mi	3.7 Mi	16 Mi	17.8Mi	10.1Mi
	Time	16 Min	10 Min	30 Min	38 Min	18 Min
2	**Distance**	11.3 Mi	2.2 Mi	11.8 Mi	12.6 Mi	13.6 Mi
	Time	26 Min	7 Min	21Min	34 Min	23 Min
1	**Distance**	17.3 Mi	6.4 Mi	8 Mi	8.3 Mi	11 Mi
	Time	32 Min	14 min	15 Min	32 Min	33 Min

Hospitals **Hotel Infrastructure Zone** **Port** **International Airport** **Main Roads** **Employee´s Residence Zone** **Golf Course**

- International airport
- Public and private transportation system
- Employee housing
- Health services infrastructure

Source: IDOM, 2023

Figure 254 - City Context Punta Cana

BENCHMARK

CITY CONTEXT PUNTA CANA (DOMINICAN REPUBLIC)

SIZE & COMPOSITION	**183 mi2 – COASTAL CITY**
POPULATION	**43,982 inhabitants** (According to the 2010 census)

Distance and time mobilization analysis

POINT	Distance and Time					
1	**Distance**	15.6 Mi	7.6 Mi	10.1 Mi	9.4 Mi	9.1 Mi
	Time	43 Min	22 Min	30 Min	23 Min	25 Min
2	**Distance**	14.7 Mi	4.7 Mi	14.9 Mi	3.3 Mi	12.4 Mi
	Time	41 Min	19 Min	42 Min	9 Min	28 Min
3	**Distance**	16.5 Mi	6.7 Mi	16.7 Mi	6 Mi	16.15 Mi
	Time	36 Min	14 min	37 Min	15 Min	35 Min

Hospitals · **Hotel Infrastructure Zone** · **Port** · **International Airport** · **Main Roads** · **Employee´s Residence Zone** · **Golf Course**

- Tourist zone in consolidation
- International airport
- Public and private transportation infrastructure
- Employee housing
- Health services infrastructure

Source: IDOM, 2023

Figure 255 - Marriott Cancun Resort

BENCHMARK (Hotels Study Cases)

MARRIOTT CANCUN RESORT– CANCUN

A. Location

B. General Characteristics.

Size:	7.1 Ha / 17.5 Acres
Estimated Guests at full capacity :	1.350
Estimated Rooms:	450
Beach:	YES
Variety of Activities :	YES
Height:	6 Floors

C. Hotel Activities

Length:	358.10 m / 1,174.86 ft

Spa, Bar, Business Center, Pool, Beach, Laundry Services

Convention Center, Gym, Restaurants, Hair Salon, Market

D. Beach Analysis

Beach Size:	Costal Zone :
0.50 ha / 1.25 ft	26.53 m / 87.05 ft

Level of Applicability:

Source: IDOM, 2023

Figure 256 – Live Aqua Hotel Punta Cana

BENCHMARK (Hotels Study Cases)

LIVE AQUA HOTEL – PUNTA CANA

A. Location

B. General Characteristics.

Size:	7.6 Ha / 17.34Acres
Estimated Guests at full capacity :	1.057
Estimated Rooms:	351
Beach:	YES
Variety of Activities :	YES
Height:	3 Floors

C. Hotel Activities

Length:	382.m / 1,253 ft

- Spa
- Bar
- Business Center
- Pool
- Beach
- Gym
- Restaurants
- Casino

D. Beach Analysis

Beach Size:	1.27Ha / 3.15 Acres
Costal Zone :	75 m /250 Feet

Level of Applicability:

Source: IDOM, 2023

6.3. New Possible Location for The Airport

The development of a new airport in the north of Ambergris Caye is a key point for the design of the scenario. The relocation of the San Pedro Airport allows infrastructure development with appropriate safety standards and improved capacity for air operations. According to the National Transportation Master Plan (NTMP) - 2018, there are three potential sites for locating the new airport: The following figure shows the three sites selected by the NTMP and the advantages and issues of each potential location.

The next chapter presents various analysis for the **New Ambergris Caye Airport**, a **benchmark** of international airfields built in similar contexts to the island, and a comprehensive **vision** for the new airport, including a **roadmap** that specifies the timeline and phases for the construction of the airport. **The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

6.3.1. Site Analysis for the New Airport

Each site was analyzed according to various factors, which included the **guidelines** outlined in the **National Transportation Master Plan**, the impact on natural protected areas, and the potential for effective property management. These aspects are explained in greater detail below.

Figure 257 Site Analysis for the New Airport

Potential sites for the New Airport according to the National Transportation Masterplan*
(Sites 1, 2 and 3)

Source: IDOM 2024

Option 1 **It was analyzed** according to the **National Transportation Masterplan.** It has the advantage of being close to future and current touristic developments. However, the lot belongs to the Social Security Board.

Option 2 **Was analyzed in the National Transportation Masterplan the site is not located on protected areas,** however, it was dismissed because its location requires additional infrastructure costs and increases travel time to downtown San Pedro.

Option 3 **dismissed** due to being **located on a natural protected area** (Bacalar Chico Natural Reserve)

Option 4 **Is not included in the National Transport Plan.** It was analyzed considering the initial development of a runway in the area, it was dismissed because of the proximity to west San Pedro lagoon.

Below is a **scoring matrix** in which the following evaluation criteria were considered: proximity to urban centers or areas of urban growth, location outside national protected areas, proximity to tourist developments, proximity to potential logistic hubs, no identified conflicts with landowners, and mobility and connection.

6.3.1.1. Scoring matrix for the New Airport

Figure 258 Scoring matrix for the New Airport

Infrastructure as a trigger for development

ICR needs
Government projects
market study main results

The relocation of the San Pedro Airport allows the development of an **infrastructure with adequate safety standards and improved capacity for air operations.** According to the National Transportation Master Plan (NTMP) - 2018, there are three potential airport location. It was also analyzed another site close to San Pedro Lagoon.

SITE	LOCATION NEAR URBAN CENTERS OR URBAN GROWTH	LOCATION OUTSIDE NATIONAL PROTECTED AREAS	CLOSE LOCATION TO TOURISTIC DEVELOPMENTS (CURRENT AND FUTURE)	PROXIMITY TO LOGISTIC HUBS	MOBILITY AND CONECTION
1 Secret Beach	✓	✓	✓	–	✓
2 Cayo Francés	✓	✓	–	–	–
3 Bacalar Chico	✗	✗	✗	✗	✗
4 West San Pedro Lagoon	✓	✓	✓	–	–

According to the last criteria, the consultancy recommends to select Site 1 (Secret Beach) to develop the New Ambergris Airport.*

SITE AREA	494 acres 200 ha	POTENTIAL RUNWAY LENGHT	8,800 ft 2,700 m	Potential use for mid-range aircraft models such as B737 or A320, and suitable for international flights

***The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

Source: IDOM 2024

Considering the above, it has been determined that **Site 1 is the most suitable potential location for the new Ambergris Caye airport** due to various factors such as: proximity to urban centers or areas of urban growth, location outside national protected areas and close location to tourist developments. It is important to emphasize that developing and improvement of the existing road network is essential for its proper functioning as it seeans in the Figure 260 Road section depending of the site of the airport

Figure 259 Opportunities and witnesses matrix (new airport site)

1 SECRET BEACH SITE

Road distance: 5,84 Miles (Estimated section 50 Ft)

Distance to San Pedro Center: 7,64 Miles

Time to San Pedro Center: 18 min*

Road cost: 3.052.000 USD

Estimated lots Intervention: 349

Estimated Speed: *25 Mph

It is important to emphasize that in this option, the construction of the boulevard should not be prioritized. Instead, the existing roads should be improved, as can be seen in the next slide with the section of road improvements

OPPORTUNITIES

Distance and time: The distance from San Pedro Center to the airport is around 18 minutes (23 minutes less than option 2). This proximity makes the airport highly accessible for residents and tourists, improving connectivity and reducing travel time.

Currently not developed area: The lot's sector is currently unused area.

Aircrafts approach and take-off: The location of the airport's site allows an optimal runway orientation for medium and large aircraft. In addition, there are no tall buildings nearby, minimizing potential obstacles for takeoff and landing operations.

WEAKNESSES

Urban footprint: The location of the airport may create future urban pressure on it. It is important to highlight the importance of purchasing the entire lot to secure an optimal space. This proactive measure will help manage and control future urban expansion.

Noise pollution: Due to the location near to a residential and touristic center (Grand Belizean Estate and Secret Beach), the landing and takeoff of aircraft could generate noise pollution impact.

Environmental impact: As the site is located in a highly dense mangrove area, significant deforestation of these vegetation would be necessary. This deforestation could have adverse effects on local wildlife and ecosystems.

2 CAYO FRANCÉS

Boulevard distance: 9,61 Miles (Estimated section 77 Ft)

Distance to San Pedro Center: 24,33 Miles

Time to San Pedro Center: 41 min

Boulevard cost: 7.176.000 USD

Estimated lots Intervention: 625

Estimated Speed: 35 Mph

It is important to emphasize that for this option, the construction of a boulevard should be prioritized, as can be seen in the next slide with the profile named Boulevard.

OPPORTUNITIES

Urban footprint: The site is not located near to consolidated urban centers, which is optimal for the potential expansion of the airport.

Noise pollution: Since the site is located in an area far from residential areas, the noise pollution would not have a significant impact to the population.

Currently unused area: The site is currently not developed, although a subdivision layout is already proposed according to the Land Department.

Aircraft approach: The aircraft approach is optimal due to the heights proposed in the zoning plan and because there are currently no adjacent constructions.

WEAKNESSES

Distance and time : The travel time from San Pedro Center to the airport could take around 41 minutes, which results in a longer travel time and distance for both domestic and international travelers.

Environmental impact: Since it is located near the Bacalar Chico Reserve, it could generate auditory, visual, and environmental pollution to the reserve, causing conflicts with the existing flora and fauna and the tree cover.

. Source: IDOM 2024

Based on the analysis previously carried out and considering the **National Transportation Masterplan**, it has been determined that **Site 1** is the best location for the potential construction of the airport. Additionally, the **previously mentioned recommendations** regarding wind factors, approach cone, and runway orientation, which are critical for the airport's development.

Figure 260 Road section depending of the site of the airport

1 SECRET BEACH SITE

Road distance: 5,84 Miles (Estimated section 50 Ft)

Distance to San Pedro Center: 7,64 Miles

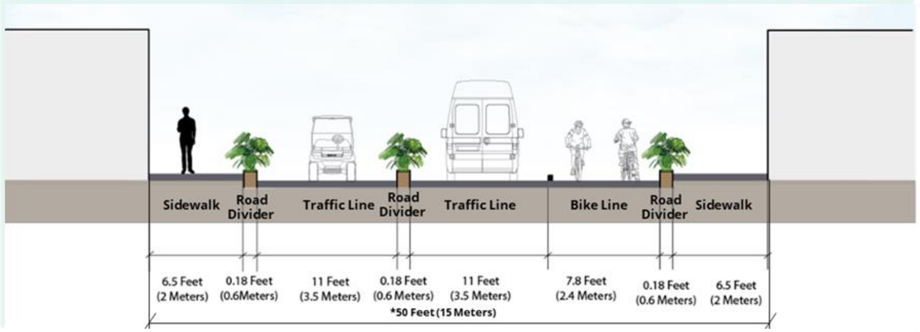
Time to San Pedro Center: 18 min*

Road cost: 3.052.000 USD

Estimated Speed: 25 Mph

It is important to emphasize that in this option, the construction of the boulevard should not be prioritized. Instead, the existing roads should be improved.

ROAD SECTION EXAMPLE (ROAD IMPROVEMENT)



2 CAYO FRANCÉS

Boulevard distance: 9,61 Miles (Estimated section 77 Ft)

Distance to San Pedro Center: 24,33 Miles

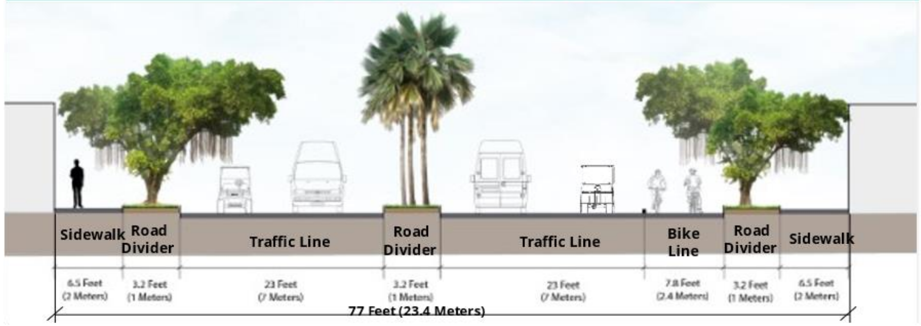
Time to San Pedro Center: 41 min

Boulevard cost: 7.176.000 USD

Estimated Speed: 35 Mph

It is important to emphasize that for this option, the construction of a boulevard should be prioritized.

ROAD SECTION EXAMPLE (BOULEVARD)



***The width of the sidewalk could depend in the with of the road section. Reviewing the existing profile between property boundaries, it is concluded that the proposed section (50 feet) fits the most critical sector from the center of San Pedro to the north.**

Source: IDOM 2024

6.3.2. Benchmark Analysis

6.3.2.1. Analysis of existing airports

To perform the benchmark, an initial analysis of Belize's two existing airports was done to understand their current operations. This involved examining factors like airport size, runway characteristics, classification (regional, domestic, or international), operational start year, weekly passenger and aircraft traffic, strengths and weaknesses, and the types of aircraft that they accommodate. The detailed analysis is explained as follows:

Figure 261 San Pedro John Greif II Airport analysis

San Pedro John Greif II Airport

Location
San Pedro, Belize

Size / /# /Landing tracks and Length
27.66 acres (11.19 Ha) / 1 / 0,63 Mile (1.1 Km)

Regional / Domestic / International
International

Beginning of commercial operations
1987

Number of flights an passengers per week
388 Flights / 4.656 Passengers / 12 Passengers per flight

Description
- The types of aircrafts that land at San Pedro Airport are primarily small to medium-sized.
- Handles domestic flights from Belize City and other regional destinations.
- Located in a popular tourist destination off the coast of mainland Belize in the Caribbean Sea
- The terminal includes basic facilities such as waiting area, check.in counters and a baggage claim area.
- Plays a crucial role in the local tourism industry.

ADVANTAGES	WEAKNESSES
Being located close to the urban center of san pedro allows for easy access to hotels and services.	The relatively short runway limits the types and sizes of aircraft and increases the risk of environmental disasters environmental and the urban vulnerability by been near San Pedro´s urban center.
Ongoing efforts to improve facilities and services to better accommodate the growing number of tourists and enhance safety and efficiency.	Small passenger capacity increasing the number of flights per day, among other environmental consequences.
Near to the current cargo port location.	Due to the urban consolidation near the airport, there is no possibility of expansion as it requires a land acquisition and likewise presents a limitation of heights and obstacles limiting the ability of aircrafts to land.
	Lack of a consolidated airport terminal.
	Vulnerability to weather-related disruptions.
	Air traffic congestion due to frequent arrivals of low-capacity aircrafts.

Type of Aircrafts

Small Commercial Aricraft
- Cessna 208 Caravan: **9-14 passengers**
- Britten-Norman Islander: **8-10 passengers**
- Cessna 172: **3 passengers**
- Cessna 182: **3 passengers**
- Cessna 207A Stationair: **7 passengers**
- Cessna 208B Grand Caravan: **10 passengers**

Charter Aircraft
- Piper PA-32 (Saratoga/Cherokee Six): **5-6 passengers**
- Beechcraft Bonanza: **4-5 passengers**

Private Aircraft
- Cessna 182: **3 passengers**
- Piper PA-28 Cherokee: **4-5 passengers**

Source: IDOM 2024

Figure 262 Philip S.W. Goldson International Airport analysis

Philip S.W. Goldson International Airport

Location
Belize City, Belize

Size / /# /Landing tracks and Length
335 acres (135 Ha) without expansion zone / 1 / 0,52 Mile (3.02 Km)

Regional / Domestic / International
International

Beginning of commercial operations
1943

Number of flights an passengers per week
378 Flights / 9.000 Passengers / 42 Passengers per flight

Description
- Located 10 miles from Belize City.
- Owned by the Government of Belize and Belize Airports Authority and operated by the Belize Airport Concession Company Limited .
- The terminal building has 110,000 sq. ft.
- In 2023: 4,200 international flights, 27,028 domestic flights, 2,040,000 domestic and international arriving, and 680,000 kg of cargo.

ADVANTAGES	WEAKNESSES
Nearest international airport with direct flights to Ambergris Caye connecting Belize to major destinations in North America, Central America and the Caribbean	During peak travel seasons, the airport can become congested, leading to long lines and wait times.
Largest and most transited airport of the country and the fifth one in Central America.	As the busiest airport in Belize, it contributes to noise pollution and carbon emissions.
Receives cargo, military and medical aircrafts.	The airport's operations can impact surrounding ecosystems and local communities.
Plans to extend the airport along with investments allow an increasing passenger and cargo capacity enhancing its facilities, services and modernization.	The airport competes with San Pedro's goal of having an international airport.
Expanding airport operations can create jobs in construction, airport services, retail, and hospitality, benefiting the local economy.	
Serves numerous international airlines offering direct flights to major cities like Miami, Houston, Dallas, and more.	

Type of Aircrafts

Commercial Passenger Jets
- Boeing 737: **85 - 215 passengers**
- Boeing 757: **200 - 295 passengers**
- Boeing 767: **181 - 375 passengers**
- Airbus A320: **140 - 240 passengers**
- Airbus A330: **250 - 440 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787: **242 - 335 passengers**

Charter Aircraft
- Cessna Citation series (CJ3, XLS): **6-12 passengers**
- Gulfstream jets (GIV, G550): **8-19 passengers**
- Bombardier Challenger series (300,605): **8-19 passengers**
- Other business jets: **6-19 passengers**

Emergency and Medical Aircraft
- Learjet 35/26: **4-8 passengers**
- Cessna Citation series: **6-12 passengers**
- Dedicated air ambulances: **Varies widely**

Cargo Aircraft
- Boeing 737: **20 tons**
- Boeing 757: **39 tons**
- Airbus A300: **48 tons**
- Boeing 747: **120 tons**

General Aviation Aircraft
- Cessna 172: **4 passengers**
- Cessna 182: **4 passengers**
- Piper PA-28: **4 passengers**
- Piper PA-32: **6 passengers**
- Beechcraft Bonanza: **6 passengers**
- Learjet series (45, 60): **6 – 8 passengers**

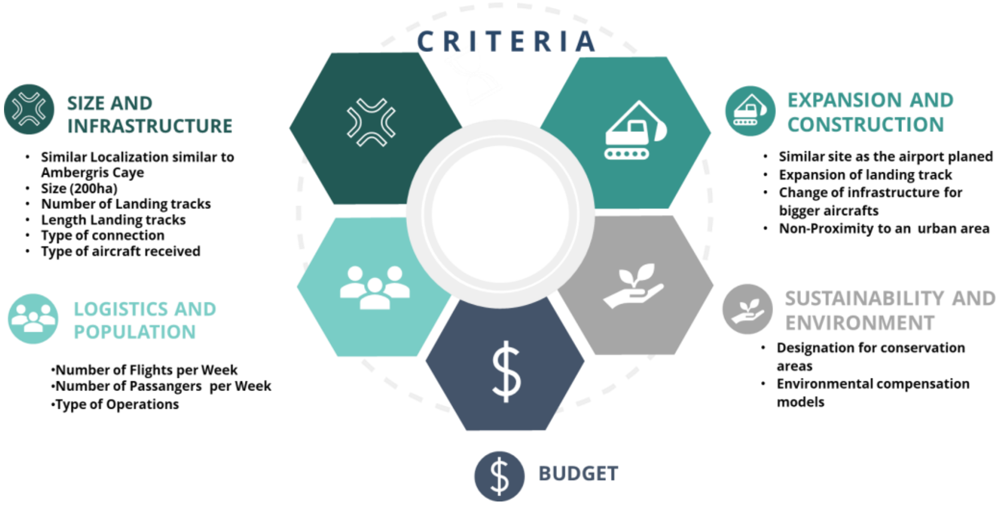
Military Aircraft
- C-130 Hercules: **92 troops / 64 paratroopers**
- F-16 Fighting Falcon: **1-2 Crew**
- Bell UH-1 Huey: **14 troops**
- Sirkosky UH-60 Black Hawk: **11 troops**

Source: IDOM 2024

6.3.2.2. Benchmark Methodology

The development of the benchmark is based, a detailed investigation will be conducted to create a comprehensive list of ten **(10) worldwide airports (Annex E).** This stage will involve reviewing similar airfields in different parts of the world to obtain a global and enriching perspective. In this investigation, the following criteria will be analyzed.

Figure 263 Benchmark Methodology

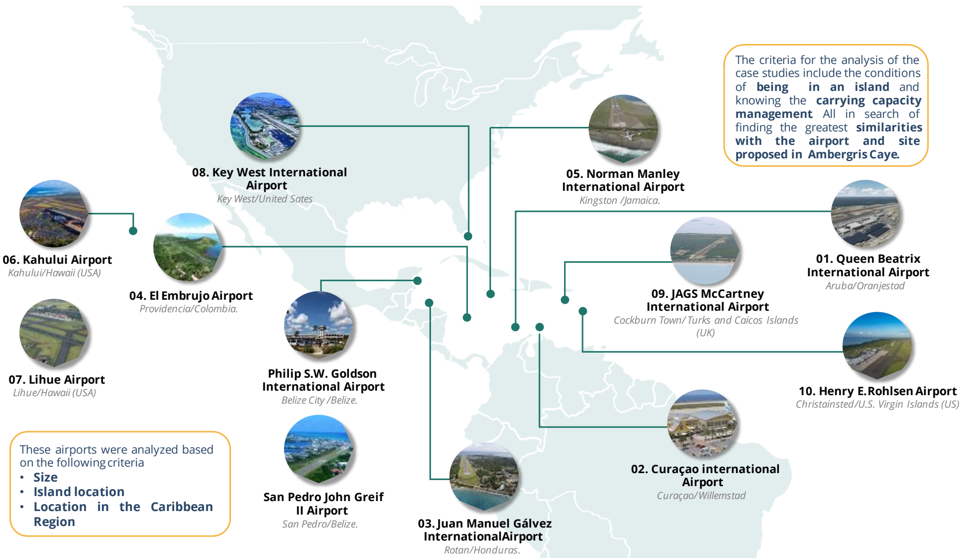


Source: IDOM 2024

6.3.2.3. Prioritization of Successful Cases

Subsequently, a more precise evaluation phase will be carried out, in which three **(3) prioritized airports will be selected from the ten previously analyzed.** These airfields will become key references, serving as guides and examples to follow for the **vision of the new Ambergris Caye airport.** This **selection will be made considering aspects** such as location, size, the year commercial operations began, the number of flights and passengers per week, and other factors that highlight each of these references, such as infrastructure, sustainability, benefits to the region, positive impacts, and a detailed analysis of lessons learned.

Figure 264 Location maps of benchmark study cases.



Source: IDOM 2024

6.3.3. Prioritized Cases

Table 120 Prioritization of Successful Cases

CRITERIA EVALUATED												
Airport	San Pedro John Greif II Airport	Philip S.W. Goldson International Airport	Queen Beatrix International Airport	Curaçao international Airport	Juan Manuel Gálvez International Airport	El Embrujo Airport	Norman Manley International Airport	Kahului Airport	Lihue Airport	Key West Airport	JAGS McCartney International Airport	Henry E. Rohlsen Airport
SIZE AND INFRASTRUCTURE												
Similar Localization similar to Ambergris Caye												
Size												
Number of Landing tracks												
Length Landing tracks												
Type of connection												
Type of aircraft received												
LOGISTICS AND POPULATION												
Number of Flights per Week												
Number of Passangers per Week												
Type of Operations												
EXPANSION AND CONSTRUCTION												
Similar site as the airport planed												
Expansion of landing track												
Change of infrastructure for bigger aircrafts												
Non-Proximity to an urban area												
SUSTAINABILITY AND ENVIRONMENT												
Designation for conservation areas												
Environmental compensation models												
BUDGET												
Construction Budget												

#	1	2	3	4	5	6	7	8	9	10	11	12
Country	Belize	Belize	Aruba	Curaçao	Honduras	Colombia	Jamaica	Hawaii- United states	Hawaii- United states	United states	Turks and Caicos Islands (United Kingdom)	U.S. Virgin Islands (United States)
City	**San Pedro**	**Belize City**	**Oranjestad**	**Willemstad**	**Rotan**	**Providencia**	**Kingston**	**Kahului**	**Lihue**	**Key West**	**Cockburn Town**	**Christainsted**
Name	San Pedro John Greif II Airport	Philip S.W. Goldson International Airport	Queen Beatrix International Airport	Curaçao international Airport	Juan Manuel Gálvez International Airport	El Embrujo Airport	Norman Manley International Airport	Kahului Airport	Lihue Airport	Key West Airport	JAGS McCartney International Airport	Henry E. Rohlsen Airport

Source: IDOM 2024

Considering Table 120 Prioritization of Successful Cases, it can be concluded that the airports with the highest applicability for the construction of the vision for the new airport in Ambergris Caye were selected using a traffic light classification methodology, where each criterion has a value depending on its hierarchy. Cases that predominated in the green color were selected for a deeper analysis, as they offer greater insights and lessons learned.

Below is a brief description of each:

- **Juan Manuel Gálvez International Airport**: Located on Roatán Island, Honduras, this airport has evolved from a modest facility in the 1970s to a modern international airport.
- **Key West International Airport (EYW):** Situated two miles east of downtown Key West, Florida. Despite its small size, it accommodates various aircraft and provides direct flights to major U.S. cities.
- **JAGS McCartney International Airport:** The main air hub for the Turks and Caicos Islands, located on Grand Turk Island. This airport, opened in 1990, primarily serves flights from North America and the Caribbean.

Figure 265 Prioritized cases localization.

Source: IDOM 2024

Below is a detailed explanation of each of the prioritized airports. An exhaustive description of each is included, as well as the differentiating factors that contribute to the formulation of the vision for the new airport in Ambergris Caye. Finally, a series of lessons learned are presented, offering guidelines and key indicators that can be implemented for its formulation.

Figure 266 Prioritized cases / Juan Manuel Gálvez International Airport

1 Juan Manuel Gálvez International Airport

Location
Roatán, Honduras

Size /# Landing tracks and Length
167.67 acres (67.5 Ha) without expansion zone / 1 / 1,36 Mile (2.2 Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1990

Budget
- Initial Construction Phase (1988): **5.000.000 USD**
- Expansion and Renovation (2013): **7.800.000 USD**
- Runway Extension (2022): **8.000.000 USD**

Number of flights an passengers per week
245 Flights / 11.538 Passengers/ 47 Passengers per flight

Project Description
Juan Manuel Gálvez International Airport, located on the island of Roatán in Honduras, has undergone several significant phases of construction and development since its inception. Initially built in the 1970s to serve the growing tourism industry, the airport was a modest facility with a short runway and limited passenger amenities. In the early 2000s, recognizing the need to accommodate increasing tourist traffic, the airport underwent a major expansion. This included extending the runway to handle larger aircraft, building a new terminal to provide modern facilities for passengers, and improving air traffic control systems. Further upgrades were made in the 2010s, with enhancements to the terminal building, additional parking areas, and improved access roads, all aimed at enhancing the overall travel experience. Today, Juan Manuel Gálvez International Airport stands as a crucial gateway to the Bay Islands, blending modern infrastructure with the natural beauty of its surroundings.

Distinguishing factors

Infrastructure
- Modern Facilities: The upgraded terminal offers a range of amenities for passenger comfort and convenience.
- Efficient Layout: Designed to minimize wait times and ensure a seamless travel experience.
- Runway Extension: The extended runway accommodates larger aircraft, enhancing connectivity.

Sustainability
- Environmental Considerations: Efforts to minimize the airport's ecological footprint, given its proximity to sensitive marine environments.
- Energy Efficiency: Implementation of energy-saving technologies and sustainable practices in airport operations.
- CultureFriendly and Hospitable Staff: Reflects the warm and vibrant culture of the island, enhancing the traveler's experience.
- Cultural Representation: Incorporation of local art and cultural elements within the airport's design and facilities.

Benefits to the Region
- Boost to Tourism: Facilitates access to Roatán's beaches, diving spots, and other attractions, driving economic growth.
- Job Creation: Provides employment opportunities for local residents, both directly at the airport and indirectly through increased tourism.
- Economic Development: Enhances the region's infrastructure and services, benefiting the local community and businesses.

Level of Applicability

Image / Project Blueprint

Positive Impacts

Connectivity | Boosting Tourism | Construction Phases | Environmental Recovery | Strategic Planning

Lessons Learned
- The airport plays a crucial role in connecting the Bay Islands of Honduras with the mainland and other international destinations.
- Its location on Roatán Island offers convenient access to other popular Bay Islands such as Utila and Guanaja.
- Providing a pleasant and efficient experience for travelers can positively impact the region's tourism industry.
- Strategic planning and continuous improvement are necessary to accommodate future growth and maintain high service standards.
- Environmental considerations, such as sustainable building practices and efficient waste management, are important for long-term operational success.
- Community engagement and support are vital in developing and maintaining airport facilities that meet the needs of both residents and visitors.

Source: IDOM 2024

Figure 267 Prioritized cases / Key West Airport

2 Key West Airport

Location
Key West, United states

Size /# Landing tracks and Length
165.58 acres (66 Ha) without expansion zone / 1 / 1,05 Mile (1.7Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1953

Budget
- Renovation (2009): **31.600.000 USD**

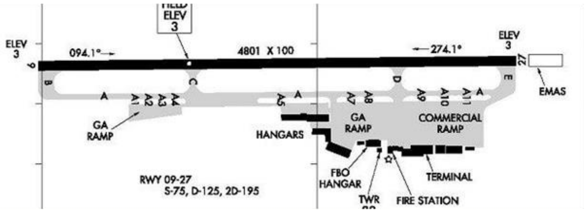
Number of flights an passengers per week
158 Flights / 18.000 passengers / 113 Passengers per flight

Project Description
Key West International Airport (EYW) is a public airport located just two miles east of downtown Key West, Florida, serving as the primary gateway for air travelers to the island. The airport features a charming, tropical-themed terminal that embodies the laid-back atmosphere of the Florida Keys. Despite its relatively small size, EYW accommodates various aircraft, including commercial airliners, private planes, and general aviation. The runway's proximity to the surrounding water offers passengers stunning views during takeoff and landing. EYW hosts several major airlines, providing direct flights to key cities such as Miami, Atlanta, Charlotte, and Dallas, making it a convenient entry point for tourists and residents. The terminal includes amenities like rental car services, ground transportation, convenient parking, dining options, a gift shop, and comfortable waiting areas. Known for its efficiency and friendly staff, EYW ensures a smooth travel experience, while its unique location and welcoming atmosphere make it a memorable part of any trip to the Florida Keys.

Distinguishing factors
- **Size and Facilities:** Despite its small size, the airport provides essential services such as car rental counters, gift shops, cafes, and a restaurant.
- **Limited Commercial Service:** Key West International Airport serves as a regional airport with limited commercial airline service, primarily connecting to major hubs like Miami and Fort Lauderdale.
- **Tourism Gateway:** As a key entry point to Key West, the airport plays a crucial role in supporting the tourism industry of the area, especially during peak seasons.
- **Convenient Location:** It's conveniently located just a few minutes from downtown Key West, making it easily accessible to tourists and locals alike.
- **Tourism Hub:** EYW is a major gateway for tourists visiting Key West, known for its vibrant arts scene, historic sites like Ernest Hemingway's home, and outdoor activities such as fishing, diving, and sailing. The airport plays a crucial role in supporting the local tourism industry.
- **Environmental Impact:** Due to its location in a sensitive ecological area, EYW operates with a focus on minimizing its environmental impact. Measures include noise abatement procedures and careful management of local wildlife and habitats.
- **General Aviation and Charter Flights**: It accommodates a significant number of general aviation and charter flights, catering to private aircraft and tours.

Level of Applicability

Image / Project Blueprint



Positive Impacts

Connectivity · Boosting Tourism · Construction Phases · Environmental Recovery · Strategic Planning

Lessons Learned

- Efficient Operations in a Small Space: EYW demonstrates that even smaller airports can efficiently handle various types of aircraft and provide essential passenger services like car rentals and dining options.
- Strategic Location for Tourism: Being located near downtown Key West, EYW serves as a vital gateway for tourists, highlighting the importance of airports in supporting local tourism economies.
- Environmental Awareness and Management: Operating in a sensitive ecological area, EYW's focus on minimizing environmental impact sets a precedent for balancing transportation needs with environmental stewardship.
- Role in Regional Connectivity: Despite its size, EYW connects to major hubs like Miami, showcasing its role in regional air travel and accessibility.

Source: IDOM 2024

Figure 268 Prioritized cases / JAGS McCartney International Airport

3 JAGS McCartney International Airport

Location
Cockburn Town, Turks and Caicos Islands (United Kingdom)

Size /# Landing tracks and Length
255.68 acres (103 Ha) without expansion zone / 1 / 1,30 Mile (2.1 Km)

Regional / Domestic / International
Domestic

Beginning of commercial operations
1984

Budget
- Concourse and Expansion (2022): **6.000.000 USD**

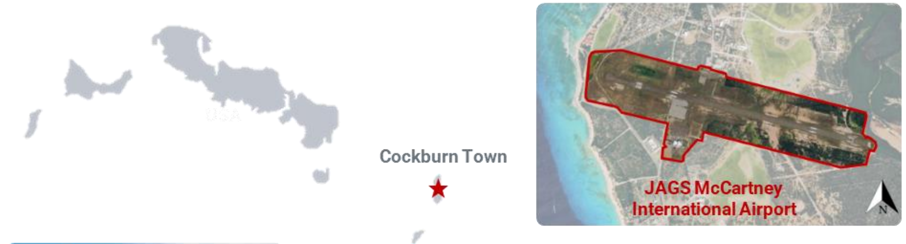
Number of flights an passengers per week
74 Flights / 1.368 Passengers / 18 Passengers per flight

Project Description
The JAGS McCartney International Airport, situated on Grand Turk Island, is the main air hub serving the Turks and Caicos Islands. Named in honor of James Alexander George Smith McCartney, a pivotal figure in the islands' political history, the airport plays a crucial role in connecting this British Overseas Territory to the rest of the world. Opened in 1990, JAGS McCartney International Airport has undergone expansions and upgrades to meet growing tourism demands. It boasts a single runway and a modern terminal equipped with amenities such as duty-free shopping, dining options, and rental car services. The airport primarily handles flights to and from destinations in North America and the Caribbean, supporting both commercial airlines and private aviation. Its strategic location on Grand Turk, with its stunning beaches and historical sites, makes it a gateway for travelers seeking tropical beauty and cultural exploration in the Turks and Caicos Islands.

Distinguishing factors
- **Gateway to Multiple Destinations:** Provides connections to various international and regional destinations, primarily in North America and the Caribbean, enhancing global accessibility for tourists and locals alike.
- **Efficient Operations:** Known for its efficient operations and reliable services, ensuring smooth transit and departures for passengers.
- **Scenic Location:** Located on Grand Turk Island, offering picturesque views and easy access to the island's natural beauty, including pristine beaches and vibrant marine life for travelers to explore.
- **Cultural and Historical Heritage:** Reflects the rich cultural heritage of the Turks and Caicos Islands, honoring James Alexander George Smith McCartney through its name and contributing to the island's historical narrative.
- **Tourism Hub:** Plays a crucial role in the tourism industry of the Turks and Caicos Islands, supporting economic growth and development through increased visitor arrivals and tourism activities.
- **Community Impact:** Acts as a vital infrastructure hub for the local community, providing employment opportunities and contributing to the socio-economic well-being of Grand Turk Island and the surrounding areas.
- **Promotion of Renewable Energy:** Implements renewable energy sources such as solar power to reduce carbon footprint and energy consumption within the airport's operations.

Level of Applicability

Image / Project Blueprint



Positive Impacts

Connectivity | Boosting Tourism | Construction Phases | Environmental Recovery | Strategic Planning

Lessons Learned

- Regional Connectivity: Playing a significant role in regional air travel by connecting to major hubs emphasizes the airport's importance in enhancing regional connectivity and accessibility.
- Environmental Stewardship: Operating in a sensitive ecological area necessitates a focus on minimizing environmental impact. This includes sustainable practices in airport operations and perhaps even initiatives to mitigate aviation-related environmental effects.
- Operational Efficiency: Despite being a smaller airport, efficient operations in handling various aircraft types and providing essential passenger services demonstrate effective management and resource utilization.
- Tourism and Economic Impact: The airport's strategic location on Grand Turk Island serves as a crucial gateway for tourism, facilitating economic growth and cultural exchange by connecting the Turks and Caicos Islands with North America and the Caribbean.

Source: IDOM 2024

6.3.3.1. Conclusion of Study Cases

The impact of an international airport generates an improvement in the **quality of life, tourism, trade, employment, international relations and connections, culture, adaptation to climate risk and risks, and ecosystem care.**

It's necessary an efficient **road accessibility.**

The airports have between **2 to 3 vehicular routes to access allowing the high vehicular flow.**

Roatan's best practices allow to understand that **an environmental management model should be implemented** to generate a smaller carbon footprint.

A space of **494.211 Acres (200 ha) is sufficient to generate an efficient airport** in terms of construction, operations, aircraft movements, and massive passenger arrivals.

All airports must **have master plans for its proper execution**.

All airports **generate strategic tourism hubs** for the territory.

A master plan ensures the arrival of medium and large aircraft.

The construction of **the new airport should be done in phases** according to tourism projections and supply and demand.

It is necessary to propose **costs aligned with the phases** required for the construction of the airport.

It is necessary to secure the surrounding lots to avoid invasions and illegal land use.

The new airport will allow the promotion of tourism, communication between the island and citizen security by locating it on a land away from the urban footprint.

Taking, in to account the benchmark analysis the proposed new airport represents a strategic infrastructure development aimed at enhancing the island's connectivity and tourism potential. Efficient road accessibility is essential to manage the anticipated traffic flow.

The implementation of an **environmental management model**, like those applied successfully in Roatan, will be critical to minimizing the airport's carbon footprint and ensuring sustainable operations.

A site of **500 Acres (200 ha)** has been identified as sufficient to support the airport's construction, operations, and the anticipated volume of aircraft movements and passenger arrivals. The development of the airport should be guided by a comprehensive **master plan**, which will ensure the facility's capacity to accommodate **medium and large aircraft** enhancing regional and international connectivity and solidify its role as a strategic hub.

The phased approach to construction, aligned with tourism projections and demand, will allow for efficient resource allocation. Securing surrounding lots will be necessary to prevent unauthorized land use and ensure the airport's long-term operational integrity.

6.3.4. Airport sites analysis and Recommendations

Regarding the proposed locations for the new airport, it is important to note that, although a preliminary wind analysis is available, it is essential to conduct a **thorough field study** that includes **detailed measurements of wind speeds and directions** at the specific sites where the runway is proposed, considering the significant crosswind component that has been observed. Additionally, it is necessary to precisely define other critical technical aspects, such as the **type of approach to be used (IFR or VFR)**, and to provide a detailed analysis of operations and airspace usage, considering interactions with nearby airports and their impact on the safety and efficiency of operations.

Figure 269 Airport sites Recommandations.

Source: IDOM 2024

This process must be carried out in strict compliance with the standards and recommendations established by Annex 14 of the ICAO, as well as other applicable regulatory documents, ensuring that all necessary technical and safety considerations are addressed for the proper implementation of the project. Furthermore, these definitions should be integrated into the airport's master plan, aligning the proposed infrastructure with long-term operational and development objectives.

6.3.5. Vision for The New San Pedro Airport

The vision for San Pedro's new airport project should be to create a premier aviation hub that catalyzes tourism growth and economic development on Ambergris Caye. This vision should involve the strategic development of a Master Plan, ensuring the airport's infrastructure supports increased aircraft and passenger traffic while maintaining economic viability. The airport should focus on secure land use to prevent invasions, integrate comprehensive environmental and risk management strategies, and maintain public safety. Additionally, the project should emphasize enhancing road accessibility and ensuring the airport's proximity to urban centers to seamlessly connect with the local community.

Figure 270 Matrix / Comparison of Study Cases

	Belize Philip S.W. Goldson International Airport	Belize San Pedro John Greif II Airport	Honduras Juan Manuel Gálvez International Airport	USA Key West Airport	Turks and Caicos Islands JAGS McCartney International Airport	Belize New San Pedro Airport
BEGINNING OF COMMERCIAL OPERATIONS	1943	1987	1990	1953	1984	**2032**
PASSENGERS PER WEEK	20.000	4.656	10.500	25.100	1.368	**12.500**
PASSENGERS PER YEAR	1.040.000	242.112	546.000	1.305.200	71.136	**640.000**
SIZE	335 acres (135 Ha) **without expansion zone**	27.66 acres (11.19 Ha) **without expansion zone**	167.67 acres (67.5 Ha) **without expansion zone**	165.58 acres (66 Ha) **without expansion zone**	255.68 acres (103 Ha) **without expansion zone**	**494.211 Acres (200 Ha) With expansion Zone**
LANDING TRACK LENGTH	0,52 Mile (3.02 Km)	0,63 Mile (1.1 Km)	1,36 Mile (2.2 Km)	1,05 Mile (1.7Km)	1,30 Mile (2.1 Km)	**1,55 Miles (2.5 Km)**
EXECUTION COST	Expansion Project: **130.000.000 USD (2023)**	Rehabilitation: **13.810.000 USD**	Initial Construction Phase (1988): **5.000.000 USD** Expansion and Renovation (2013): **7.800.000 USD** Runway Extension (2022): **8.000.000 USD**	Renovation (2009): **31.600.000 USD**	Concourse and Expansion (2022): **6.000.000 USD**	Prefeasibility (2027-2030): **5.000.000 USD** Initial Construction Phase (2030-2032): **20.000.000 USD** Internationalization (2038-2040) **10.00.000 USD**
OPERATIONS	Commercial Private, Cargo, Military, Emergency and Medical	Small Commercial, Private	Commercial, Cargo, Private, Military	Commercial, Cargo, Private, Military	Commercial, Cargo, Private, Military	Comercial, Private, cargo

TARJETS

- Development of a Master Plan in phases
- Secure use landing to avoid invasions and illegal land use
- Economic viability
- Environmental and risk management
- Public safety
- Accessibility of road infrastructures* and proximity to urban centers

***The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

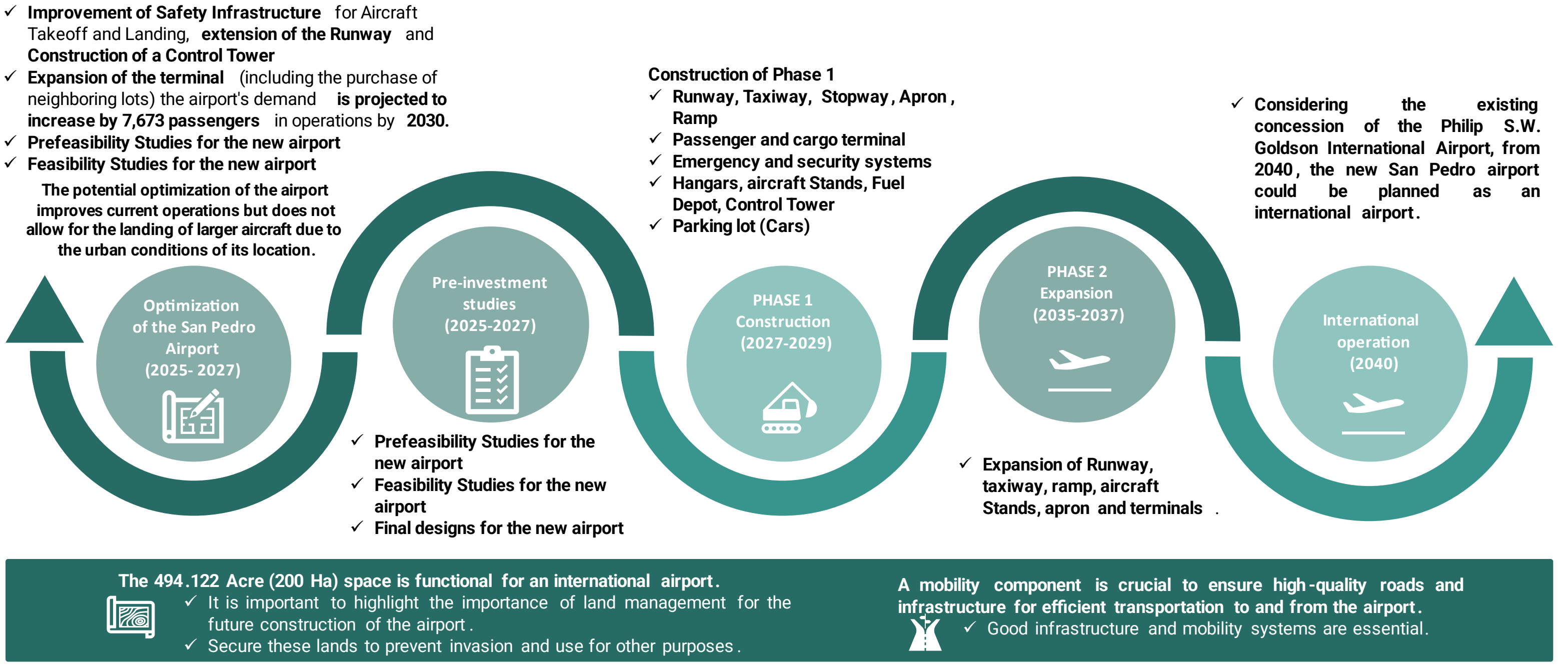
Source: IDOM 2024

6.3.5.1. Airport Road Map

Ambergris Caye New Airport project is an ambitious plan to reactivate and bring new tourists to Ambergris Caye, developing an infrastructure that allows a higher traffic of aircrafts and passengers than the actual airport. Taking into a count this objective, its vision considers:

Figure 271 Airport Road Map

NUMBER OF PASSENGERS									
YEAR	2022	Passengers % increase	2030	Passengers % increase	2035	Passengers % increase	2040	Passengers % increase	2045
# OF PASSENGERS PER YEAR	16,582	7,673	24,255	8,751	33,006	9,126	42,132	11,628	53,760
# OF PASSENGERS PER WEEK	318	178	496	137	633	175	808	223	1031



***IDOM´S Action Plan estimates a Pre-investment studies of 5,000,000 USD and an investment of 30,000,000 USD in two construction phases for the execution of the airport**

Source: IDOM and BTB projections, 2024

6.4. Triggering projects and actions to develop the north of the Caye.

Once defined and analyzed the minimum characteristics that must be considered to achieve a high-end tourist destination. A comparative matrix was developed that describes and demonstrates the different components that the Caye has or should have. The matrix is shown below.

Figure 272 - Comparative matrix between tourist destination

	Task	Cancun	Punta Cana	Ambergris Caye	ICR Needs	Northern Proposal
INFRASTRUCTURE REQUIREMENTS	International Airport	✓	✓	Local Airport	✓	✓
	Main Roads	✓	✓	Infrastructure	✓	✓
	Cargo Port	✓	✓	Size Improvement	✓	✓
FACILITIES	Hospitals & Health Centers	✓	✓	✗	✓	✓
PUBLIC SERVICES	Water & Sanitation	✓	✓	✗	✓	✓
	Public Transportation	✓	✓	✗	✓	✓
HOUSING	Employee's Residence Zone	✓	✓	Housing Improve	✗	✓

✓ Existent; ✗ Non-Existent; Need of Improvement

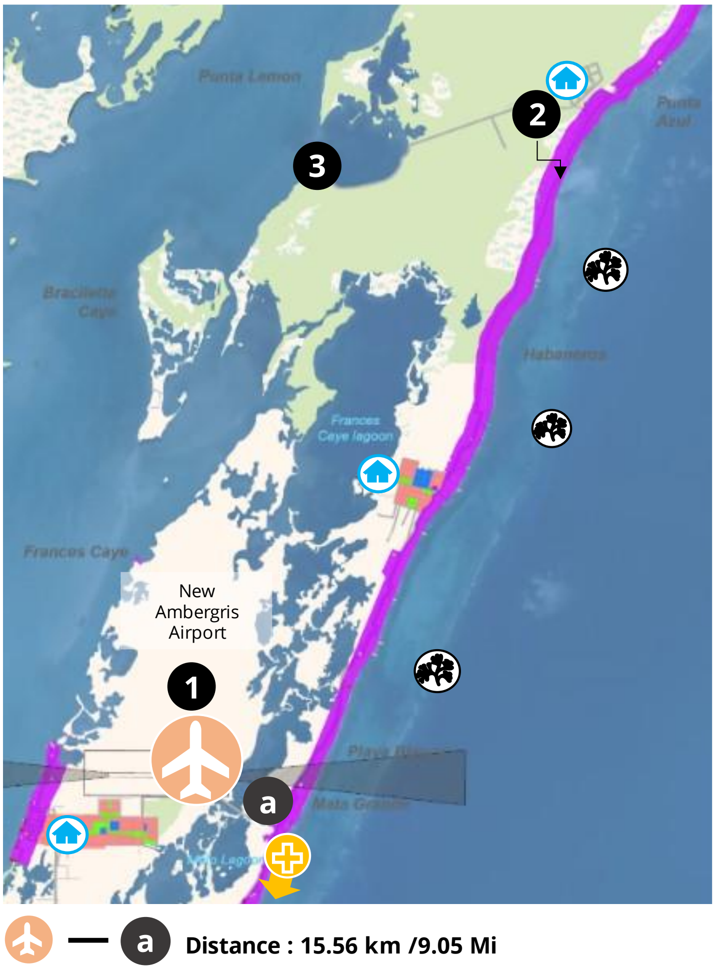
Source: IDOM,2023

As can be seen in the matrix, the Caye has great potential to become a high end tourist destination. However, it is evident that major infrastructure improvements must be developed to cover the basic needs of tourists visiting the island. Considering the cities compared and analyzing the missing elements for Ambergris Caye to become a responsible and sustainable tourism destination, the analysis of the consultancy was further developed.

To redefine the growth vectors and promote north development in a sustainable way, inputs were considered:

- Identification of **triggering projects that will change the vectors of growth** in the Caye, through key infrastructure (Investment Climate Reform -ICR.) and projects prioritized by the government.
- Identification of main **barriers to investment**
- Analysis of **best practices for the development of high-end tourism**, in conditions similar to those of the Caye.
- Evaluation of **potential airport locations**.

Figure 273 – Key factors to redefine the growth vectors and promote north development.



Source: IDOM, 2023

Key factors:

- Build new roads to link south - north side of the Caye.
- Develop new international airport infrastructure.
- Strengthen the transportation hub including the cargo port in the north of the cay.
- Construction of health facilities with high service standards.
- Extension of the tourist development corridor on the east coast- Approximately 1150 feet (350 meters deep).
- Develop housing nodes in the north of the island that offer services to the tourist industry.
- Develop facilities in the developed areas that guarantee quality of life for the local population and tourists.

A roadmap for the execution of the key factors identifies the timing and costs, according to pre-investment and investment relevant to the develop the north part of the island.

These are an integral part of the overall plans and projects, shown on the previous chapter, involving the south of the Caye.

Total **pre-investment US$2.1 million and total investment is US$97.4 million.** The pre-investment provides the appropriate technical support for the execution of investment, guaranteeing their quality and articulation with the fulfillment of the general vision of sustainable development 2045.

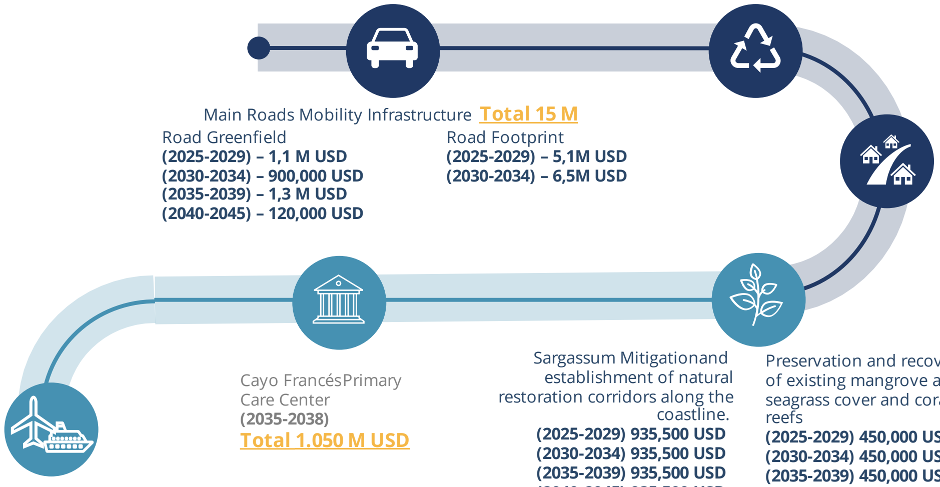
Figure 274 – General Roadmap to re-determinate the growth vectors and promote north development

To re-determine the growth vectors and promote north development, it is required:

Official approval and implementation of Plans (2025-2029)

1. Zoning plan official approval
2. Land use plan and its urban standards **150,000 USD**
3. Neighborhood improvement and land development Master Plan **150,000 USD**
4. Sustainable mobility plan (land, maritime, air and active mobility and public transportation system) **250,000 USD**
5. Master plan for public services (water, sewage, sanitation and energy) **1,500,000 USD**
6. Master plan for public space **90.000 USD**
7. Master plan for facilities **110.000 USD**
8. Master Plan for natural protected areas **350.000 USD**
9. Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process. **180.000 USD**

Total 12.2M



Expansion and improvement of road infrastructure
(2025-2029) 6,270,000 USD
(2030-2034) 7.400,000 USD
(2035-2039) 1,350,000 USD
(2040-2045) 120,000 USD
Total 15 M USD

Public services: water, sewage and energy
(2025-2029) 10,200,000 USD
(2030-2034) 2,100,000 USD
(2035-2039) 9,525,000 USD
(2040-2045) 1,850,000 USD
Total 23.6 M USD

Implementation of a public bicycle system, including bike lines
(2025-2029) 1,500,000 USD
(2030-2034) 600,000 USD
(2035-2039) 600,000 USD
(2040-2045) 250,000 USD
Total 2.9 M USD

Main Roads Mobility Infrastructure **Total 15 M**

Road Greenfield
(2025-2029) – 1,1 M USD
(2030-2034) – 900,000 USD
(2035-2039) – 1,3 M USD
(2040-2045) – 120,000 USD

Road Footprint
(2025-2029) – 5,1M USD
(2030-2034) – 6,5M USD

Urban Housing Development (Cayo Frances)
(2025-2029) 2,800,000 USD
(2030-2034) 3,500,000 USD
(2035-2039) 3,500,000 USD
Total 9.8 M USD

Preschool and elementary school
(2025-2029)
Total 732,500 USD

Construction of parks and green areas
(2025-2029) 950,000 USD
(2030-2034) 950,000 USD
(2035-2039) 950,000 USD
(2040-2045) 950,000 USD
Total 3.8 M USD

New Ambergris Caye Airport
30 M USD
New Northern Cargo Port
9 M USD
(2025-2040)
Total 39 M USD

Cayo Francés Primary Care Center
(2035-2038)
Total 1.050 M USD

Sargassum Mitigation and establishment of natural restoration corridors along the coastline.
(2025-2029) 935,500 USD
(2030-2034) 935,500 USD
(2035-2039) 935,500 USD
(2040-2045) 935,500 USD
Total 3.7 M USD

Preservation and recovery of existing mangrove and seagrass cover and coral reefs
(2025-2029) 450,000 USD
(2030-2034) 450,000 USD
(2035-2039) 450,000 USD
Total 1.3 M USD

Period	2025 -2029	2030 -2034	2035 -2049	2040 -2045	Total
Pre-investment	$12,370,000	$ 60,000	$ 57,000	$ 3,000	**$12,490,000**
Investment	$50,540,500	$31,535,500	$36,660,500	$15,405,500	**$134,142,000**
Total	**$62,910,500**	**$31,595,500**	**$36,717,500**	**$15,408,500**	**$146,632,000**

Note 1: All prices and execution dates include studies, design and construction phases.
Note 2: The roadmap and costs must be adjusted according to the preinvestment plans.

Source: IDOM, 2023

Table 121 Roadmap and Investment Plan for the Northern Zone

Specific Activities (Plans and Projects)		Pre-investment ($USD)	Investment ($USD)	Execution time (Years) Note: F: Formulation I:Implementation E:Execution 2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
TA1 - SUSTAINABLE AND INTEGRATED URBAN DEVELOPMENT																								
SL1 - SUSTAINABLE TERRITORY																								
PL1	Land Use Plan and its urban standards	$ 150,000	N/A	F										I										
						$ 150,000																		
SL2 - SUSTAINABLE MOBILITY																								
PL3	Sustainable Mobility Plan (land, maritime and air system, active mobility and public transportation system)	$ 250,000	N/A	F										I										
						$ 250,000																		
PR2	Expansion and improvement of road infrastructure	$ 180,000	$ 15,140,000	F											E									
PR2 F1	Expansion and improvement of road infrastructure greenfield north zone	$ 30,000	$ 3,490,000	$ 20,000			$ 1,120,000		$10,000			$ 900,000				$ 1,350,000					$ 120,000			
PR2 F2	Expansion and improvement of road infrastructure footprint north zone	$ 150,000	$ 11,650,000	$ 110,000			$ 5,150,000		$40,000			$ 6,500,000												
PR3	Implementation of a public bicycle system, including bike lines	$ 30,000	$2,950,000	F	E				F	E				F	E				F	E				
PR3 F1	Implementation of a public bicycle system, including bike lines in the north	$ 30,000	$ 2,950,000	$10,000			$ 1,500,000		$ 10,000			$ 600,000		$7,000			$ 600,000		$ 3,000			$ 250,000		
SL3 - NEIGHBORHOOD IMPROVEMENT AND HOUSING ACCESS																								
PL4	Neighborhood improvement and land development Master Plan	$ 150,000	N/A	F						I														
						$ 150,000																		
PR7	Urban Housing Development for the North (Cayo Francés)	$ 150,000	$ 9,800,000	F								E												
				$ 150,000			$ 2,800,000				$ 3,500,000					$ 3,500,000								
PR9	New Housing Development	$ 2,500,000	$ 32,900,000	F											E									
PR9 F1	Construction of new urban housing (Cayo Francés)	$ 2,500,000	$ 32,900,000	$ 2,500,000																				
PR9 F1A	*New affordable housing (Cayo Francés)*	N/A	$ 10,500,000			$ 2,200,000					$ 2,100,000					$ 2,600,000					$ 3,600,000			
PR9 F1B	*New workers housing (Cayo Francés)*	N/A	$ 22,400,000			$ 4,500,000					$ 4,500,000					$ 5,700,000					$ 7,700,000			
SL4 - PUBLIC SPACE AND URBAN FACILITIES																								
PL5	Master plan for facilities	$ 110,000	N/A	F										I										
						$ 110,000																		
PR10	Construction of educational facilities	N/A	$ 735,000	F										E										
PR10 F1	Preschool and elementary school North	N/A	$ 735,000			$ 735,000																		
PR11	Construction of Health Centers	$ 50,000	$ 1,050,000	F	E																			
PR11 F2	Cayo Francés Primary Care Center	$ 50,000	$ 1,050,000											F		E								
														$ 50,000			$ 1,050,000							
PL6	Master plan for public space	$ 90,000	N/A	F										I										
						$ 90,000																		
PR12	Construction of parks and green areas	N/A	$ 3,800,000	F										E										
PR12 F1	Construction of parks and green areas north zone	N/A	$ 3,800,000			$ 950,000					$ 950,000					$ 950,000					$ 950,000			
SL5 - PUBLIC SERVICES																								
PL7	Master plan for public services (water, waste, sewage, sanitation, and energy)	$ 1,500,000	N/A	F										I										
						$ 1,500,000																		
PR13	Expansion of the water and sewerage network	N/A	$ 20,075,000			F									E									
PR13 F1	Main Water & Sewage lines (North)	N/A	$ 800,000			$ 200,000					$ 200,000					$ 200,000					$ 200,000			
PR13 F3	Expansion of freshwater & Sewage network (North)	N/A	$ 2,350,000			$ 750,000					$ 700,000					$ 450,000					$ 450,000			
PR13 F5	Expansion of wastewater treatment plant	N/A	$ 6,800,000			$ 5,200,000										$ 1,600,000								
PR13 F6	Expansion of Desalinization treatment plant	N/A	$ 10,125,000			$ 4,050,000										$ 6,075,000								
PR17	Electrical network expansion plan	$ 300,000	$ 3,600,000				F									E								
PR17 - F4	North power grid construction (High Voltage)	$ 300,000	$ 3,600,000				$ 300,000				$ 1,200,000					$ 1,200,000					$ 1,200,000			
TA2 - NATURAL HERITAGE AND ENVIRONMENTAL CONSERVATION																								
SL6 - PROTECTION AND RESTAURATION OF HIGH VALUE ECOSYSTEMS AND ADAPTATION TO CLIMATE CHANGE																								
PL8	Master Plan for natural protected areas	$ 350,000	N/A	F										I										
						$ 350,000																		
PR18	Preservation and recovery of existing mangrove and seagrass cover and coral reefs	N/A	$ 5,092,000	F								E												
PR18 F1	Preservation and recovery of existing mangrove and seagrass cover and coral reefs (Located in the north zone)	N/A	$ 1,350,000			$ 450,000					$ 450,000					$ 450,000								
PR18 F2	Sargassum collection in the northern zone	N/A	$ 3,742,000			$ 935,500					$ 935,500					$ 935,500					$ 935,500			
TA3- COMPETITIVE AND SUSTAINABLE ECONOMY																								
SL7 - INCLUSIVE, COMPETITIVE AND SUSTAINABLE TOURISM																								
PL10	Update of the sustainable tourism plan for the island with regenerative tourism strategies and destination certification process.	$ 180,000	N/A	F										I										
						$ 180,000																		
PR24	New Ambergris Caye Airport	$ 5,000,000	$ 30,000,000		F		E								E				E					
					$ 5,000,000		$ 20,000,000								$ 10,000,000									
PR25.2	New Northern Cargo Port*	$ 1,500,000	$ 9,000,000					F		E														
						$ 1,500,000					$ 9,000,000													

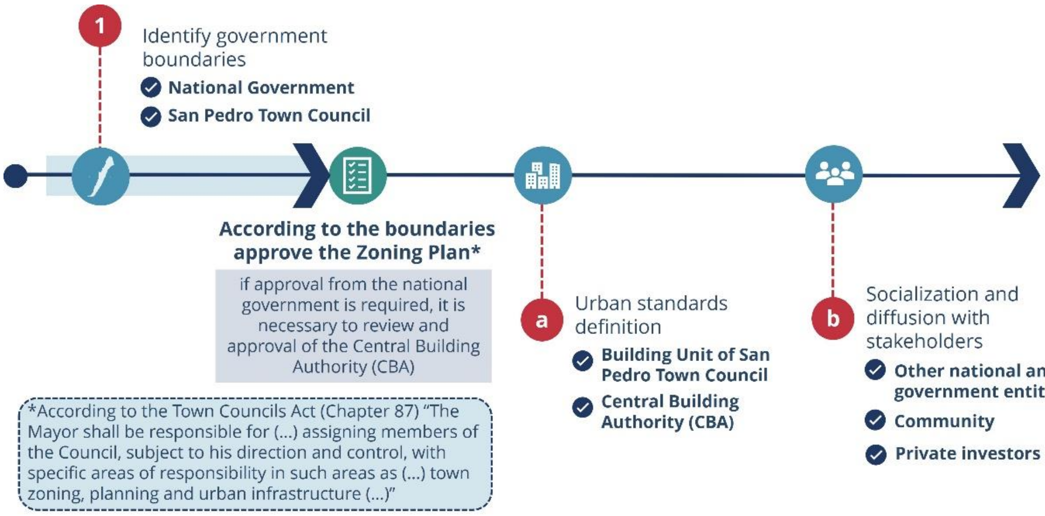
* It is important to notice that the investment in new housing (apart for social and workers) is not being considered in the total of the Action Plan/ the final price will depend in the approval of the power network project

Source: IDOM, 2024

Focusing on the first steps and narrowing down the needs, it is recommended to decide to strengthen the bases for the development of the projects in question, through the following actions:

- Identify administrative boundaries.
- Approve the Zoning Plan.
- Design and approve urban standards definitions.
- Socialization and diffusion with stakeholders.

Figure 275 – General Roadmap to approve the Zoning Plan.



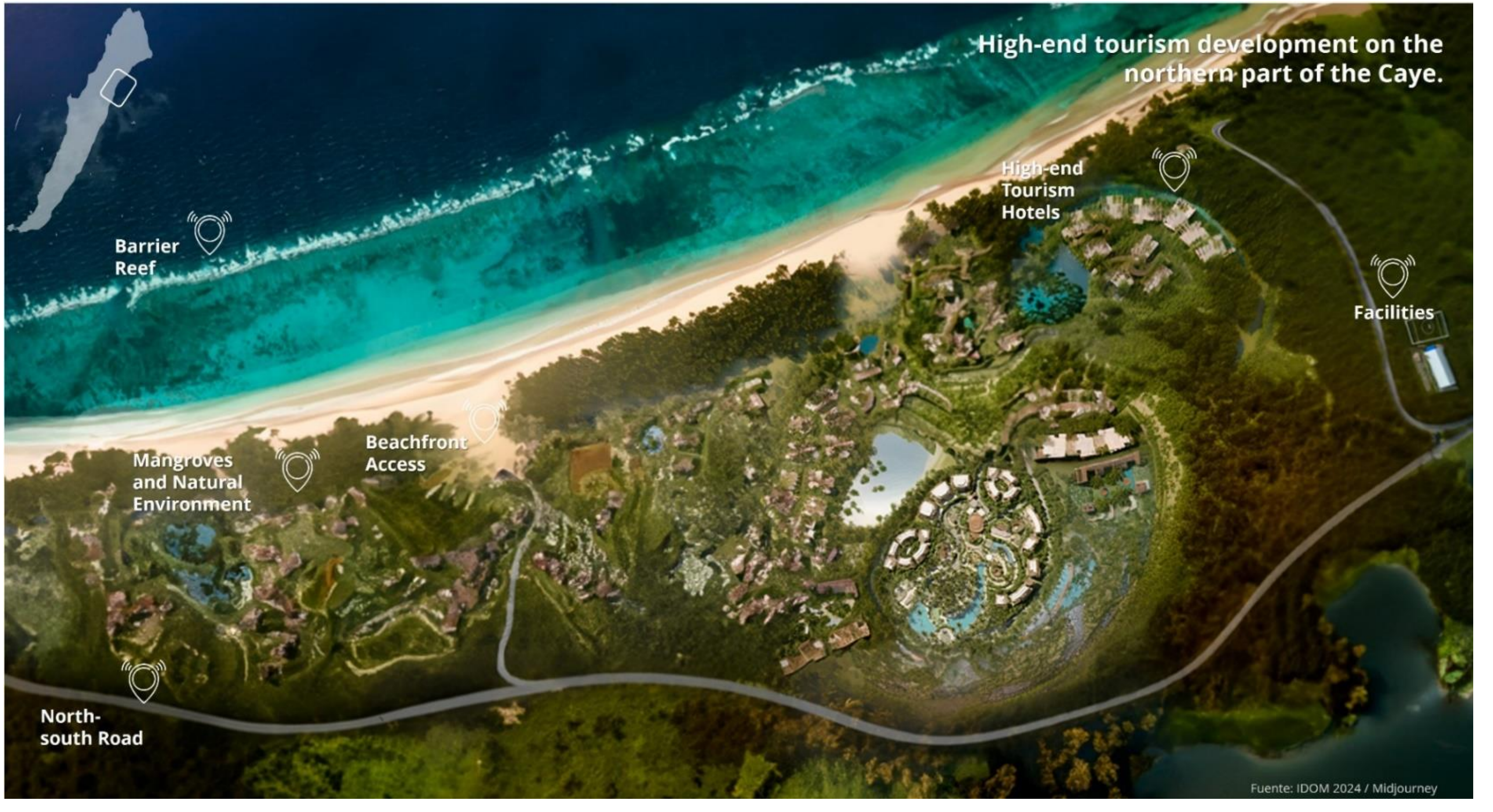
Source: IDOM, 2023

- **Identifying administrative boundaries:**
  Considering Belize´s institutional framework, which grants authority to both local and national governments for regulatory approval and recognizing the ongoing modification and delineation of new administrative boundaries on Ambergris Caye, it is highly recommended to conduct a legal analysis of the jurisdictional competences of the national and local governments across the entire perimeter of the caye. Such an analysis is essential, as the proposals outlined in this consultancy for sustainable urban development aim to cover 100% of the Caye´s territory.
- **Approve the Zoning Plan:**
  In order to ensure the planned and sustainable growth of the Caye, and considering its alignment with the Vision, Development Objectives and Plans and Projects to 2045, it is recommended that the Zoning Plan developed by this consultancy (Phase 4.) be adopted.
- **Design and approve urban standards definitions:**
  Based on the guidelines of the adopted Zoning Plan and the sustainable development guidelines, it is recommended to develop urban standards for sustainable development on a smaller scale, which will guide urban development on the Caye.
- **Socialization and dissemination with stakeholders:**
  Once the legal framework for the Caye's development has been adopted, it is recommended that the information be shared with the various stakeholders, according to the communications strategy developed by Pacifico.

6.5. Tentative renderings of the development in the north

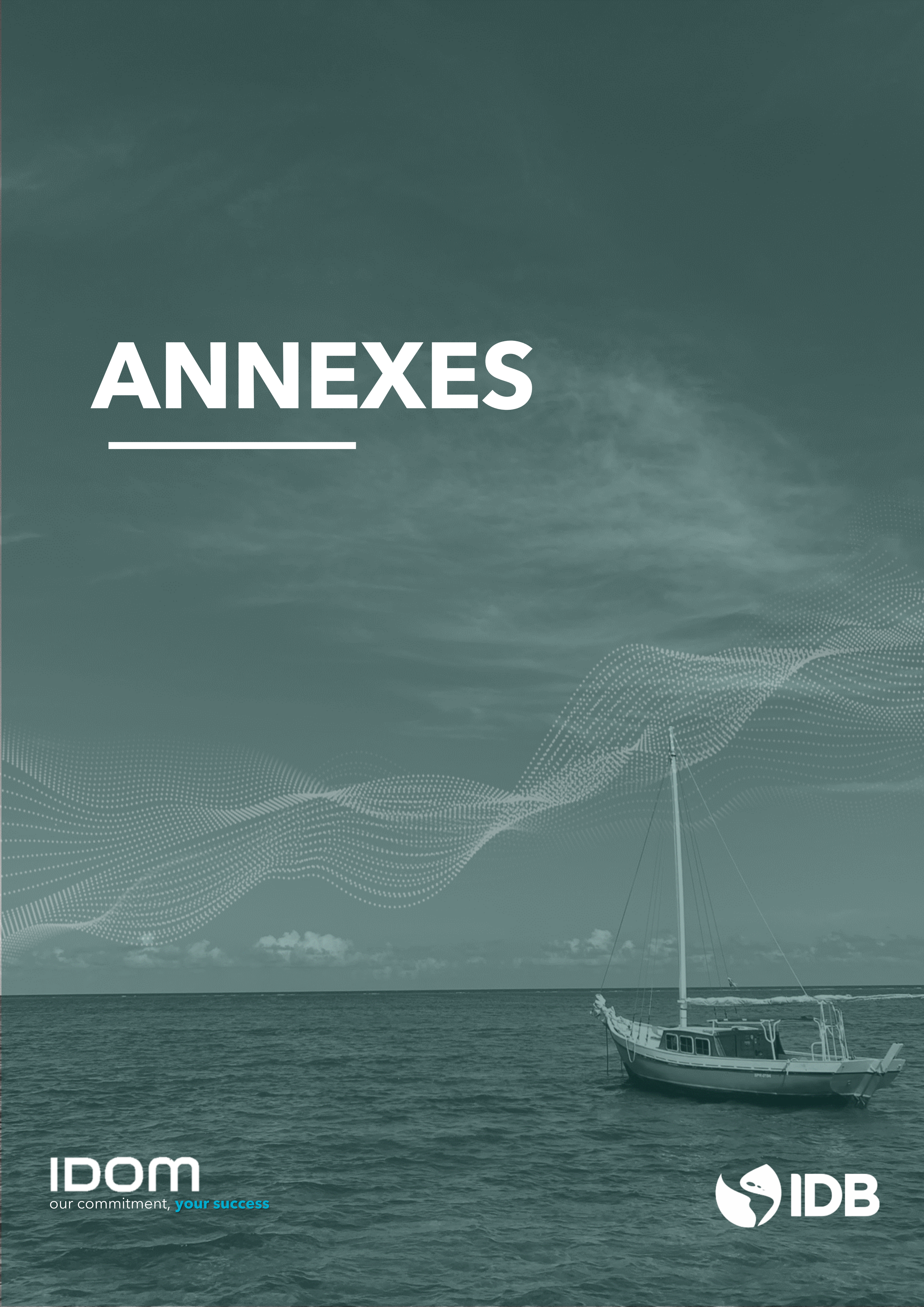
Some tentative images of the coastal area in the north of the island were made. The proposed hotel complexes and the different infrastructures and facilities that will be proposed for this sector can be seen.

Figure 276- Tentative renderings of the intermediate scenario



Source: IDOM, 2023

ANNEXES



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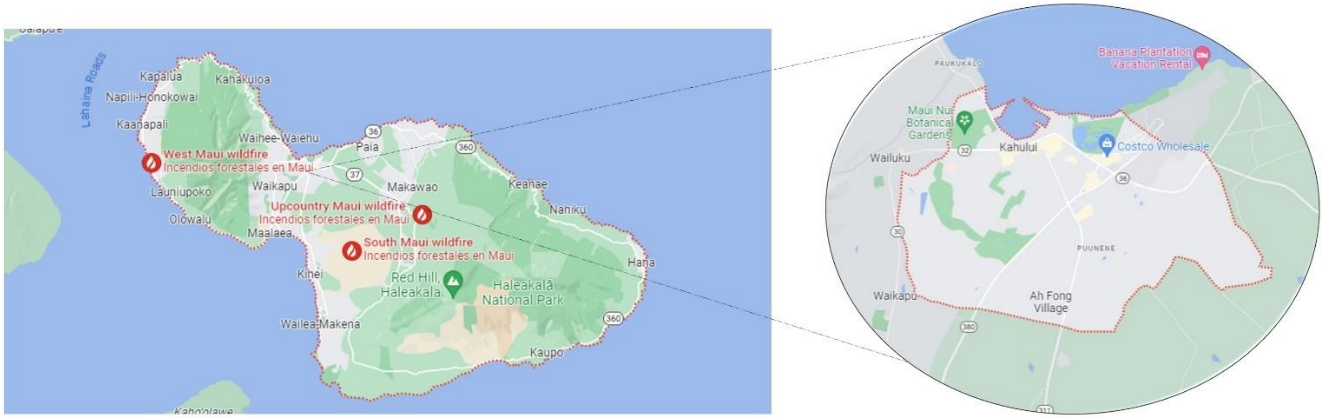
Annex A: Urban Growth and Carrying Capacity

In the following section can be found the different analyses carried out for the 11 destinations studied in the Benchmark, with the objective of collecting the lessons learned from each destination and the different forms of management, planning, environment, tourism, carrying capacity, among others. Likewise, an evaluation matrix was created to evaluate the 11 destinations in different components and thus prioritize 4 of them. Those with the highest scores in the matrix will be analyzed in detail in deliverable III of the consultancy. In this way, the case selection process was carried out to obtain the best lessons learned from the destinations previously studied.

Benchmark Case Studies

Maui Island, Hawaii – United States



SIZE & COMPOSITION	**728 square miles - ISLAND**
POPULATION	**165,386** inhabitants (According to projections to the 2022 US Census Bureau) Approximately
TRANSPORT INFRASTRUCTURE	**Kahului Airport.** Maui has 2 big commercial and cruise ports, **Kahului Harbor and Wailea Maui Ports.**
TOURISM & ECONOMY	**Tourism and construction** are the leading components of the Maui County economy
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** - ‘Ahihi-Kina‘u:, marine reserve, - Hanawi, natural reserve. - Kanaio, natural reserve - West Maui, Nature Reserve

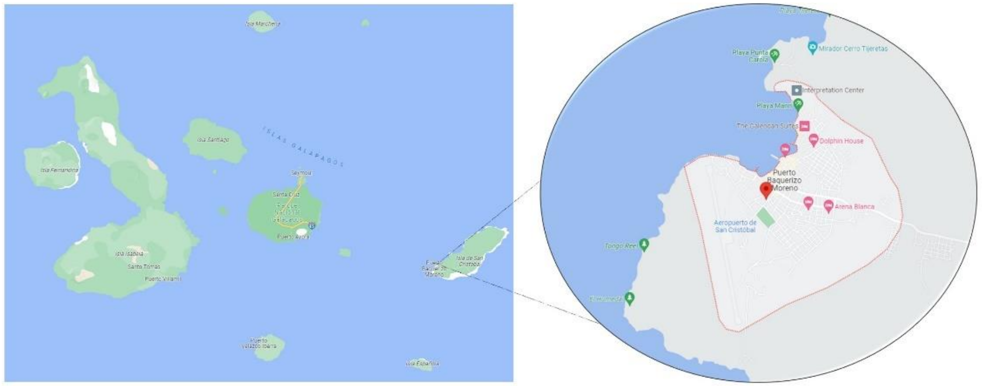
Highlights about Maui?

- Maui has a large number of environmental, tourism, land use and other **regulations.** These documents are **regularly updated** to ensure **optimal development of the island.**
- **Regenerative tourism** initiatives in process
- They have a high percentage of **repeat visitors and second homes** (short-term). Additionally, they are aware of the different **tourism targets**, honeymoons, leisure, and beaches, among others.

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Galapagos Islands – Ecuador



SIZE & COMPOSITION	**3,000 mi2 (Surface area calculated for the 13 islands.) - ISLANDS**
POPULATION	**33,042 inhabitants** (According to projections to 2020 from the 2015 census) Around the **13 islands**, the majority of the population settles in **Puerto Baquerizo Moreno**, the capital
TRANSPORT INFRASTRUCTURE	**"Seymour Airport" National Airport**. To arrive by air, you must land in Quito or Guayaquil. The Galapagos Islands have 3 ports of high relevance. **Puerto Baquerizo Moreno**, the main port located in the capital. **Puerto Ayora**, one of the most important tourist spots in the area and **Puerto Villamil.**
TOURISM & ECONOMY	The main economic activity of Galapagos is **leisure tourism** for its beaches and **unique biodiversity.**
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** - National Park Galapagos, declared natural heritage by UNESCO - Marine Reserve Galapagos. - Ecologic Reserve El Chato - Whale Marine Reserve

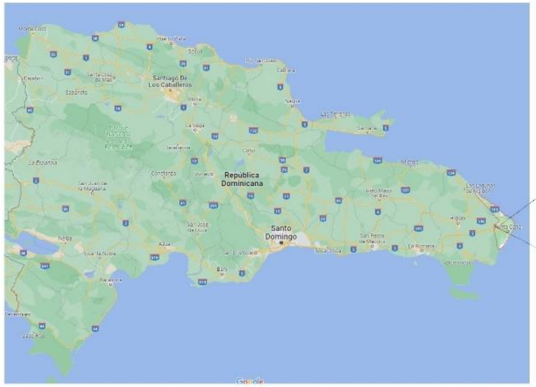
Highlights about Galapagos?

- It has **many planning instruments** for the different territorial components. **Urban, Environmental and Tourism.**
- **Land use plans** propose different **strategies to regulate, revalue and generate** new developments for **housing, public space and facilities**, among others.
- The **Environmental System** considers the need to **protect the territory** and **not affect the Galapagos National Park**, which encompasses all of the islands.

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Punta Cana – Dominican Republic



SIZE & COMPOSITION	**183 mi2 – COASTAL CITY**
POPULATION	**43,982 inhabitants** (According to the 2010 census)
TRANSPORT INFRASTRUCTURE	**Punta Cana International Airport,** recognized as one of the top ten international airports in Latin America and the Caribbean. Although Punta Cana is **not a major port area**, it has ports that play an important role in **maritime transportation and tourism activities**: - **Port of La Romana** - **Port of Higuey** - **Port of Cap Cana**
TOURISM & ECONOMY	Large hotels and resorts, beaches, foreign investments, among others, are the main pillars of the area's economy. Tourism is the main source of Punta Cana's economy.
PROTECTED AREAS AND/OR NATURE RESERVES	As an area known for its beaches and resorts, it does **not have any protected areas or nature reserves** in its surroundings.

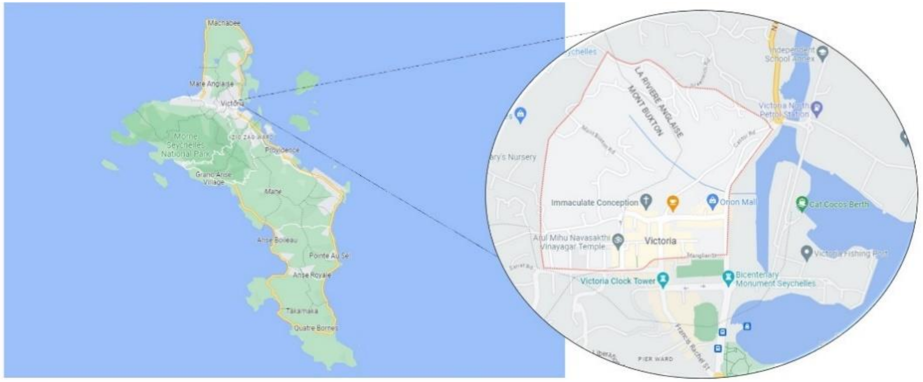
Highlights about Punta Cana?

- One of the **most popular tourist destinations** in the entire Caribbean.
- It has **paradisiacal beaches** with white sand, turquoise sea and coconut palm trees
- Prestigious **chain hotels, most of them all-inclusive.**
- **Vibrant nightlife** in its clubs, bars and casinos
- **Family destination**, with dolphinariums and fun for all ages.

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Mahe – Seychelles



SIZE & COMPOSITION	**61 mi2 - ISLAND**
POPULATION	**105,505 inhabitants** (According to the 2022 census)
TRANSPORT INFRASTRUCTURE	**Seychelles International Airport,** located on the island of Mahé, close to the capital Victoria The most relevant ports in the Mahé area are: **-Port Victoria** **-Mahé Inter-island Port** **-Eden Island Marina** **-Victoria Fishing Port**
TOURISM & ECONOMY	The main economic activity of Roatan is **leisure tourism** for its beaches and **aquatic activities** such as scuba diving and snorkeling.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** -Roatan National Marine Park, marine reserve, - Carambola Wildlife Reserve, natural reserve. - Gumbalimba Park, natural reserve - Sandy Bay-West End Nature Reserve

Highlights about Mahé?

- It is the **main island of Seychelles**
- One of the **largest terrestrial national parks** is located in Mahé, the Morne **Seychellois National Park, with an area of 2718 acres.**
- Mahé is the **political and economic center** of Seychelles.
- There are several **taxi/ferry companies** offering services on each of **the three main islands** (Mahé, Praslin and La Digue).

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Rapa Nui – Chile

SIZE & COMPOSITION	**63 mi2 - ISLAND**
POPULATION	**7,800 inhabitants** (According to estimations from 2021)
TRANSPORT INFRASTRUCTURE	**"Mataveri International Airport"**. To arrive to the island by air, you must land in Santiago de Chile. Rapa Nui has 2 main ports: - **Hanga Piko Port:** Cargo & Fishing Port
TOURISM & ECONOMY	Tourism is the primary economic driver on the island. The archaeological sites, the iconic Moai Statues, the beaches, the hiking trails, among others
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** - Rapa Nui National Park, declared natural heritage by UNESCO - Orongo Ceremonial Village, archaeological site - Rano Raraku, protected area - Anakena Beach, protected area

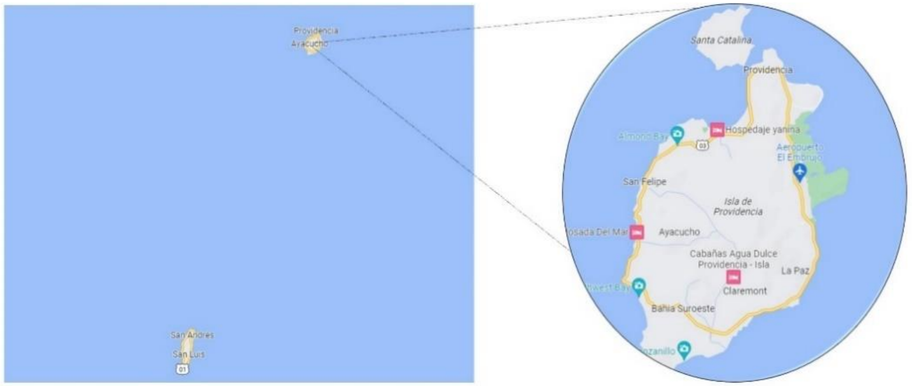
Highlights about Rapa Nui?

- Adequately cared for **archaeological values** and appropriate **sustainable tourism management.**
- The island establishes a **limit on the number of visitors** that can access the island in a given period. Limiting the number of tourists helps **reduce pressure on natural and cultural resources.**
- **Continuous monitoring** to evaluate the **impact of tourism** and adjust **management measures** according to the results.

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Providencia – Colombia



SIZE & COMPOSITION	**17 mi2 - ISLAND**
POPULATION	**4,545 inhabitants** (According to the 2018 census)
TRANSPORT INFRASTRUCTURE	**El Embrujo National Airport,** To arrive to the island by air, you must land in San Andrés to the Gustavo Rojas Pinilla Airport. Although Providencia is **not a major port area**, it has small docks that play an important role in **maritime transportation and tourism activities**: - **Puerto Morgan**, recreational boats - **Santa Catalina Port**, Fish Dock - **Bahía Aguadulce**, small dock or pier
TOURISM & ECONOMY	Tourism and the economy of Providencia are closely linked. The island attracts visitors for the pristine beaches, coral reefs and water activities
PROTECTED AREAS AND/OR NATURE RESERVES	**The entire island is considered a protected area**, there are no designated nature reserves on Providencia. However, the island is part of the **Seaflower Biosphere Reserve, which is a UNESCO-designated marine protected area.**

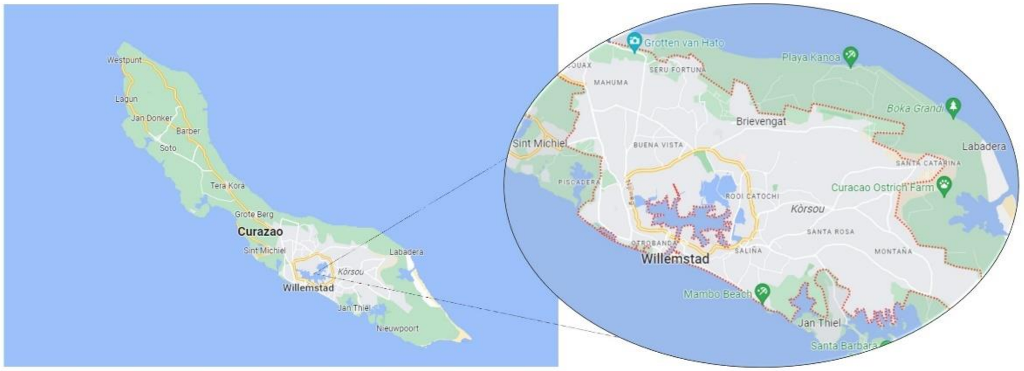
Highlights about Providencia?

- **Limited growth** due to the fact that **housing construction** can only be **for natives** of the area.
- The island significantly **restricts independent people, investors, and even locals** (Raizales). This allows **urban development and massive growth to be controlled appropriately.**
- Providencia promotes a **wide range of types of tourism**, including **new tourism strategies** that allow for the **care and regeneration of nature** and a sense of local ownership

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Willemstad – Curacao



SIZE & COMPOSITION	**7 mi2 - ISLAND**
POPULATION	**150,563 inhabitants** (According to the 2011 census)
TRANSPORT INFRASTRUCTURE	**Hato International Airport,** connecting with destinations in the Caribbean, North America, Europe and South America. The most relevant ports in Willemstad are: -**St. Anna Bay Port**, Cargo Port -**Mega Pier**, Cruise Ship Terminal -**Rif Seaport**, Commercial Port -**Caracasbaai Port**, Recreational Boat Port
TOURISM & ECONOMY	Important **center of tourism** and a significant **contributor to the island's economy.** Known as its colorful Dutch colonial architecture, UNESCO World Heritage status, and vibrant cultural scene.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **3 large environmental zones:** - Christoffel National Park, largest national park - Shete Boka National Park, protected area - Curazao Underwater Marine Park, marine reserve

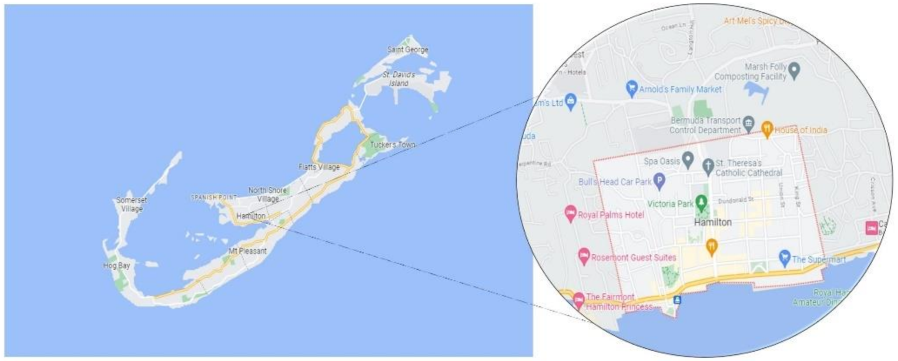
Highlights about Willemstad?

- The **main tourism products** promoted have been **beach tourism and marine sports**. It also has a big **downtown tourism.**
- Tourism directly contributes **9.2% of GDP** and **9.6% of employment**
- Strong **local support** for tourism development amongst the **local population**
- **Strong economic** and **job growth** from the tourism sector

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Bermudas Islands – Bermudas



SIZE & COMPOSITION	**21 mi2 - ISLAND**
POPULATION	**37,441 inhabitants** (According to estimations from 2016)
TRANSPORT INFRASTRUCTURE	**"L.F. Wade International Airport"**. Serves as hub for both domestic and international flights, connecting to North America, Europe and the Caribbean. Bermuda has 4 main ports: - **Royal Naval Dockyard:** Cruise Ship Port - **Hamilton Harbour:** Cargo Port - **St. Gerorge's Harbour:** Small boats & Yachts Port - **Ordnance Island:** Ferry Services Port
TOURISM & ECONOMY	Tourism is one of the primary sector of the economy from Bermuda. Attracts visitors from around the world who come to enjoy its pristine beaches, turquoise waters, historical sites, and cultural offerings.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** - Cooper's Island National Park, nature reserve - Spittal Pond Nature Reserve, nature reserve - Walsingham Nature Reserve, nature reserve - Nature Reserves managed by Bermuda National Trust

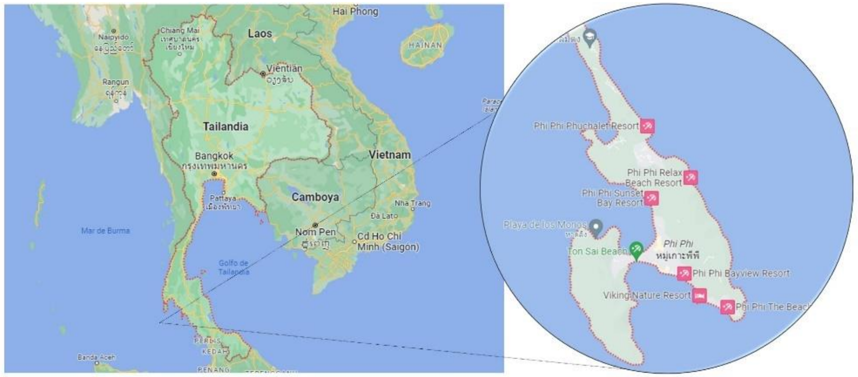
Highlights about Bermuda?

- **Ecotourism** is a **rapidly growing** trend, and clean oceans, beaches and healthy reefs are important **attractions for visitors.**
- Visitors to the island cite **interactions with locals as one of the best parts of their trip.**
- Bermuda Tourism Authority's execution of the **National Tourism Plan**
- By the **end of 2026**, it will be **280,000** business and leisure arrivals

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Phi Phi Islands - Thailand



SIZE & COMPOSITION	**3 mi2 - ISLAND**
POPULATION	**3,000 inhabitants** (According to the 2013 projections)
TRANSPORT INFRASTRUCTURE	**Phi Phi islands does not have an airport of their own.** To reach the islands, travelers usually fly to either Krabi or Phuket The Phi Phi Islands **do not have any dedicated ports on the islands themselves**. Instead, visitors to the Phi Phi Islands typically arrive at the main port in Phi Phi Don, the main inhabited island.
TOURISM & ECONOMY	Tourism is the primary driver of the economy on the Phi Phi Islands. The influx of tourists supports a wide range of businesses, including hotels, restaurants, bars, shops, tour operators, and water sports centers.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** - Hat Noppharat Thara National Park, marine reserve - Maya Bay, marine reserve - Viking Cave, protected area - Hin Bida: marine reserve

Highlights about Phi Phi Islands?

- The **most visited tourist destination** during the holidays in Thailand
- Phi Phi islands are part of a **marine park**, are small in size and have **several natural resources** that **need protection**
- **Ferries or speedboats** are typically used to reach Phi Phi Islands from the mainland, taking about **45 to 90 minutes in travel time.**

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Cancun - Mexico

SIZE & COMPOSITION	**452 mi2 – COASTAL CITY**
POPULATION	**777,615 inhabitants** (According to the 2020 census)
TRANSPORT INFRASTRUCTURE	**Cancun International Airport,** connecting with destinations in the Caribbean, North America, Europe and South America. The most relevant ports in Willemstad are: **-Puerto Juarez**, Ferry Services **-Punta Sam**, Ferry Services **-Puerto Cancun Marina**, Yacht Club -**Marina Hacienda del Mar**, Fishing Port
TOURISM & ECONOMY	Tourism is the primary driver of the economy in Cancun. The city attracts millions of tourists each year, generating revenue through hotel bookings, restaurants, tour operators, transportation services, and various tourism-related businesses.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **3 large environmental** zones: - Sian Ka'an Biosphere Reserve, UNESCO World Heritage Site, protected area - Isla Contoy, protected national park - Isla Mujeres Underwater Museum , marine reserve

Highlights about Cancun?

- Cancun offers a wide variety of **accommodation options**. All with the seal of warmth in service and the renowned Mexican hospitality.
- Has **23 kilometers of beaches** of fine white sand and turquoise blue water
- **Natural attractions** such as majestic mangrove swamps, lush jungle, coral reefs, mystical cenotes and mysterious underwater caverns

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Roatan – Honduras

SIZE & COMPOSITION	**32 square miles - ISLAND**
POPULATION	**26,543** inhabitants (According to projections to 2022 from the 2013 census) Approximately **11,414** inhabitants belong to the rural area and **15,129** to the urban area.
TRANSPORT INFRASTRUCTURE	**"Juan Manuel Gálvez" International Airport.** Roatan has 2 cruise ports, one in **Mahogany Bay** and the other in **Coxen Hole.**
TOURISM & ECONOMY	The main economic activity of Roatan is **leisure tourism** for its beaches and **aquatic activities** such as scuba diving and snorkeling.
PROTECTED AREAS AND/OR NATURE RESERVES	It has **4 large environmental zones:** -Roatan National Marine Park, marine reserve, - Carambola Wildlife Reserve, natural reserve. - Gumbalimba Park, natural reserve - Sandy Bay-West End Nature Reserve

Highlights about Roatan?

- Roatan has a sustainable **tourism model and tourism-free zones** to regulate the territory, minimize impacts and **position tourism as an engine of the economy.**
- **Coasts and natural** sectors have been **regularized.**
- It has an **Island Management Plan** in process and different strategic, development, environmental and tourism plans, among others.

Level of Applicability to the Caye

Source: IDOM, 2023 & Google Maps

Analysis of Study Cases

Prioritization of Study Cases

For this stage, four (4) case studies were chosen to be subjected to an exhaustive analysis. These cases, which share similarities with the present consultancy, stand out for their differentiating factors that provide valuable perspectives for the development of proposals. These analyses provide a solid foundation that will allow us to formulate informed recommendations and make informed decisions in project development.

The case studies were prioritized, for which a series of items were selected to evaluate the 11 locations related to the topics of this consultancy. Each location was rated in three levels: low (value 1), medium (value 2) and high (value 3), to establish its level of importance. Based on this evaluation, hierarchy ranks were assigned to each of the items, which made it possible to analyze various factors.

This process of rating and ranking the items was carried out to obtain a more complete and accurate view of each location, considering different aspects that are relevant for decision-making and the preparation of future recommendations.

Below is a table showing the hierarchy ranks assigned:

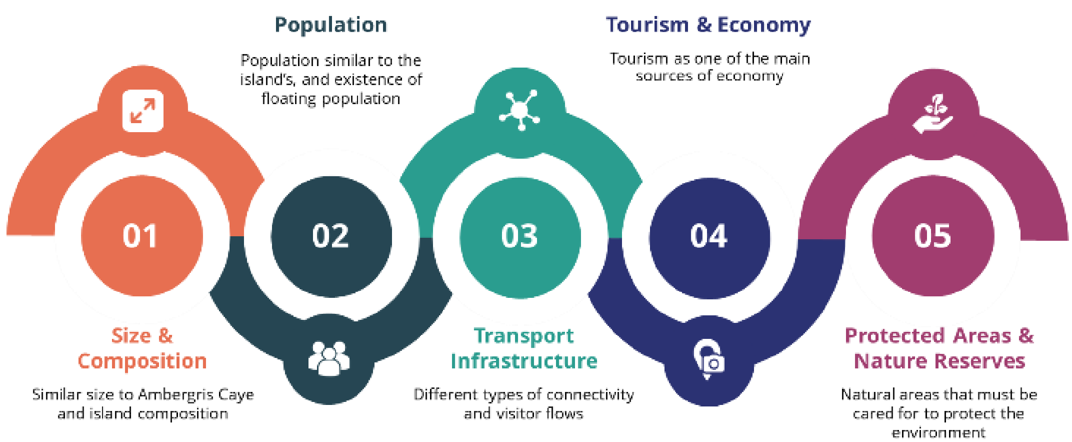
Table 122 - Maximum and Minimum Rating by Evaluated Criteria

LEVEL	NUMERICAL VALUE
High	3
Medium	2
Low	1

Source: IDOM, 2023

The criteria to be scored in the evaluation matrix are as follows

Criteria to be evaluated



Source: IDOM, 2023

The results obtained and the comparison between cases are shown below:

Evaluation Matrix

Evaluation Matrix / Maximum and minimum score per evaluated criteria

#	1	2	3	4	5	6	7	8	9	10	11	Points	
Country	United States	Ecuador	Dominican Republic	Seychelles	Chile	Colombia	Curacao	Bermudas	Thailand	Mexico	Honduras	%	# Total of Points
City/Place	**Maui**	**Galapagos Islands**	**Punta Cana**	**Mahe**	**Rapa Nui**	**Providencia**	**Willemstad**	**Bermudas Islands**	**Phi Phi Islands**	**Cancun**	**Roatan**	Equivalent percentage of ...	Total possible points in the weighted average

CRITERIA EVALUATED												
No. 1 Size & Composition											20%	6
City	**Maui**	**Galapagos Islands**	**Punta Cana**	**Mahé**	**Rapa Nui**	**Providencia**	**Willemstad**	**Bermudas Islands**	**Phi Phi Islands**	**Cancun**	**Roatan**		
Similar Size to Ambergris Caye Size (25 square miles)	1	1	1	2	2	3	2	3	1	1	3		
Island Composition	3	3	1	3	3	3	3	3	3	1	3		
Average	2	2	1	2,5	2,5	3	2,5	3	2	1	3		

No. 2 Population												20%	3
City	**Maui**	**Galapagos Islands**	**Punta Cana**	**Mahe**	**Rapa Nui**	**Providencia**	**Willemstad**	**Bermudas Islands**	**Phi Phi Islands**	**Cancun**	**Roatan**		

Similar to Ambergris Caye Population (18,319 inhabitants)	1	3	2	1	2	2	1	2	1	3	1		
Average	1,0	3,0	2,0	1,0	2,0	2,0	1,0	2,0	1,0	3,0	1,0		

No. 3	Transport Infrastructure											20%	9
City		Maui	Galapagos Islands	Punta Cana	Mahé	Rapa Nui	Providencia	Willemstad	Bermudas Islands	Phi Phi Islands	Cancun	Roatan		
National Airport		2	3	1	1	3	3	1	1	1	1	2		
Cargo Port		3	3	2	1	3	2	3	3	1	3	2		
Ferry Services Port / Small Boats Docks		3	2	1	1	3	3	1	1	1	1	1		
Average		2,7	2,7	1,3	1,0	3,0	2,7	1,7	1,7	1,0	1,7	1,7		

No. 4	Tourism & Economy											20%	9
City	Maui	Galapagos Islands	Punta Cana	Mahe	Rapa Nui	Providencia	Willemstad	Bermudas Islands	Phi Phi Islands	Cancun	Roatan		
Tourism as the primary economy	3	3	3	3	3	3	2	3	3	3	3		
Ecotourism	3	3	1	2	3	3	2	2	3	1	3		
Archaeological Sites	3	3	1	2	3	3	2	2	1	2	2		
Diving Tourism	3	3	2	1	2	3	1	2	2	2	3		
Average	3,0	3,0	1,8	2,0	2,8	3,0	1,8	2,3	2,3	2,0	2,8		

No. 5	Protected Areas & Nature Reserves											20%	9
City	Maui	Galapagos Islands	Punta Cana	Mahe	Rapa Nui	Providencia	Willemstad	Bermudas Islands	Phi Phi Islands	Cancun	Roatan		
Protected Areas	3	2	1	3	3	3	3	1	3	3	2		
Nature Reserves	3	3	1	1	3	3	1	3	1	1	3		
Marine Reserve	3	3	1	3	2	3	3	1	3	2	3		
Average	3,0	2,7	1,0	2,3	2,7	3,0	2,3	1,7	2,3	2	2,7		
Weighted Averages	**2,3**	**2,7**	**1,4**	**1,8**	**2,6**	**2,7**	**1,9**	**2,1**	**1,7**	**1,5**	**2,2**	100%	48
Cities	Maui	Galapagos Islands	Punta Cana	Mahe	Rapa Nui	Providencia	Willemstad	Bermudas Islands	Phi Phi Islands	Cancun	Roatan		

Source: IDOM, 2023

Considering the previous table "Evaluation Matrix / Maximum and minimum score per evaluated criteria", it is possible to conclude the locations with higher scores and greater applicability for the present consultancy. These cities were selected using a numerical ranking methodology, in which each criterion has a value that depends on its hierarchy. Those locations that obtained a weighted average higher than 2,5 were selected for prioritization, as they offer greater contributions and lessons learned. Below is the list of cities with the highest scores that will be prioritized and analyzed in more detail.

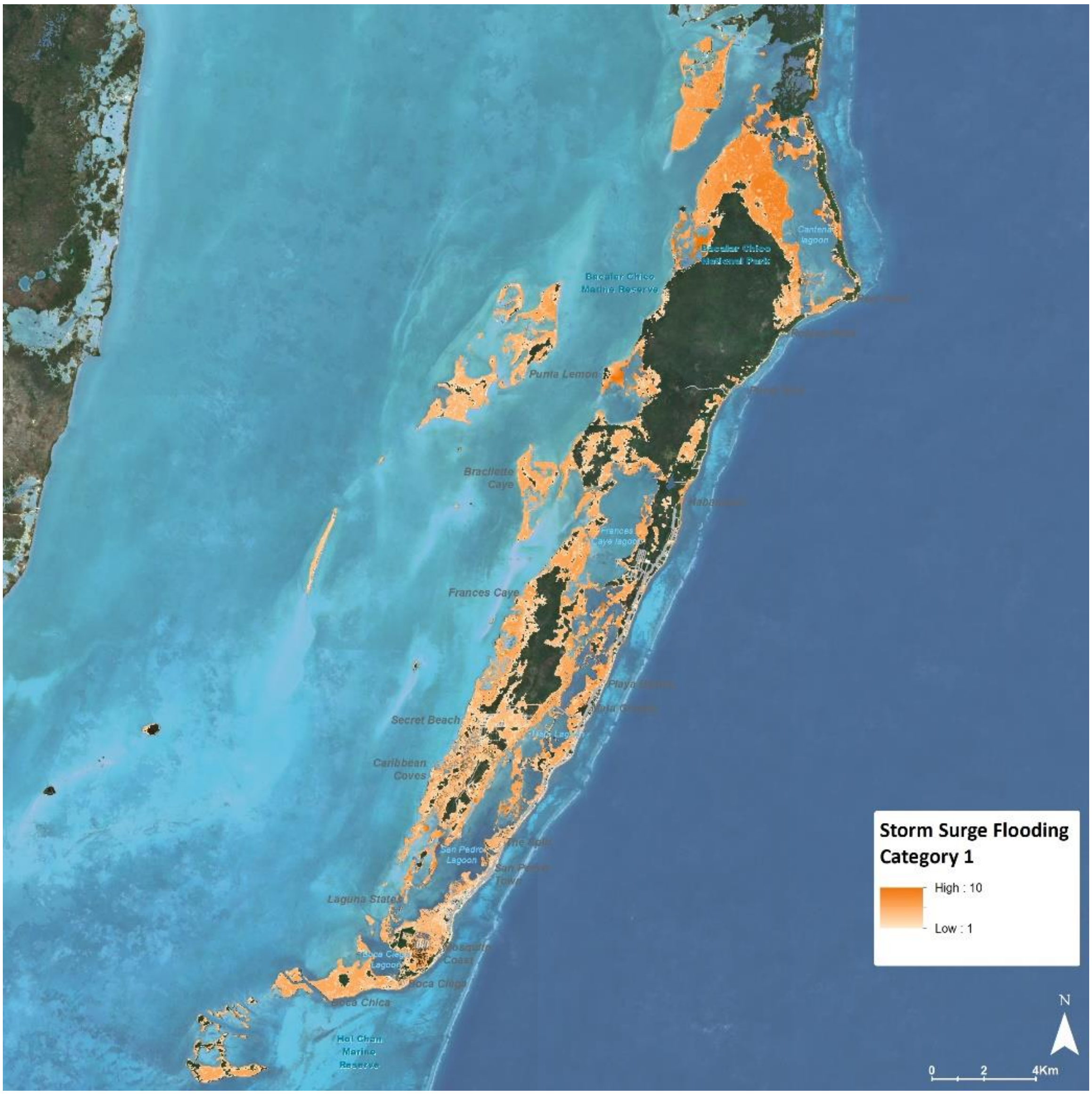
- **Maui Island, Hawaii – United States**
- **Galapagos Islands – Ecuador**
- **Rapa Nui - Chile**
- **Providencia - Colombia**

ANNEX B

Annex B: Vulnerability to Natural Risks

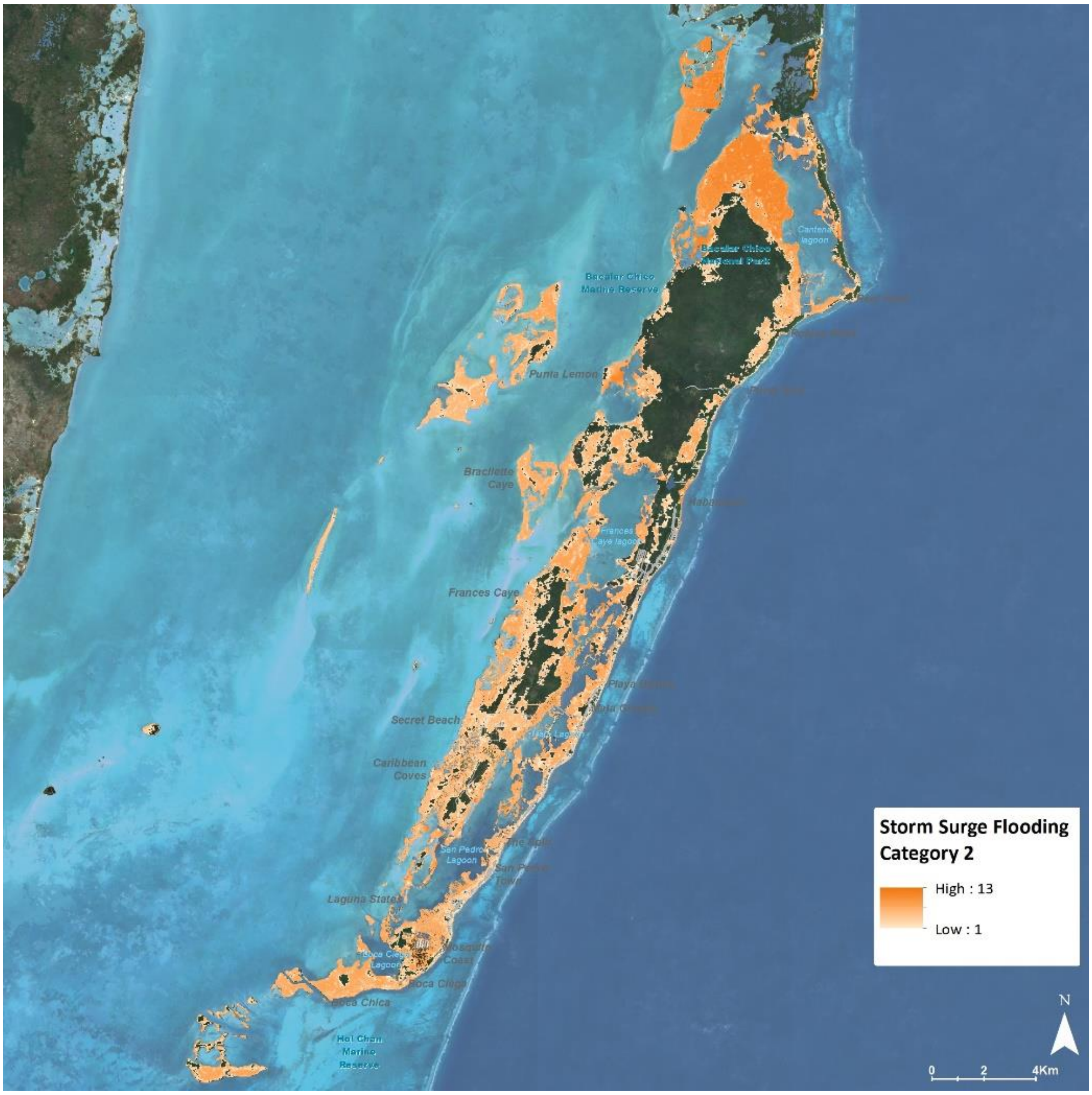
Storm Surge Hazard Maps

Storm Surge flooding associated with Category 1 hurricanes



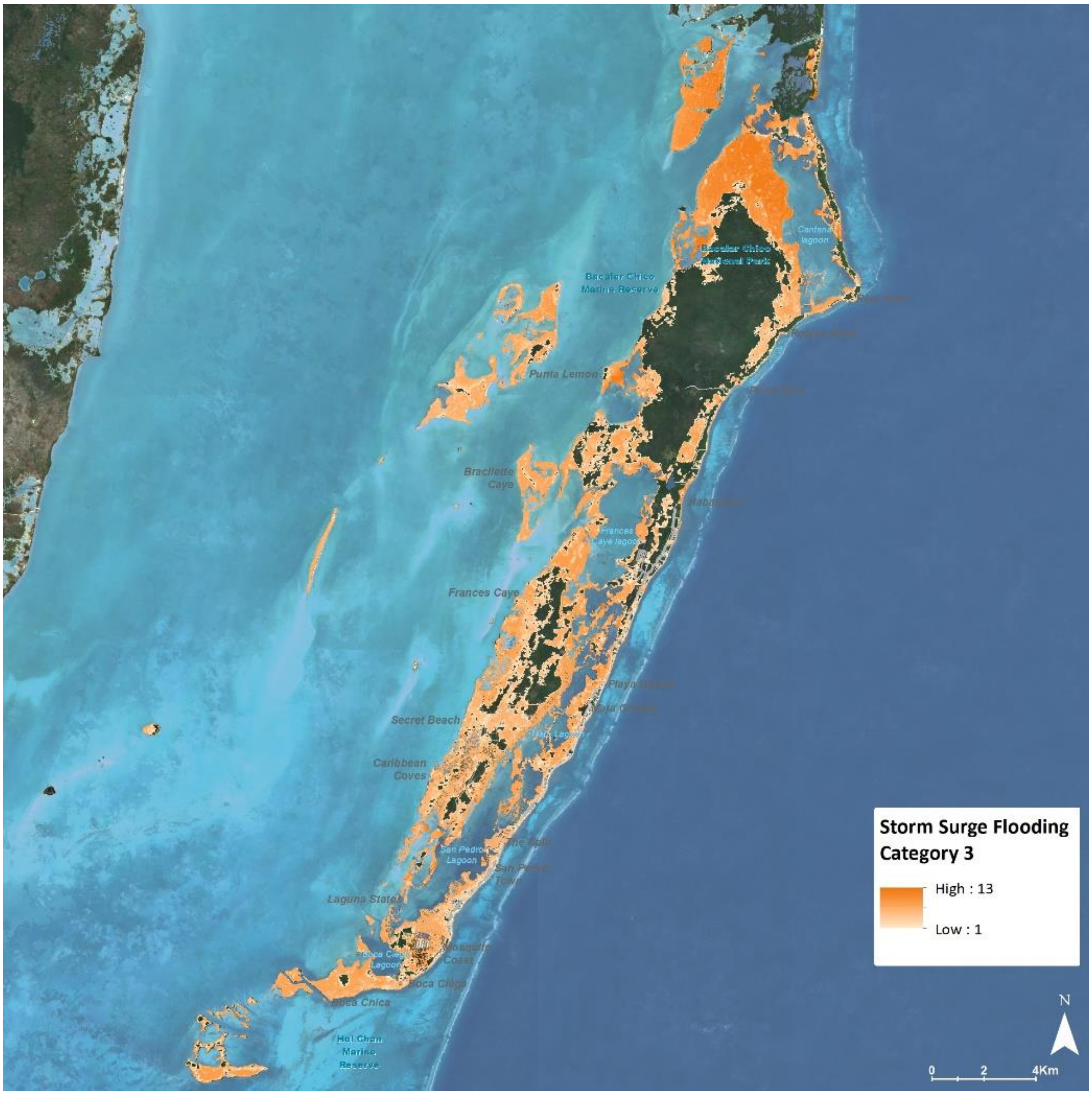
Source: IDOM 2023

Storm Surge flooding associated with Category 2 hurricanes



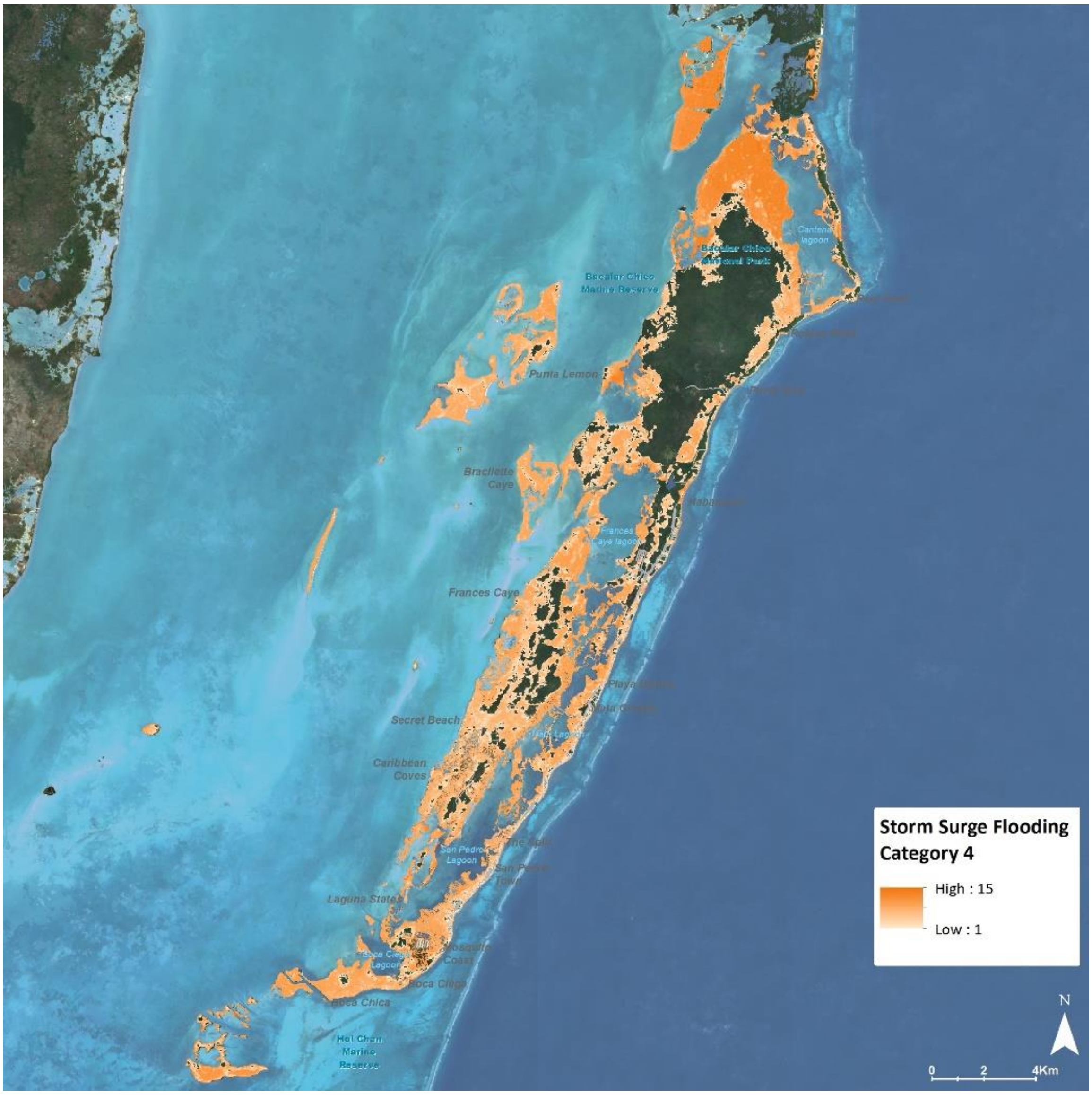
Source: IDOM 2023

Storm Surge flooding associated with Category 3 hurricanes



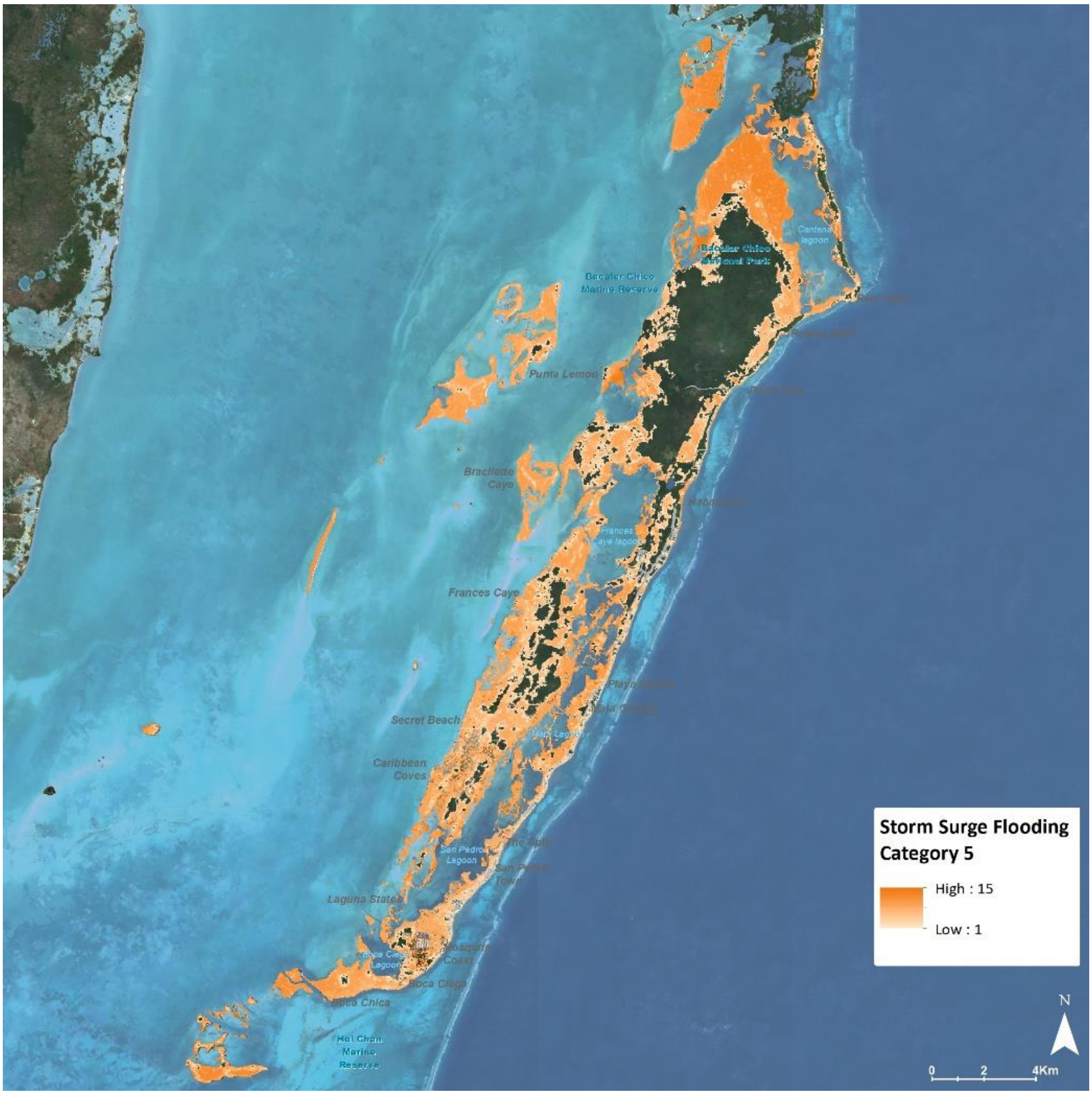
Source: IDOM 2023

Storm Surge flooding associated with Category 4 hurricanes



Source: IDOM 2023

Storm Surge flooding associated with Category 5 hurricanes



Source: IDOM 2023

ANNEX C

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IDB

Annex C: Tourism Analysis

Details and type of establishments found in each of the 36 blocks georeferenced for tourism proposes by IDOM team at Ambergris Caye in June 2023.

Nº	Block	Establishment	Type	Total	%
1	B1	Captain Sharks	SS1 (Sporto Shop)	6	2%
2		Ambergris Golf Cart Rental	VR1 (Vehicle Rental)		
3		Budget Golf Cart Rental	VR2 (Vehicle Rental)		
4		FM Golf Cart Rental	VR3 (Vehicle Rental)		
5		Reine Golf Cart Rental	VR4 (Vehicle Rental)		
6		Nola Gulf Karts	VR5 (Vehicle Rental)		
7	B2	Mr Chi Tire Repair and Welding Shop	VRP1 (Vehicle Repair Shop)	4	2%
8		Swan Chinese Fast Food	Restaurant - R1		
9		La Mulata Backyaad Eatery	Restaurant - R2		
10		El Torito Mexican Pub	Restaurant - R3		
11	B3	El Fogón	Restaurant - R4	1	0.75%
12	B4	Reel Belize	Sport Shop - SS2 / Tour Operator TO1	7	3%
13		Playtime Sports Bar	BAR1		
14		Sarita Heladería	Restaurant - R5		
15		French Croissant Bakery	Restaurant - R6		
16		Belize Tourist Board San Pedro Branch	Tour Operator . TO2		
17		Doctor of the Flats	Tour Operator . TO3		
18	B5	Welcome to San Pedro Sign	Tourism Item - TI1	1	0.75%
19	B6	One Love Golf Car Rental	Vehicle Rental - VR6	19	8%
20		Master Lee	Restaurant - R7		
21		Love Belize Wear Souvenirs	Souvenir Shop - SOUS1		
22		Celis Deli	Restaurant - R8		
23		Di Bush Gift Store	Souvenir Shop - SOUS2		
24		El Patio Grill	Restaurant - R9		
25		Unique Golf Cart Rental	Vehicle Rental - VR7		
26		Midtown Coffee Bar	Restaurant - R10		
27		Gift Shop (sin nombre)	Souvenir Shop - SOUS3		
28		Super Sub	Restaurant - R11		
29		Aqua Reef Souvenirs	Souvenir Shop - SOUS4		
30		Mesa Bistró Restaurant	Restaurant - R12		
31		Highlife San Pedro	Souvenir Shop - SOUS5		
32		Seaduced by Belize	Tour Operator - TO4		
33		Vilma Linda Plaza	Souvenir Shop - SOUS6		
34		Beach Cruiser Bike Rentals & Ice Cream	Vehicle Rental - VR8 / Restaurant - R13		
35		12 Belize	Souvenir Shop - SOUS7		
36		EMZ Orange Walk Tacos	Restaurant- 14		
37	B7	J&B Golf Cart Rental	Vehicle Rental - VR9	11	4%
38		TNT Dive Pro Tours	Tour Operator - TO5		
39		Thai Spa	SPA1		
40		Foreva Fancy Boutique	Souvenir Shop - SOUS8		
41		Da Hong	Restaurant - R15		
42		Aloha Fast Food	Restaurant - R16		
43		Norma's Kitchen	Restaurant - R17		
44		The Island Wear House	Boutique - B1		
45		Lola's Gift Shop	Souvenir Shop - SOUS9		
46		Middle Street Cuisine	Restaurant - R18		
47		The Brand His and Her's	Boutique - B2		
48	B8	Anglers Sea Food	Restaurant - R19	12	4%
49		Juvinie's Sports Bar & Cevicheria	Restaurant - R20		
50		Hungry Grouper	Restaurant - R21		
51		Storm Restaurant Bar & Grill	Restaurant - R22		
52		LIV Hookah Lounge	BAR2		
53		Belizean Thingz	Boutique - B3		
54		Sea Shuttle Express Tours	Tour Operator - TO6		
55		Guevara Tours	Tour Operator - TO7		
56		Neri's Tacos	Restaurant - R23		
57		Ray Dan's Ceviches	Restaurant - R24		
58		Sandra's Deli	Restaurant - R25		
59		Casas de la Caye Villas Dork	Hotel - H1		
60	B9	Hotel Central Park	Hotel - H2	10	4%
61		Hotel Coastal Bay	Hotel - H3		
62		ABN Golf Cart Rental	Vehicle Rental - VR10		
63		In Land and Sea Tours	Tour Operator - TO8		
64		Bilios Kitchen	Restaurant - R26		
65		Golf Cart Rental	Vehicle Rental - VR11		

Nº	Block	Establishment	Type	Total	%
66		OM Danny Boy Tours and Cart Rental	Tour Operator - TO9 / Vehicle Rental - VR12		
67		Breez Bike Rentals	Vehicle Rental - VR13		
68		El Sazón	Restaurant - R27		
Nº	**Block**	**Establishment**	**Type**	**Total**	**%**
69	B10	Artisan Market - Casa de la Cultura	Souvenir Shop - SOUS10	7	3%
70		Tourism Information Center	Tour Operator - TO10		
71		Pupuseria Salvadoreña	Restaurante - R26		
72		Rocks Cart Rental	Vehicle Rental - VR15		
73		Ramen 501	Restaurant - R28		
74		Y&J's Deli	Restaurant - R29		
75		Deep Drop Fast Food	Restaurant – R30		
76	B11	Puestos de Souvenirs/Mercado	Souvenir Shop - SOUS11	1	0.75%
B					
77	B12	Maxie's Restaurant	Restaurant - R31	5	2%
78		Caye Supplies	Souvenir Shop - SOUS12 / Sport Shop - SS3		
79		Churro O'Clock	Restaurant – 32		
80		Corner's Sixty	Restaurant – 33		
81	B13	Ladino's Chicken Shack	Restaurant – 34	11	4%
82		Marquesitas Vargas	Restaurant – 35		
83		Papi's Pizza	Restaurant – 36		
84		Paradise Framing Art Gallery	Art Gallery - AG1		
85		Killyanie's Boutique	Boutique - B4		
86		Elvi's Kitchen	Restaurant - R37		
87		Ruby's Deli	Restaurant - R38		
88		C Jewels Gift Shop	Boutique - B5		
89		Graphic Design Gift Shop	Souvenir Shop - SOUS13 / Sport Shop - SS4		
90		La Esquinita Deli	Restaurant - R39		
91	B14	Juice Dive	Restaurant – R40	7	3%
92		Jaguars Night Club	BAR3		
93		Lounge	BAR4		
94		Island Torch Bar & Grill	Restaurant – 41		
95		Omar´s Golf Cart Rental	Vehicle Rental - VR16		
96		Casa Pan Dulce Bakery	Restaurant - R42		
97		DIS DA FI WI CHIKIN	Restaurant - R43		
B	B15	Church Office and Gift Shop	Souvenir Shop - SOUS14	12	5%
99		3 Pescados Fly Shop	Sport Shop - SS5/ Tour Operator -TO11		
100		Mark's Golf Cart Rental	Vehicle Rental - VR17		
101		Ola Gift Shops	Tienda de souvenirs y artesanías		
102		Pink Boutique	Boutique - B6		
103		Little China Fast Food	Restaurant - R44		
104		Lil Outfitters Boutique	Boutique - B7		
105		Hotel Ocean Paradise	Hotel - H4		
106		DandE's	Restaurant - R45		
107		Casino	CAS1		
108		Sun and Reef Hotel	Hotel - H5		
109	B16	La Fonda Tacos	Souvenir Shop - SOUS15	9	4%
110		Norma's Deli	Restaurant - R46		
111		Iguanas Juan's	Restaurant - R47		
112		Big Taste Parrillada	Restaurant - R48		
113		Indian Restaurant Tik Tok	Restaurant - R49		
114		World Class Fashion	Boutique - B8		
115		Super Buy Supermarket	Souvenir Shop - SOUS16		
116		Pippo's Pizzeria	Restaurant – R50		
117		Green Espresso Café Bar	Restaurant - R51		
118	B17	Briana's Food Place	Restaurant - R52	4	2%
119		Maya Golf Cart Rental	Vehicle Rental - VR18		
120		Ambergris Sunset Hotel	Hotel - H6		
121		D'Local Taste	Restaurant - R53		
122	B18	Caliente Mexican Food	Restaurant - R54	3	1%
123		Affordable Golf Cart Rental	Vehicle Rental - VR19		
124		Waruguma	Restaurant - R55		
125	B19	Global Cells Accessories	Souvenir Shop - SOUS17	9	4%
126		Izzy's Smoothies	Restaurant - R56		
127		Frydays	Restaurant - R57		
128		Kiry's TakeOut	Restaurant - R58		
129		Pirate Pizza	Restaurant - R59		
130		Pollo Feliz	Restaurant – R60		
131		Melza's Art & Soul	Art Gallery – AG		
132		The Cork & Cooperage	Restaurant - R61		
133		Saul's Cigars and Coffee	Restaurant - R62		

Nº	Block	Establishment	Type	Total	%
134	B20	Lavish Habit Coffee	Restaurant - R63	9	4%
135		Oh Sugar! Candy & Gifts	Souvenir Shop - SOUS18		
136		Isla Ceviche	Restaurant -R64		
137		Golf Cart Rental Hop	Vehicle Rental - VR20		
138		San Pedro Tourist Car Association	Tour Operator - TO12		
139		Man O' War Supplies	Souvenir Shop – SOUS19 / Sport Shop - SS6		
140		Anglers Sea Shop	Sport Shop - SS7		
141		China Village Fast Food	Retsaurat - R65		
142	B21	Mayan Princess Hotel	Hotel - H7	10	4%
143		La Casa de Paz Guesthouse	Hotel - H8		
144		Salty Dog Gift Shop	Souvenir Shop - SOUS20		
145		Manellis	Restaurante - R66		
146		Amigos del Mar Tours	Tour Operator - TO13		
147		Tomás Hotel	Hotel - H9		
148		Rio Golf Cart Rental	Vehicle Rental - VR21		
149		Coyote Golf Cart Rental	Vehicle Rental - VR22		
150		Tienda Souvenirs (Sin Nombre)	Souvenir Shop - SOUS21		
151		The Thirsty Tarpon	Restaurant - R67		
152	B22	San Pedro Sign	Tourim Item – 12	7	3%
153		Central Park	Tourim Item - 13		
154		Clock Tower	Tourim Item - 14		
155		San Pedro Roman Catholic Church	Tourim Item - 15		
156		Daddy Rock	BAR5		
157		Fidos Courtyard & Pier	Restaurant - R68		
158		The Farmhouse Café	Restaurant - R69		
159	B23	The Fry Jack House	Restaurant - R70	9	4%
160		Art Gallery (sin nombre)	Art Gallery - AG4		
161		Bzeful Gift Shop	Souvenir Shop - SOUS22		
162		Taboo Treasures Boutique	Boutique - B9		
163		Chill Mambo Boutique	Boutique . B10		
164		Spindrift Hotel	Hotel - H10		
165		J & H Golf Rental	Renta de vehículos		
166		Scuba Store Belize Tours	Sport Shop -SS8 / Tour Operator 13		
167		Ambergris Divers	Tour Operator . TO14		
168	B24	Blue Heaven Tours	Tour Operator - TO15	11	4%
169		La Sanpedrana	Restaurant - R71		
179		Holiday Hotel	Hotel - H11		
171		Belizean Breezes Soap Co	Souvenir Shopr - SOUS23		
172		Paradigm	Restaurant - R72		
173		San Pedro Original Art Gallery	Art Gallery - AG4		
174		DIS DA FI WI CHIKIN	Restaurant – R73		
175		Herban Vape Lounge	BAR7		
176		Gill-E's Pour House	Restaurat -R74		
177		Inland Sea Adventures	Tour Operator -TO16		
178		Xsite Belize Sailing Adventures	Tour Opertartor - TO17		
179	B25	Belize Chocolate Company	Restaurant - R75	5	2%
180		Eat Wild Mangos	Restaurant - R76		
181		Sun Breeze Hotel	Hotel - H12		
182		Sea Rious Adventures Tour Center	Tour Operator - TO18		
183		San Pedro Public Library	Tourism Item - TI6		
184	B26	Meng's Fast Food	Redtaurant - R77	7	3%
185		Tephany Massage Studio	SPA2		
186		Sun Breeze Suites	Hotel - H13		
187		Jambel's Jerk Pit Restaurant	Restaiurant - R78		
188		Reef and View Hotel	Hotel - H14		
189		Mayan Flavaz Souvenirs	Souvenir Shop - SOUS24		
190		Polo's Golf Cart Rental	Vehicle Rental - VR23		
191	B27	Everglow Clothing	Boutique - B11	2	1%
192		Divas & Dudes Boutique	Boutique -B12		
193	B28	Hol Chan Marine Reserve	Tour Operator - TO19	4	2%
194		The Chic Spot	Boutique - B13		
195		Be youtiful Boutique	Boutique - B14		
196		La Bodeguita	Restaurant - R79		
197	B29	Caribeña Gas Station	Gas Station - GS1	1	0.75%
198	B30	Harmouth's Center	Souvenir Shop - SOUS25 / Sport Shop - SS9	4	2%
199		Phoenix Hotel Resort	Hotel - H15		
200		Paradise Villas	Hotel - H16		

Nº	Block	Establishment	Type	Total	%
201	B31	Kmart Supermarket	Souvenir Shop - SOUS26 / Sport Shop - SS10	1	0.75%
202	B32	Chuck and Robbie's Tours	Tour Operator -TO20	6	2%
203		Palapa Bar	Restaurant – R80		
204		Nu-Palm Island Lounge	Restaurant – R81		
205		Yolo Island Tours	Tour Operator - TO21		
206		Sandbar Beachfront Hostel	Hotel - H17		
207		Blue Tang Hotel	Hotel - H18		
208	B33	D'Family Café	Restaurant - R82	8	3%
209		Sandy Toes Beach Bar	Restaurant - R83		
210		Losers Restaurant	Restaurant - R84		
211		Playa Bar & Grill	Restaurant - R85		
212		Brianna's Beach House	Restaurant - R86		
213		Shalom's Nads Massage	SPA3		
214		Gonzalez Adventures Fishing Trips Tours	Tour Operator - TO22		
215		Elite Tours	Tour Operator - TO23		
216	B34	Delano Firmont Hotel	Hotel - H19	9	4%
217		Ugly Duck Sports Bar and Grill	Restaurant - R87		
218		Aquavista Hotel	Hotel – H20		
219		Seven Seas Hotel	Hotel -H21		
220		Nauticrab Bar	Restaurant - R88		
221		Neptune´s Cove Tours	Tour Operator - TO24		
222		Oasis Hotel	Hotel - H22		
223		Hurricanes Ceviche Bar	Restaurant - R89		
224		Royaltea Café	Restaurant – R90		
225	B35	Golf Cart Avis	Vehicle Rental -. VR24	6	2%
226		Tanisha Tours	Tour Operator - TO25		
227		Just Relax Massage	SPA4		
228		Caye Casa Hotel	Hotel - H23		
230		Hotel del Rio	Hotel - H24		
231		Wayos Restaurant	Restaurant – R91		
232	B36	Caye Coffe	Restaurant - R92	7	3%
233		GoFish Belize Tours	Tour Operator - TO26		
234		Maya Healing Massage	SPA5		
235		Tropical Ice Raspado	Restaurant - R93		
236		Pupuseria al Gusto	Restaurant - R94		
237		Road Runner Deli	Restaurant - R95		
238		Arabella's Island Cuisine	Restaurant - R96		
Total				245	100%

Source: Prepared by the consulting team with Geo-Tracker App, 2023. Data was not only geo-referenced with Geotracker, but also contrasted in Google Maps. B=Blocks.

Consolidated proposal of indicators based on Ambergris Caye´s Tourism Value Chain´s available info regarding Overnight Tourism Arrivals - Overnight Cruise Tourism Arrivals to Ambergris Caye, visits to Hol Chan´s Marine Reserve and number of active bus

N°	Type (Indicators)	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	Average	2023	2024	2025	2026	2027	2028	2029	2030	Total	Remarks
1	BTB´s Registered Overnight Tourist Arrivals to Belize	321,220	341,161	385,583	427,076	489,621	503,167	144,123	218,957	371,634	355838	355,838	411583	409214	464959	470951	526341	540695	596984	619646	4,396,210	Growth calculated at 15% per year (2023-2030)
2	BTB´s Registered Overnight Cruise Tourist Arrivals to Belize	968,131	957,975	1,005,394	1,014,231	1,208,137	1,170,558	343,099	210,206	615,021	7,492,752	832,528	682673	682673	924106	757767	757767	698375	841122	841122	13,678,358	Growth calculated at 11% per year (2023-2030)
3	BTB´s Registered Overnight Tourist Arrivals to Ambergris	144,425	141,422	165,387	176,777	202,882	185,064	60,079	74,703	116,030	1,266,769	140,752	132274	128793	156235	146824	142961	131756	162975	180902	2,544,155	Growth calculated at 14% per year (2023-2030)
4	BTB´s Registered Overnight Cruise Tourist Arrivals to Ambergris	6,958	10,007	8,380	27,158	27,746	23,948	6,381	4,051	12,330	126,959	14,107	14056	14056	16082	16024	16024	18333	18267	20825	313,583	Growth calculated at 14% annual growth (2023-2030)
5	BTB´s Total Registered ONTA and ONCTA to AC	151,383	151,429	173,767	203,935	230,628	209,012	66,460	78,754	128,360	1,393,728	154,859	147614	160278	178088	169756	184320	204801	195220	211968	3,330,083	Sum of previous cell plus the other previous cell (2023-2030)
6	BTB´s Registered visits to Hol Chan Marine Reserve	74,387	80,293	93,938	122,373	164,482	172,037	1,916	84,799	N/A	794,225	88,247	94127	104481	115974	128731	142891	158609	176056	195422	1,995,316	Growth calculated at 11% annual growth (2023-2030)
7	BTB´s Registered Licensed Hotels	166	172	170	169	172	196	186	183	198	1,612	179	218	240	264	290	319	351	386	424	226	Growth calculated at 1% annual growth
8	BTB´s Registered Licensed Hotel Rooms	1833	1898	2231	2086	2253	2378	2288	2301	2412	19,680	2,187	2436	19877	2209	2460	2485	2510	2535	2560	17864	Growth calculated at 1% annual growth (2023-2030)

9	BTB´s Registered BTB´s Licensed Hotel Beds	3388	3427	3195	3351	3447	3981	3485	3157	3104	30,535	3,393	3135	30840	3427	3166	31149	3461	3198	3510	28356	Growth calculated at 1% annual growth (2023-2030)
10	BTB´s AC´s Registered National Tour Operators.	57	59	68	57	66	79	62	59	53	560	62	58	64	71	78	85	94	103	114	61	Growth calculated at 10 % annual growth (2023-2030)
11	BTB´s AC´s Registered National Tour Guides	305	260	322	296	357	364	393	357	470	3,124	347	494	518	544	571	600	630	661	694	224	Growth calculated at 5 % annual growth (2023-2030)

Source: BTB´s statistics (2014-2023).

ANNEX D

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Annex D: - Financial Plan

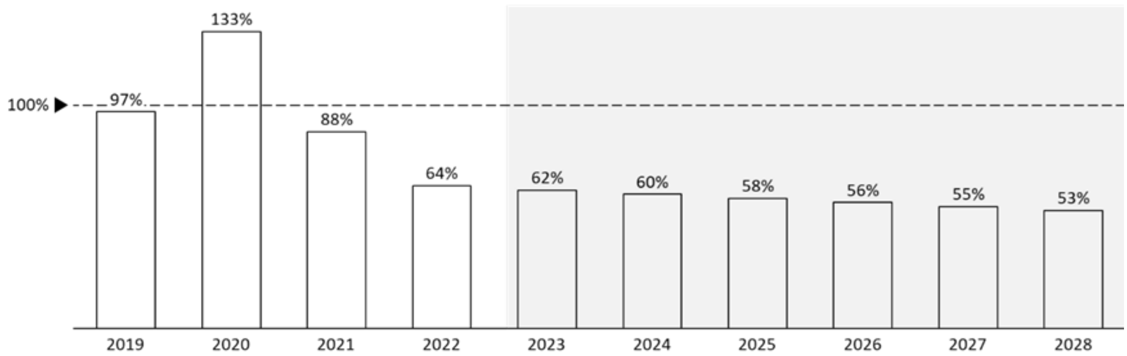
Financial status of the government

The purpose of this section is to analyze Belize's current and future financial situation by analyzing its debt profile and international debt, its budget allocation by entity, among others, in order to define the financial viability of project implementation.

Belize has historically had a relatively large public debt and has gone through several debt restructuring processes. The first of these processes was in 2007, due to the fact that the public debt had grown rapidly as a result of expansionary fiscal policies in the early years of the 21st century. The second was in 2013, when the government reached an agreement with the main creditors, but after a long period of negotiations, the restructuring process was completed in 2017.

However, in 2019, public debt exceeded 97% of GDP and reached 133% in 2020, forcing a new restructuring process. As for the external debt, it represented 92% of GDP in 2020 and 88% in 2021, and it is expected to continue decreasing. In December 2022, the total public debt stood at $USD 2,016 million, the equivalent of 64% of GDP and it is expected that this ratio can decrease to 53% of GDP by 2028.

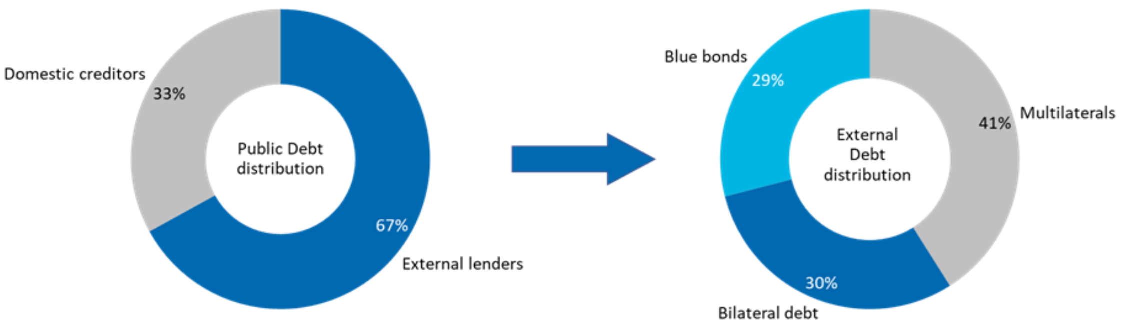
Debt as a percentage of the GDP



Source: IDOM, 2023

Disaggregated, approximately 67% of the public debt is represented by loans of external lenders and 33% is owned by domestic creditors. With regard of the external debt, approximately 41% is owed to multilateral lenders such as WB and IDB, 30% is classified as bilateral debt with Republic of China and Venezuela; and the remaining 29% is Blue Bonds obligations.

Public debt distribution



Source: IDOM, 2023

These situations have caused Belize's international credit assessment at the hands of entities such as S&P and Moody's to be historically negative and declared to have a public debt as unsustainable. However, since November 2021 the quarterly reports of these entities have declared Belize's finances as stable; and linked to the previous forecast, it is expected to remain this way and generate a positive evaluation in the future.

On the other hand, Belize's recurrent and capital budget is composed of three main areas, Revenues & Grants, Expenditures and Financing. Regarding revenues, a growth dynamic has been noted here since the last years and it is expected to continue this dynamic towards 2026, however, expenditures also follow this dynamic and to a greater concern, expenditures are higher than revenues, which generates a fiscal deficit year after year.

This fiscal deficit, in contrast, has been decreasing over the years, as it represented 12.82% of GDP in 2020-2021, 2.5% of GDP in 2022-2023, and is projected to be 0.09% of GDP in 2025-2026.

In this way, the budget for the fiscal year 2023-2024 is forecasted with a primary surplus of $USD 12.2 million equivalents to 0.39% of GDP and the overall deficit will be 1.41% of GDP, or some $USD 44 million. The GDP is projected to be $USD 3,127 million.

A summary of the Recurrent and Capital Budget is presented below.

Summary of recurrent and capital budgets in USD.

Description	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Recurrent Revenue	452,984,118	546,211,649	611,309,674	659,972,831	686,371,743	718,937,536	753,093,183
Capital Revenue	8,126,995	2,321,121	2,840,398	4,210,650	2,762,500	3,015,000	3,515,000
Grants	15,374,418	19,348,345	17,500,001	15,639,192	15,000,000	17,500,000	20,000,000
Total revenue and grants	476,485,531	567,881,114	631,650,072	679,822,672	704,134,243	739,452,536	776,608,183
Recurrent Expenditures	470,243,061	469,529,806	543,950,271	516,383,519	556,427,526	573,120,352	584,916,705
Capital Expenditures	217,227,148	131,172,456	139,035,949	180,997,214	191,713,404	191,149,312	194,649,312
Total Expenditures	687,470,209	600,702,261	682,986,219	697,380,733	748,140,930	764,269,664	779,566,017
Financing	-246,425,597	-65,329,294	-100,071,965	-61,703,429	-105,403,606	-94,206,385	-81,657,000
GDP in millions	1,646	1,854	1,974	2,927	3,127	3,307	3,426
Primary Surplus/Deficit as GDP%	-10.81%	-0.03%	0.24%	1.20%	0.39%	1%	1.55%
Overall, Surplus/Deficit as GDP%	-12.82%	-1.77%	-2.60%	-0.60%	-1.41%	-0.75%	-0.09%

Source: Budget for fiscal year 2023/2024

The national budget allocation is distributed per ministry, where each of them has its own revenues and expenditures. The budget for expenditures it's composed by the recurrent expenditures; Capital II expenditures, which consists in the expenditures for assets with a life of more than one year but less than 5 years; and Capital III expenditures, that are foreign loans.

In this way, the budget allocation per ministry, including revenue and expenditure in the past years, current year and forecast is:

Budget allocation in USD.

Description	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
MINISTRY OF EDUCATION, CULTURE, SCIENCE AND TECHNOLOGY							
Revenue	254,077	286,718	369,949	194,080	201,843	205,880	209,997
Recurrent Expend	119,200,945	108,087,439	120,855,010	116,319,154	130,544,216	130,544,216	130,544,216
Capital II Expend	8,428,619	1,093,785	1,700,348	1,481,748	3,947,474	3,643,919	3,604,919
Capital III Expend	8,877,659	2,264,730	6,805,710	4,717,298	6,761,728	5,000,000	4,000,000
Total Expenditure	136,507,222	111,445,953	129,361,067	122,518,199	141,253,418	139,188,135	138,149,135
MINISTRY OF NATURAL RESOURCES,PETROLEUM & MINING							
Revenue	249,529	82,864	182,060	34,001	35,361	36,068	36,790
Recurrent Expend	3,845,928	3,671,738	4,194,648	3,883,600	5,249,486	5,236,602	5,220,984
Capital II Expend	6,979,093	12,343,696	6,674,998	10,171,832	7,474,345	7,414,345	7,414,345
Capital III Expend	0	1,461	0	2,144	0	0	0
Total Expenditure	10,825,021	16,016,894	10,869,646	14,057,575	12,723,831	12,650,947	12,635,328
MINISTRY OF SUSTAINABLE DEVELOPMENT, CLIMATE CHANGE & DISASTER RISK MANAGEMENT							
Revenue	275,837	313,591	299,000	334,195	347,562	354,514	361,604
Recurrent Expend	7,109,197	7,320,567	9,435,781	8,205,996	10,051,064	10,053,594	10,053,220
Capital II Expend	2,603,642	3,524,636	3,582,508	4,116,551	6,218,500	7,203,500	7,306,880
Capital III Expend	1,818,053	801,977	676,002	1,086,347	2,169,919	1,794,919	1,544,919
Total Expenditure	11,530,892	11,647,180	13,694,291	13,408,893	18,439,482	19,052,013	18,905,018
MINISTRY OF THE BLUE ECONOMY & CIVIL AVIATION							
Revenue	21,435	120,484	87,500	170,968	177,807	181,363	184,990
Recurrent Expend	2,014,680	2,396,442	2,880,008	2,639,185	3,091,858	3,091,858	3,091,858
Capital II Expend	103,618	352,002	437,993	375,473	765,344	672,784	678,944
Capital III Expend	0	5,781	0	0	0	0	0
Total Expenditure	2,118,298	2,754,224	3,318,001	3,014,658	3,857,202	3,764,642	3,770,802
MINISTRY AGRICULTURE, FOOD SECURITY AND ENTERPRISE							
Recurrent Expend	4,959,151	4,676,911	4,812,276	4,864,758	4,971,529	4,971,529	4,971,529
Capital II Expend	277,916	508,507	448,501	1,665,405	962,500	962,500	962,500
Capital III Expend	2,850,063	2,850,063	2,850,063	1,324,886	6,203,895	6,923,984	5,459,400
Total Expenditure	8,087,131	5,905,969	6,610,776	7,855,048	12,137,923	12,858,012	11,393,429
MINISTRY OF INFRASTRUCTURE DEVELOPMENT AND HOUSING							
Recurrent Expend	8,892,814	7,802,870	11,271,965	10,075,514	11,116,230	11,125,662	11,133,676
Capital II Expend	14,365,177	18,364,938	29,514,083	44,428,093	45,084,517	42,205,139	44,952,690
Capital III Expend	28,277,045	34,549,996	34,025,000	43,740,618	40,805,185	40,611,204	47,319,174
Total Expenditure	51,535,036	60,717,803	74,811,048	98,244,225	97,005,932	93,942,004	103,405,539
TOTAL BUDGET CEILING							
Recurrent Expend	470,243,061	469,529,806	543,950,271	516,383,519	556,427,526	573,120,352	584,916,705
Capital II Expend	105,210,601	75,841,804	80,380,830	109,847,902	109,062,269	110,000,000	112,500,000
Capital III Expend	105,413,051	51,927,416	57,505,807	70,000,000	79,001,823	80,000,000	81,000,000
Total Expenditure	680,866,712	597,299,025	681,836,907	696,231,421	744,491,618	763,120,352	778,416,705

Source: IDOM own elaboration with information from the Budget for fiscal year 2023/2024

Now, looking further into the budgets of each ministry for the development of programs the following is obtained.

The ministry of Infrastructure Development and Housing is currently assisting the Ministry in Urban Development Services and construction of low-income housing program for the construction of homes and is working with the aim of having a public infrastructure that meet all the highest standards to provide a high-quality public road infrastructure that promotes sustainable economic development. The current budget allocation is:

Budget allocation MIDH in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Strategic Management and administration	38,153,394	48,337,569	67,853,564	89,334,723	88,932,777	89,159,360	98,629,428
Roads and bridges construction and maintenance	11,567,418	9,153,925	5,713,398	5,352,931	5,993,437	4,029,110	4,027,077
Construction and maintenance of inland waterways and drains	1,246,256	2,773,667	525,004	3,025,327	1,325,000	0	0
Construction and maintenance of public buildings	213,800	189,881	273,703	212,932	257,769	256,663	253,896
Housing development	354,169	262,763	445,380	318,313	496,951	496,871	495,138

Source: Budget for fiscal year 2023/2024

The Ministry of Sustainable Development, Climate Change and Disaster Risk Management is working to achieve a national sustainable approach to development, integrated disaster risk management, and climate mitigation and adaptation, and green financing. It is the ministry uncharged of the programs of construction of hurricane shelters, Infrastructure Readiness - Building Capacity for Climate Resilient Infrastructure and Sustainable Urban Land Management, Integrated flood management, environmental and solid waste management, among others.

Budget allocation MSDCC and RM in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Strategic Management and administration	606,012	606,012	1,465,224	1,301,178	3,332,699	693,197	702,841
Forestry Resource management	1,347,023	1,399,378	1,853,603	1,704,676	2,096,940	2,112,583	2,123,601
Environmental Management	452,844	496,807	630,882	437,371	722,765	724,472	726,001
Solid Waste management	2,736,165	3,192,603	2,824,602	2,937,676	6,082,536	6,331,979	6,185,358
Office of emergency management	1,191,281	1,012,740	1,271,107	1,883,834	2,254,102	2,253,548	2,253,629
National Meteorological services	618,072	560,805	819,392	603,265	839,925	868,250	838,877
National fire services	2,693,534	3,039,891	4,043,485	3,418,715	3,993,061	3,957,508	3,987,177

Source: Budget for fiscal year 2023/2024

In other hand, In the fiscal year 2022 – 2023, The Ministry established a Policy, Planning and Projects Unit to improve donor coordination and project implementation across departments, strengthen partnerships with other sectors and increase the Ministry's management effectiveness of its programs and projects. This unit is supporting the initiatives of biodiversity protection, climate change, green finance and got a budget to archive that of $USD 9 million approximately.

The Ministry of Natural Resources, Petroleum and Mining is currently developing some programs like the strategic and land management and administration to ensure the correct manner of the national land use for the future. In this way, their budget allocation consists of:

Budget allocation MNRPM in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Strategic Management and administration	7,825,278	13,548,430	7,699,081	11,047,828	8,562,082	8,563,184	8,559,726
Land Management and administration	2,425,528	1,827,074	2,534,680	2,374,891	3,413,418	3,339,314	3,338,197
Mining	100,412	97,928	100,149	105,507	144,427	144,427	147,739
Hydrology	135,065	142,706	154,090	148,990	158,907	158,951	158,951
Geology	338,740	400,757	381,647	380,360	444,998	445,073	430,717

Source: IDOM, 2023 Source: Budget for fiscal year 2023/2024

The Ministry of Education, Culture, Science and Technology is the one in charge of the construction and establishment of secondary schools across the country, executing programs of education and workforce development, providing environmental education, etc. The internal budget allocation is:

Budget allocation MECST in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Operations	125,069,132	103,197,838	111,304,698	108,498,106	120,458,123	120,415,946	120,381,946
Education development	111,151	111,514	1,829,031	705,937	1,741,415	1,726,415	1,726,415
School supervision and support	2,571,297	2,076,589	8,019,524	5,625,674	9,455,901	9,453,401	9,453,401
Student support services	1,802,864	1,596,701	1,827,783	1,188,319	1,683,579	1,683,579	1,683,579
National resource services	2,877,344	3,315,854	3,613,277	3,398,210	3,899,184	3,893,579	3,888,579
Policy and planning	3,765,480	913,220	2,286,060	2,843,678	3,536,653	1,536,653	536,653
Workforce development	309,954	234,239	480,696	258,277	478,564	478,563	478,563

Source: Budget for fiscal year 2023/2024

The ministry of Agriculture, Food Security and Enterprise, is working to enhance the national production and productivity increasing the market development. The specific budget allocation per program is:

Budget allocation MAFE in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Agriculture research and development	4,066,035	2,150,401	2,829,242	3,573,995	8,089,934	8,810,023	7,345,440
National agriculture extension program	2,381,537	2,222,715	2,266,155	2,305,230	2,337,780	2,337,780	2,337,780
Aquaculture	158,406	141,728	178,416	155,032	196,909	196,909	196,909
Cooperatives	369,033	37,048	383,875	362,364	372,769	372,769	372,769
Financial assistance	589,170	526,680	526,680	526,680	526,680	526,680	526,680
Trade standards	522,951	493,965	426,408	931,749	613,853	613,853	613,853

Source: Budget for fiscal year 2023/2024

And last, the Ministry of Blue Economy and Civil Aviation is working on the blue economy development pathway to a sustainable future. But the most important initiative that the ministry have is the promotion of a safe and efficient od the domestic and international air transportation. And so on, the budget allocation corresponds to:

Budget allocation MBECA in USD.

Program	ACTUAL OUT-TURN 2020/21	ACTUAL OUT-TURN 2021/22	APPROVED BUDGET 2022/23	PROJECTED OUT-TURN 2022/23	SUBMITTED BUDGET 2023/24	FORECAST 2024/25	FORECAST 2025/26
Strategic Management and administration	92,576	629,236	736,811	669,031	860,234	864,074	870,234
Fisheries resources management and development	1,319,319	1,444,670	1,669,639	1,580,167	1,624,390	1,624,390	1,624,390
Civil aviation	706,404	680,318	911,551	765,460	1,372,579	1,276,179	1,276,179

Source: Budget for fiscal year 2023/2024

The government also has other initiatives working on the sustainability of the country. The ministry of Economic Development and Investment is currently developing the Energy Resilience for Climate Adaptation Project (ERCAP) and it counts with the financing of US$ 11,975,00 from the Global Environment Facility, World Bank, Belize Electricity Limited and the Government of Belize.

It also has the program "Building Capacity for Climate Resilient Infrastructure and Sustainable Urban Land Management" that counts with the pre-accreditation of the Green Climate Fund with a budget of US$ 998,307; the National Adaptation Planning for Integrated Water Resources Management project with a budget of US$ 902,937; the construction of hurricane shelters led by the NEMO agency with a projected cost of $USD 12.5 million; among others.

Belize has been reducing its debt as a percentaje from 133% in 2020 to 64% in 2022 (as a percentaje of GDP). This trend is expected to continue in the following years to become 53% by 2028.

Since 2022 the country has a primary surplus in its budget and (0,24%) and it is expected to grow until 1.55% by 2026. The surplus is justified in an greater increase of revenues and grants over the total expenditures; while the first is expected to grow by 4,6% anually, the latter is expected to grow 3,8%.

The budget allocation for several ministrys are expected to grow for the following years. Capital expenditures are expected to grow by 2.5% year on year between 2023 and 2026.

Looking furhter in budget allocation of different ministrys, it was found that programs similar to the prioritized projects already exist.

ANNEX E

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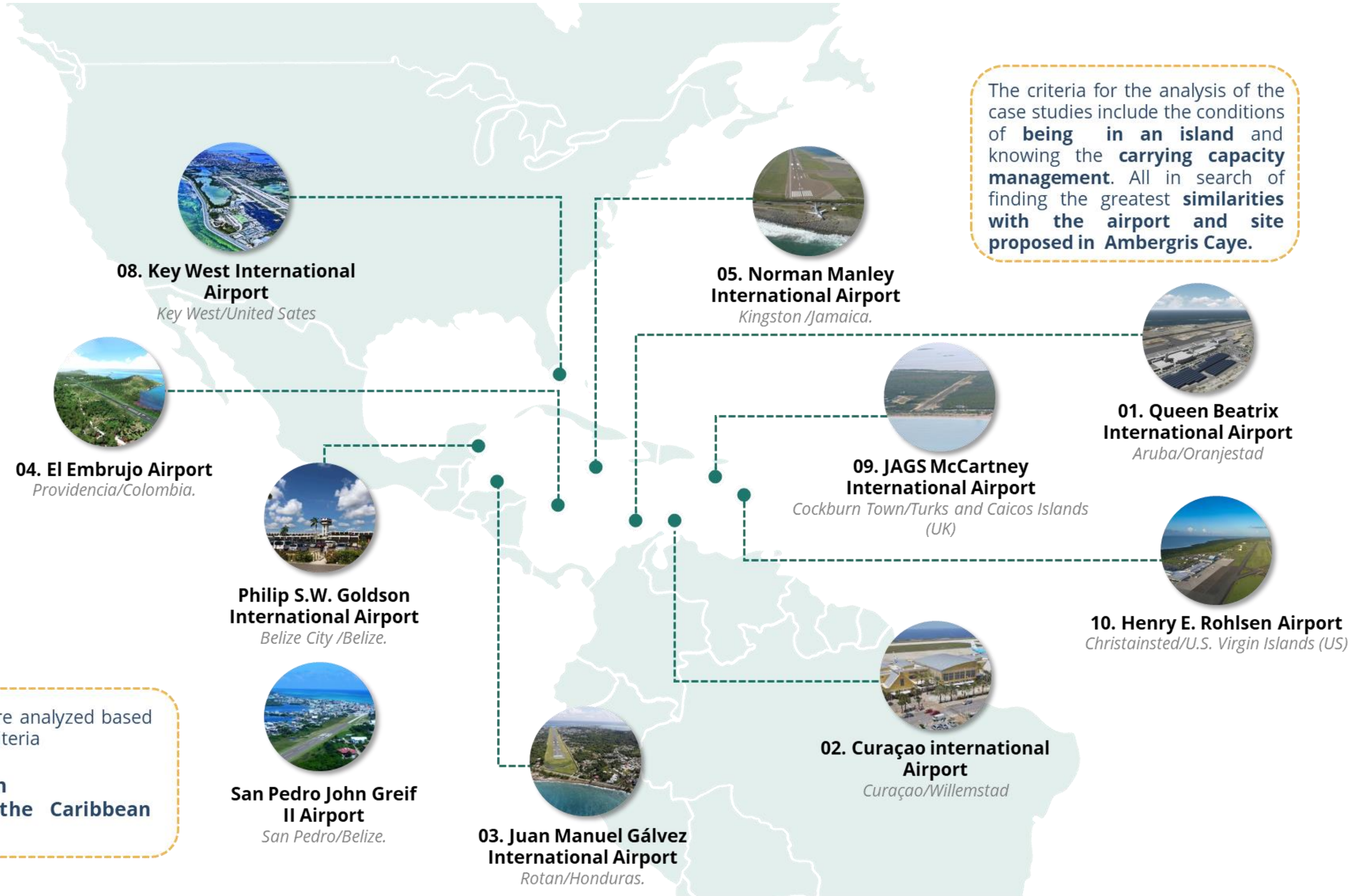
Annex E: - Airport Benchmark

The criteria for the analysis of the case studies include the conditions of **being in an island** and knowing the **carrying capacity management**. All in search of finding the greatest **similarities with the airport and site proposed in Ambergris Caye.**



These airports were analyzed based on the following criteria

- **Size**
- **Island location**
- **Location in the Caribbean Region**

1 Queen Beatrix International Airport

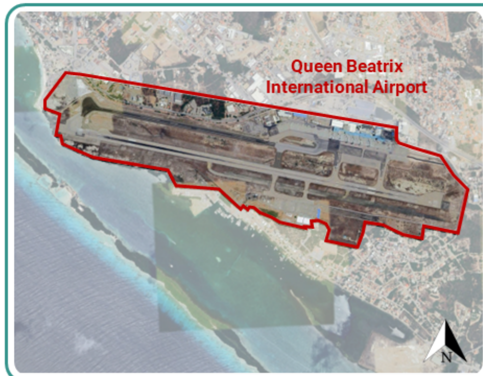
Location
Oranjestad, Aruba

Size / /# /Landing tracks and Length
514 acres (208 Ha) without expansion zone / 1 / 1,7 Mile (2.8 Km)

Regional / Domestic / International
International

Beginning of commercial operations
2000

Number of flights an passengers per week
308 Flights / 48.000 Passengers / 155 Passengers per flight



Construction Phases

Beginnings and Original Construction:
- **1934**: The airport initially opened as a small airfield with a dirt runway.
- **1955**: The airport was renamed in honor of Queen Beatrix of the Netherlands, and a new terminal was built to accommodate the increased air traffic.

First Expansion:
- **1972:** A new terminal was built, and the runway was extended to handle larger aircraft and a higher volume of passengers.

Modernization and Expansion:
- **1990s**: Several improvements were made, including the expansion of the terminal and the modernization of facilities to enhance the airport's capacity and safety.
- **2000**: A major expansion project was completed, increasing the terminal's capacity and improving passport control and customs facilities

Renovation and New Facilities:
- **2007:** A new arrivals terminal was opened, and the departures terminal was renovated, significantly improving the passenger experience.
- **2013:** The construction of a new aircraft parking apron was completed, and the runways and taxiways were modernized.

Gateway 2030 Project:
- **2018 - Present:** The Gateway 2030 Project is a long-term expansion and modernization plan that includes the construction of a new terminal, runway extensions, security infrastructure improvements, and the addition of new commercial facilities. This project aims to transform the airport into a world-class facility and handle future growth in air traffic.

Type of Commercial Aircrafts

Regional Planes
- ATR 42**: 40 - 50 passengers**
- ATR 72: **68 - 78 passengers**
- Bombardier CRJ: **50 - 104 passengers**
- Embraer ERJ Series: **37 - 50 passengers**

Narrow- Body Planes
- Boeing 737: **85 - 215 passengers**
- Airbus A320: **140 - 240 passengers**
- Embraer E-Jets (E170, E175, E190, E195): **70 - 130 passengers.**
- Boeing 757: **200 - 295 passengers**

Wide-body Planes
- Boeing 767: **181 - 375 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787 Dreamliner: **242 - 335 passengers**
- Airbus A330: **250 - 440 passengers**
- Airbus A340: **260 - 475 passengers**

Type and Number of Aircrafts per week

Passengers: 308 Flights per week
Cargo: 15 Flights per week
Private: 80 Flights per week
Military : 2 Flights per week

Cargo Aircrafts
- Boeing 747 Freighter - 231.8 feet (70.66 Meters)
- Boeing 767 Freighter - 180 feet (55 Meters)
- Airbus A330 Freighter - 192.9 feet (59 Meters)

Private Jets
- Gulfstream G550 - 96.5 feet (30 Meters)
- Bombardier Global 6000 - 99.5 feet (30.3 Meters)
- Cessna Citation X - 72.4 feet (22 Meters)
- Dassault Falcon 7X - 76.1 feet (23.19 Meters)

Military Aircrafts
- Lockheed C-130 Hercules - 97.9 feet (39 Meters)
- Boeing C-17 Globemaster III - 174 feet (53 Meters)

Distinguishing factors
- Situated on a Caribbean island, the airport serves as a main gateway to Aruba, a popular tourist destination known for its beaches, warm climate, and luxury resorts. Its strategic location makes it a key point for travelers from North America and Europe seeking tropical destinations.
- The airport has undergone several renovations and expansions to improve its infrastructure and services. This includes modernizing terminals, adding more gates, and enhancing waiting areas and passenger services.
- The airport has implemented several initiatives to improve its environmental sustainability, such as recycling programs, energy efficiency, and sustainable resource management.

Level of Applicability

2 Curaçao international Airport

Location
Willemstad, Curaçao

Size / /# /Landing tracks and Length
528 acres (213 Ha) without expansion zone / 1 / 2,11 mile (3.4 km)

Regional / Domestic / International
International

Beginning of commercial operations
1997

Number of flights an passengers per week
334 Flights / 30.700 Passengers/ 92 Passengers per flight

Construction Phases

Beginnings and Original Construction:
- **1930s:** The airport began as a small airfield in Hato, located in the northern part of Willemstad.
- **1940s:** During World War II, the facilities were significantly expanded to support Allied military operations. This period saw the construction of the main runway and the basic infrastructure needed for air operations.

Expansion and Modernization:
- **1954:** The official inauguration of Curaçao International Airport with a new passenger terminal to support the increase in commercial air traffic.
- **1960s:** Additional improvements were made to the runway and new facilities were constructed to handle the growth of tourism.

Renovation and Enlargement
- **1997:** A major modernization project began, which included the renovation of the passenger terminal, the expansion of aircraft parking areas, and the improvement of security systems.
- **2000:** The first phase of the modernization project was completed with a new modern passenger terminal, which included shopping areas, restaurants, and other passenger amenities.

Recent Projects:
- **2014-2018:** Several expansion and modernization projects were carried out, including the expansion of the passenger terminal, improvements to the runways, and the incorporation of new airport management technologies.
- **2020-2022:** Despite the challenges caused by the COVID-19 pandemic, further improvements to the facilities were completed, focusing on improving operational efficiency and passenger experience.

Type of Commercial Aircrafts

Regional Planes
- ATR 42: **40 - 50 passengers**
- ATR 72: **68 - 78 passengers**
- Bombardier CRJ: **50 - 104 passengers**
- Embraer ERJ Series: **37 - 50 passengers**

Narrow- Body Planes
- Boeing 737: **85 - 215 passengers**
- Airbus A320: **140 - 240 passengers**
- Embraer E-Jets (E170, E175, E190, E195): **70 - 130 passengers.**
- Boeing 757: **200 - 295 passengers**

Wide-body Planes
- Boeing 767: **181 - 375 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787 Dreamliner: **242 - 335 passengers**
- Airbus A330: **250 - 440 passengers**
- Airbus A340: **260 - 475 passengers**

Type and Number of Aircrafts per week

Passengers: 334 Flights per week
Cargo: 11 Flights per week
Private: 30 Flights per week
Military : 2 Flights per week

Cargo Aircrafts
- Boeing 747 Freighter - 231.8 feet (70.66 Meters)
- Airbus A330 Freighter - 192.9 feet (59 Meters)

Private Jets
- Gulfstream G650 - 99.7 feet (30.4 Meters)
- Bombardier Global Express - 99.5 feet (30.32 Meters)
- Cessna Citation series - 53.3 feet (16.26 Meters)

Military Aircrafts
- Lockheed C-130 Hercules - 97.9 feet (39 Meters)
- Boeing C-17 Globemaster III - 174 feet (53 Meters)

Distinguishing factors
- Situated in the Southern Caribbean, Curaçao International Airport serves as a crucial hub for flights between North America, South America, Europe, and the Caribbean.
- The airport has a long runway (3,410 meters or 11,186 feet), capable of accommodating large aircraft, including wide-body jets used for long-haul international flights.
- The airport has been involved in various sustainability initiatives aimed at reducing its environmental footprint, such as energy-efficient infrastructure and waste management programs.
- The airport has a long runway (3,410 meters or 11,186 feet), capable of accommodating large aircraft, including wide-body jets used for long-haul international flights.

Level of Applicability

3 Juan Manuel Gálvez International Airport

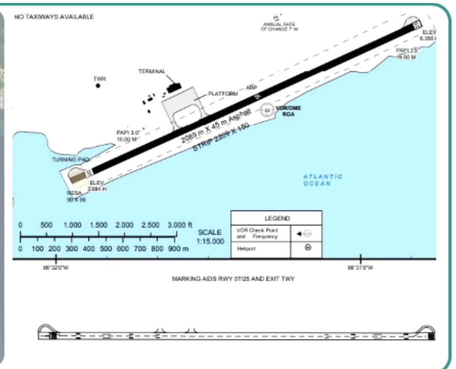
Location
Roatán, Honduras

Size / /# /Landing tracks and Length
167.67 acres (67.5 Ha) without expansion zone / 1 / 1,36 Mile (2.2 Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1990

Number of flights an passengers per week
245 Flights / 11.538 Passengers/ 47 Passengers per flight



Construction Phases

Initial Construction Phase (1990s):
- **Site Selection and Planning:** The location on Roatán was chosen for its strategic importance in boosting tourism and providing a direct connection to the Bay Islands.
- **Runway Construction:** The initial runway was constructed to accommodate domestic flights and small international aircraft.
- **Terminal Building:** A small terminal building was constructed to handle passenger processing, including customs and immigration.

Expansion Phase (2000s):
- **Runway Extension:** To accommodate larger aircraft and increased traffic, the runway was extended.
- **Terminal Expansion:** The terminal was expanded to include more gates, larger waiting areas, and additional services such as restaurants and duty-free shops.
- **Navigation and Safety Enhancements:** Implementation of modern navigation aids and safety equipment to improve landing and takeoff procedures.

Modernization Phase (2010s)
- **Infrastructure Upgrades:** Significant upgrades to airport infrastructure, including better access roads, parking facilities, and expanded apron space for aircraft.
- **Environmental Considerations**: Implementation of environmental measures to minimize the airport's impact on the island's ecosystem, including waste management systems and noise reduction initiatives.
- **Technological Improvements**: Introduction of advanced baggage handling systems, security screening technologies, and passenger information systems..
- **Recent Developments (2020s)**
- **Further Terminal Enhancements:** Ongoing improvements to the terminal building to increase capacity and improve passenger comfort.
- **Sustainability Initiatives:** Continued focus on sustainability, including the installation of solar panels and energy-efficient systems.
- **Operational Efficiency:** Upgrades to air traffic control systems and other operational technologies to enhance efficiency and safety.

Type of Commercial Aircrafts

- Boeing 737-800: Typically seats around **162 passengers** in a standard configuration.
- Airbus A320: Can accommodate approximately **180 passengers**.
- ATR 72 (Turboprop): Seats between **68 to 78 passengers** depending on the configuration.
- Embraer E190 (Regional Jet): Often configured to carry around **100 passengers.**

Type and Number of Aircrafts per week

Passengers: 245 Flights per week
Cargo: 1 Flights per week
Private: 0 Flights per week
Military : 0 Flights per week

Cargo Aircrafts
- Boeing 747 Freighter - 231.8 feet (70.66 Meters)

Private Jets
- Gulfstream G650 - 99.7 feet (30.4 Meters)
- Bombardier Global Express - 99.5 feet (30.32 Meters)
- Cessna Citation series - 53.3 feet (16.26 Meters)
- Learjet 75 - 58.6 feet (17.9 meters)
- Embraer Phenom 300 - 52.2 feet (15.9 meters)
- Pilatus PC-12 NG - 47.3 feet (14.4 meters)
- Beechcraft King Air 350i - 46.8 feet (14.3 meters)

Distinguishing factors
- The airport has undergone recent upgrades to improve its facilities, including expanded terminal space and improved amenities for travelers.
- It plays a significant role in connecting the Bay Islands of Honduras with mainland Honduras and other international destinations.
- While not a large airport by international standards, it efficiently handles the influx of tourists and local traffic, especially during peak tourist seasons.
- Being situated on Roatán Island, it provides easy access to other Bay Islands such as Utila and Guanaja, which are also popular tourist destinations.

Level of Applicability

4 El Embrujo Airport

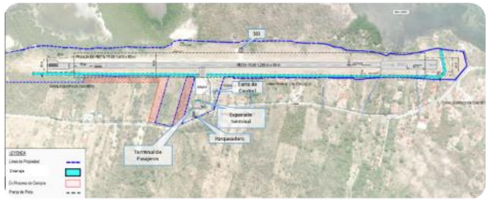
Location
Providencia, Colombia

Size / /# /Landing tracks and Length
58.3 acres (23.59 Ha) without expansion zone / 1 / 1,55 Mile (2.5 Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1990

Number of flights an passengers per week
17 Flights / 1.153 Passengers/ 90 Passengers per flight



Construction Phases

Initial Construction (1970s)
- The airport was originally constructed to facilitate transportation to and from Providencia Island, primarily to connect with San Andrés Island.

Runway Extension and Improvements (2000s):
- The runway was extended and reinforced to accommodate larger aircraft, improving safety and allowing for more frequent flights.
- Upgrades were made to the runway lighting and navigation systems to enhance operational safety.

Terminal Renovations (2010s):
- The passenger terminal was renovated to provide better services and facilities for travelers.
- Improvements included updated waiting areas, restrooms, and security checkpoints.

Infrastructure Enhancements (Late 2010s - Early 2020s):
- Additional enhancements were made to the airport's infrastructure, including the construction of new taxiways and aprons.
- Further improvements in safety features, such as modernized fire-fighting equipment and emergency response facilities.

Type of Commercial Aircrafts

- ATR 42:Capacity: Approximately **40-50 passengers**.
- De Havilland Canada DHC-6 Twin Otter: Capacity: Approximately **19 passengers.**
- Beechcraft 1900:Capacity: Approximately **19 passengers.**
- Cessna 208 Caravan: Capacity: Approximately **9-14 passengers.**

Type and Number of Aircrafts per week

Passengers: 17 Flights per week
Cargo: 0 Flights per week
Private: 0 Flights per week
Military : 0 Flights per week

Distinguishing factors
- The runway is relatively short, which limits the size of aircraft that can land there, making it suitable primarily for smaller, regional planes.
- Enhanced to support the specific requirements of short takeoff and landing (STOL) aircraft.
- Due to its size and infrastructure, the airport has limited capacity and fewer daily flights compared to larger airports.
- Primarily handles domestic flights with no direct international services.

Level of Applicability

5 Norman Manley International Airport

Location
Kingston, Jamaica

Size / /# /Landing tracks and Length
415 acres (167.9 Ha) without expansion zone / 1 / 1,67 Mile (2.7 Km)

Regional / Domestic / International
International

Beginning of commercial operations
1980

Number of flights an passengers per week
158 Flights / 30.769 Passengers/ 190 Passengers per flight

Construction Phases

Initial Construction:
- **1948**: The airport was officially opened, initially named Palisadoes Airport. It started with basic facilities to handle the initial traffic.

Expansion and Upgrades:
- **1953-1959**: The airport underwent significant expansions, including runway extensions to accommodate larger aircraft. The runway was extended to its current length of 2,716 meters (8,911 feet).

Modernization Efforts:
- **1980s-1990s:** Several modernization projects were undertaken, including terminal upgrades, installation of new navigational aids, and improvements in passenger facilities

Phase 1 - Terminal and Airside Development:
- **2004-2007:** The first major phase of the airport's modernization under the NMIA Airports Limited (NMIAL) included the expansion of the departure concourse, construction of a new arrivals hall, and upgrades to the check-in area. This phase also saw improvements in the baggage handling systems and the installation of jet bridges.

Phase 2 - Airside Improvements
- **2011-2016:** This phase focused on airside improvements, including the resurfacing of the runway and taxiways, upgrades to the airfield lighting system, and improvements in safety and security system

Type of Commercial Aircrafts

Regional Planes
- ATR 42: **40 - 50 passengers**
- ATR 72: **68 - 78 passengers**
- Bombardier CRJ: **50 - 104 passengers**
- Embraer ERJ Series: **37 - 50 passengers**

Narrow- Body Planes
- Boeing 737: 85 - 215 passengers
- Airbus A320: 140 - 240 passengers
- Embraer E-Jets (E170, E175, E190, E195): **70 - 130 passengers.**
- Boeing 757: **200 - 295 passengers**

Wide-body Planes
- Boeing 767: **181 - 375 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787 Dreamliner: **242 - 335 passengers**
- Airbus A330: **250 - 440 passengers**
- Airbus A340: **260 - 475 passengers**

Type and Number of Aircrafts per week

Passengers: 158 Flights per week
Cargo: 15 Flights per week
Private: 25 Flights per week
Military : 1 Flights per week

Cargo Aircrafts
- Boeing 747 Cargo - 231 feet (70.1 meters)
- Boeing 777 Freighter - 209 feet (63.7 meters)
- Airbus A330-200F - 203 feet (61.7 meters)
- McDonnell Douglas MD-11F - 200 feet (61 meters)

Private Jets
- Gulfstream G550 - 96.5 feet (30 Meters)
- Bombardier Global 6000 - 99.5 feet (30.3 Meters)
- Cessna Citation X - 72.4 feet (22 Meters)
- Dassault Falcon 7X - 76.1 feet (23.19 Meters)

Military Aircrafts
- Boeing C-17 Globemaster III - 174 feet (53 Meters)

Distinguishing factors
- The airport boasts a runway length of 2,716 meters (8,911 feet), capable of accommodating large commercial aircraft, including long-haul international flights.
- The airport has implemented various environmental sustainability initiatives, including energy-efficient systems and waste management programs.
- NMIA is a vital economic asset for Jamaica, contributing significantly to tourism, trade, and overall economic development.
- The airport boasts a runway length of 2,716 meters (8,911 feet), capable of accommodating large commercial aircraft, including long-haul international flights.

Level of Applicability

6 Kahului Airport

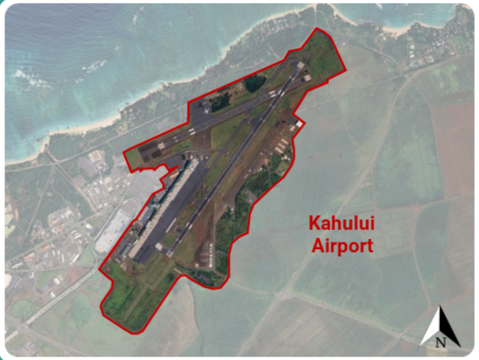
Location
Kahului, Hawaii- United states

Size / /# /Landing tracks and Length
602 acres (243 Ha) without expansion zone / 2 / 1,30 Mile (2.1 Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1970

Number of flights an passengers per week
776 Flights / 115.384 / 150 Passengers per flight



Construction Phases

Initial Construction:

- **1942:** Kahului Airport was constructed by the United States Navy during World War II as Naval Air Station Kahului.
- **1946:** The airport was decommissioned as a military facility and turned over to the Territory of Hawaii for civilian use.
- **1952:** The airport officially opened for commercial service, featuring a small terminal and limited facilities.

Expansion and Modernization:

- **1957:** Construction of a new terminal building to accommodate increased passenger traffic.
- **1960:** Runway extensions and improvements to handle larger aircraft.
- **1970:** Further expansions of the terminal and parking areas.

Major Upgrades and Terminal Enhancements :

- **1980:** Major renovations including the construction of a new ticket lobby, baggage claim area, and improved passenger amenities.
- **1990:** Construction of a new control tower.
- **1995:** Completion of an extended runway to accommodate larger aircraft and increase safety.
- **2000:** Further terminal improvements and expansion of concourses to handle increased passenger traffic and enhance security.

Phase 4: Recent Developments (2010s-Present)

- **2012:** Opening of a new rental car facility.
- **2016:** Completion of a new concourse, providing additional gates and passenger amenities.
- **2020:** Ongoing upgrades and maintenance to modernize the airport, improve passenger experience, and meet environmental standards.

Type of Commercial Aircrafts

Regional Planes

- ATR 42: **40 - 50 passengers**
- ATR 72: **68 - 78 passengers**
- Bombardier CRJ: **50 - 104 passengers**
- Embraer ERJ Series: **37 - 50 passengers**

Narrow- Body Planes

- Boeing 737: 85 - 215 passengers
- Airbus A320: 140 - 240 passengers
- Embraer E-Jets (E170, E175, E190, E195): **70 - 130 passengers.**
- Boeing 757: **200 - 295 passengers**

Wide-body Planes

- Boeing 767: **181 - 375 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787 Dreamliner: **242 - 335 passengers**
- Airbus A330: **250 - 440 passengers**
- Airbus A340: **260 - 475 passengers**

Type and Number of Aircrafts per week

Passengers: 776 Flights per week
Cargo: 30 Flights per week
Private: 105 Flights per week
Military : 2 Flights per week
Cargo Aircrafts

- Boeing 747 Cargo - 231 feet (70.1 meters)
- Boeing 777 Freighter - 209 feet (63.7 meters)
- Airbus A330-200F - 203 feet (61.7 meters)

Private Jets

- Gulfstream G550 - 96.5 feet (30 Meters)
- Bombardier Global 6000 - 99.5 feet (30.3 Meters)
- Cessna Citation X - 72.4 feet (22 Meters)
- Dassault Falcon 7X - 76.1 feet (23.19 Meters)

Military Aircrafts

- Boeing C-17 Globemaster III - 174 feet (53 Meters)

Distinguishing factors

- The airport has a primary runway that is 6,995 feet long, which accommodates a variety of aircraft, including large commercial jets.
- The terminal has an open-air design that reflects the tropical climate and enhances the passenger experience with outdoor courtyards and gardens.
- Kahului Airport serves as a major hub for inter-island flights, providing frequent connections to other Hawaiian islands, which is essential for both residents and tourists.
- The airport has initiatives aimed at sustainability, including energy-efficient practices and a focus on minimizing environmental impact.
- Being in a tropical climate, the airport is designed to handle Hawaii's specific weather conditions, including high humidity and occasional heavy rains.

Level of Applicability

7 Lihue Airport

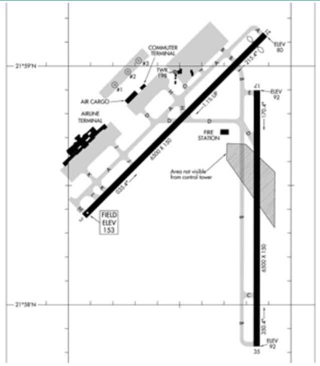
Location
Lihue, Hawaii- United states

Size / /# /Landing tracks and Length
618.66 acres (250 Ha) without expansion zone / 2 / 6.780 feet / 1,30 Mile (2.1Km)

Regional / Domestic / International
International

Beginning of commercial operations
1970

Number of flights an passengers per week
335 Flights / 57.692 Passengers / 170 Passengers per flight



Construction Phases

Initial Construction and Early Developments:

- **1950s:** Lihue Airport was established to serve the growing travel needs of Kauai. The initial construction included basic runway and terminal facilities.
- **1970s:** The airport saw significant expansion with the construction of additional runways and improvement of existing infrastructure to handle increased air traffic.

Major Expansion Phases:

- **1980s:** A significant expansion phase included the construction of a new terminal building to accommodate more passengers and provide better amenities. This phase also involved upgrading the runways and taxiways.
- **1990s:** Continued improvements were made, including enhancements to the terminal and airfield to support larger aircraft and more frequent flights.

Modernization Efforts:

- **2000s:** Modernization efforts focused on improving passenger experience with upgraded facilities, such as expanded baggage claim areas, enhanced security checkpoints, and improved dining and shopping options.
- **2010s:** Further upgrades included the installation of energy-efficient systems, improved accessibility features, and enhanced safety measures. This decade also saw the introduction of advanced technology for air traffic control and passenger services.

Recent and Ongoing Projects:

- **2010s to 2020s:** Recent projects have focused on sustainability and efficiency. Solar power systems were installed to reduce the airport's carbon footprint, and additional measures were taken to manage stormwater and protect the local environment.

Type of Commercial Aircrafts

Regional Planes

- ATR 42: **40 - 50 passengers**
- ATR 72: **68 - 78 passengers**
- Bombardier CRJ: **50 - 104 passengers**
- Embraer ERJ Series: **37 - 50 passengers**

Narrow- Body Planes

- Boeing 737: 85 - 215 passengers
- Airbus A320: 140 - 240 passengers
- Embraer E-Jets (E170, E175, E190, E195): **70 - 130 passengers.**
- Boeing 757: **200 - 295 passengers**

Wide-body Planes

- Boeing 767: **181 - 375 passengers**
- Boeing 777: **314 - 396 passengers**
- Boeing 787 Dreamliner: **242 - 335 passengers**
- Airbus A330: **250 - 440 passengers**
- Airbus A340: **260 - 475 passengers**

Type and Number of Aircrafts per week

Passengers: 335 Flights per week
Cargo: 12 Flights per week
Private: 125 Flights per week
Military : 2 Flights per week
Cargo Aircrafts

- Boeing 747 Cargo - 231 feet (70.1 meters)
- Boeing 777 Freighter - 209 feet (63.7 meters)
- Airbus A330-200F - 203 feet (61.7 meters)

Private Jets

- Gulfstream G550 - 96.5 feet (30 Meters)
- Bombardier Global 6000 - 99.5 feet (30.3 Meters)
- Cessna Citation X - 72.4 feet (22 Meters)
- Dassault Falcon 7X - 76.1 feet (23.19 Meters)

Military Aircrafts

- Boeing C-17 Globemaster III - 174 feet (53 Meters)

Distinguishing factors

- Lihue Airport has implemented several environmental sustainability initiatives. These include the installation of solar power systems, energy-efficient lighting, and water conservation measures. The airport's commitment to sustainability sets it apart from many other regional airports.
- Lihue Airport serves as a crucial hub for inter-island flights within Hawaii. It provides frequent connections to other Hawaiian islands, facilitating easy and convenient travel for both residents and tourists.

Level of Applicability

8 Key West Airport

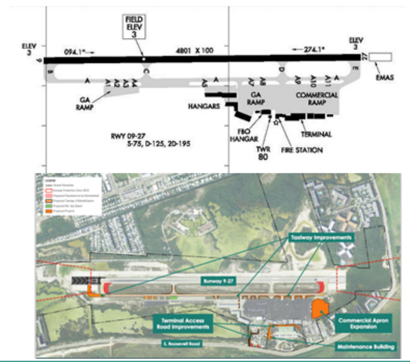
Location
Key West, United states

Size / /# /Landing tracks and Length
165.58 acres (66 Ha) without expansion zone / 1 / 1,05 Mile (1.7Km)

Regional / Domestic / International
Regional

Beginning of commercial operations
1953

Number of flights an passengers per week
158 Flights / 18.000 passengers / 113 Passengers per flight



Construction Phases

Initial Construction:
- **1948**: The airport was officially opened, initially named Palisadoes Airport. It started with basic facilities to handle the initial traffic.

Expansion and Upgrades:
- **1953-1959**: The airport underwent significant expansions, including runway extensions to accommodate larger aircraft. The runway was extended to its current length of 2,716 meters (8,911 feet).

Modernization Efforts:
- **1971:** A new passenger terminal was opened to accommodate growing passenger traffic.
- **1988:** Runway extension and terminal improvements were made to handle larger aircraft and increased traffic.
- **1993:** Another major terminal expansion to increase capacity and improve passenger facilities.

Recent Developments:
- **2009:** The runway was extended again, and safety improvements were made.
- **2011:** A new Concourse A was opened, featuring new gates, baggage claim area, and improved passenger amenities.
- **2014:** The old terminal was renovated to include more modern facilities and better accommodate growing passenger numbers.
- **2021:** Monroe County announced plans for further expansions and renovations, including parking facilities and security enhancements.
- **2023:** Groundbreaking on a new terminal expansion project aimed at further increasing capacity and enhancing passenger experience.

Type of Commercial Aircrafts

Embraer E-Jet Series:
•Embraer E170/E175: 70-88 passengers.
•Embraer E190/E195: 96-124 passengers.
Bombardier CRJ Series:
•Bombardier CRJ200: 50 passengers.
•Bombardier CRJ700: 66-78 passengers.
•Bombardier CRJ900: 76-90 passengers.
Airbus:
•Airbus A319: 124-156 passengers.
Boeing 737 Series:
•Boeing 737-700: 126-149 passengers.
Cessna Citation Series:
•Cessna Citation CJ3: 6-9 passengers.
•Cessna Citation XLS: 8-12 passengers.
•Cessna Citation Sovereign: 8-12 passengers.
Gulfstream Series:
•Gulfstream G150: 6-8 passengers.
•Gulfstream G280: 8-10 passengers.
•Gulfstream G450: 14-19 passengers.

Type and Number of Aircrafts per week

Passengers: 158 Flights per week
Cargo: 2 Flights per week
Private: 609 Flights per week
Military : 1 Flight per week

Cargo Aircrafts
- Cessna 208 Caravan – 41.7 feet (12.67 meters)
- Beechcraft Model 99 – 44.4 feet (13.51 meters)
- Pilatus PC-12 – 47.3 feet (14.40 meters)

Private Jets
- Cessna Citation Mustang - 40.7 feet (12.37 meters)
- Embraer Phenom 100 – 42.1 feet (12.98 meters)
- Cessna Citation CJ3 - 51.2 feet (15.60 meters)
- Embraer Phenom 300 – 52.2 feet (15.91 meters)

Military Aircrafts
- C-130 Hercules – 97.9 feet (29.77 meters)

Distinguishing factors
- As a regional airport, EYW has a relatively small footprint and a single runway (4,801 feet to 4,996 feet depending on the source), which limits the size and types of aircraft that can operate there.
- Despite its size, EYW handles a significant volume of tourists and general aviation traffic due to its location as a popular tourist destination.
- Due to its location within a sensitive environmental area, EYW adheres to strict regulations regarding noise abatement, environmental impact, and wildlife management.

Level of Applicability

9 JAGS McCartney International Airport

Location
Cockburn Town, Turks and Caicos Islands (United Kingdom)

Size / /# /Landing tracks and Length
255.68 acres (103 Ha) without expansion zone / 1 / 1,30 Mile (2.1 Km)

Regional / Domestic / International
Domestic

Beginning of commercial operations
1984

Number of flights an passengers per week
74 Flights / 1.368 Passengers / 18 Passengers per flight

Construction Phases

Initial Construction:
- **1984**: The airport, originally known as Grand Turk International Airport, was built in 1984 to provide air service to Grand Turk Island.

Expansion and Renaming:
- **1994**: In 1994, the airport was expanded to accommodate larger aircraft and increased passenger traffic. It was also renamed JAGS McCartney International Airport in honor of James Alexander George Smith McCartney, the first Chief Minister of the Turks and Caicos Islands.

Runway Extension
2008: The runway was extended in 2008 to handle larger aircraft and increase the airport's capacity for international flights.

Terminal Upgrades:
- **(2011-2012):** The terminal building underwent significant upgrades between 2011 and 2012 to improve passenger facilities, including a larger waiting area, enhanced security, and better amenities.

Recent Developments
- **(2019-2021):** Additional improvements were made to the airport's infrastructure, including upgrades to the runway and taxiways, as well as enhancements to the terminal to further improve passenger experience and operational efficiency.

Type of Commercial Aircrafts

- Cessna 208 Caravan: 8 to 10 passengers.
- Britten-Norman BN-2 Islander: 9 to 14 passengers.
- Pilatus PC-12: 6 to 9 passengers.
- Havilland Canada DHC-6 Twin Otter: 19 passengers.
- Beechcraft King Air: 6 to 11 passengers.
- Piper PA-31 Navajo: 6 to 8 passengers.

Type and Number of Aircrafts per week

Passengers: 78 Flights per week
Cargo: 0 Flights per week
Private: 2 Flights per week
Military : 0 Flight per week

Private Jets
- Cessna Citation Mustang - 40.7 feet (12.37 meters)
- Embraer Phenom 100 – 42.1 feet (12.98 meters)

Distinguishing factors
- It serves as a critical hub for domestic flights within the Turks and Caicos Islands, facilitating connectivity between the islands and playing a key role in the local transportation network..
- The airport's close proximity to the Grand Turk Cruise Center enhances its importance, as it provides convenient air travel options for cruise passengers.

Level of Applicability

10 Henry E. Rohlsen Airport

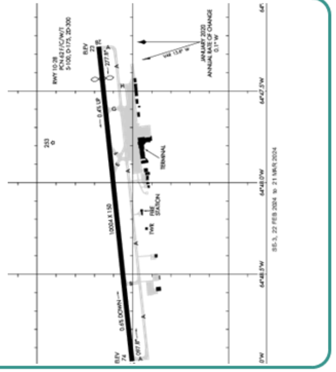
Location
Christainsted, U.S. Virgin Islands (United States)

Size / /# /Landing tracks and Length
578 acres (233 Ha) without expansion zone / 1 / 1,864 mile (3 Km)

Regional / Domestic / International
International

Beginning of commercial operations
1980

Number of flights an passengers per week
60 Flights / 3.847 Passengers / 60 Passengers per flight



Construction Phases

Initial Construction and Early Years

- **1940s:** The airport was originally built as an airfield by the U.S. military during World War II and named Benedict Field. It served as a base for anti-submarine patrols.
- **1948:** The airfield was converted for civilian use and renamed the Alexander Hamilton Airport.

Major Upgrades and Expansion:

- **1980s:** The airport underwent significant renovations and expansions to modernize its facilities and accommodate increasing passenger traffic.
- **1996:** The airport was renamed Henry E. Rohlsen Airport in honor of the prominent Virgin Islands aviator and Tuskegee Airman, Henry E. Rohlsen.

21st Century Developments

- **2001-2005:** This period saw further improvements, including upgrades to the terminal building, runway, and other infrastructure to enhance safety and capacity.
- **2015:** The Virgin Islands Port Authority (VIPA) announced additional upgrades, including plans for expanding the terminal and improving passenger services.
- **2017-2018:** Following the devastation caused by Hurricanes Irma and Maria, the airport underwent repairs and improvements to restore and enhance its facilities.

Recent and Ongoing Projects

- **2020-Present:** VIPA has initiated several projects aimed at further upgrading the airport. This includes enhancing the runway, improving the taxiways, and expanding the terminal to better serve the needs of passengers and airlines.

Type of Commercial Aircrafts

Regional Planes

- ATR 42: 40 - 50 passengers
- ATR 72: 68 - 78 passengers
- Bombardier CRJ: 50 - 104 passengers
- Embraer ERJ Series: 37 - 50 passengers

Narrow- Body Planes

- Boeing 737: 85 - 215 passengers
- Airbus A320: 140 - 240 passengers

Wide-body Planes

- Boeing 767: 181 - 375 passengers
- Boeing 777: 314 - 396 passengers
- Boeing 787 Dreamliner: 242 – 335 passengers
- Airbus A330: 250 - 440 passengers
- Airbus A340: 260 - 475 passengers

Type and Number of Aircrafts per week

Passengers: 168 Flights per week
Cargo: 3 Flights per week
Private: 75 Flights per week
Military : 2 Flight per week

Cargo Aircrafts

- Cessna 208 Caravan – 41.7 feet (12.67 meters)
- Beechcraft Model 99 – 44.4 feet (13.51 meters)
- Pilatus PC-12 – 47.3 feet (14.40 meters)

Private Jets

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- Cessna Citation CJ3 - 51.2 feet (15.60 meters)
- Embraer Phenom 300 – 52.2 feet (15.91 meters)

Distinguishing factors

- HERA has a long runway (10,004 feet) capable of accommodating large aircraft, including wide-body jets, making it suitable for both commercial and cargo flights..
- The airport has been involved in various environmental and sustainability projects aimed at reducing its carbon footprint and enhancing the eco-friendliness of its operations.
- The airport has undergone extensive modernization efforts to enhance passenger amenities, including upgraded terminal facilities, dining options, retail outlets, and comfortable lounge areas, ensuring a pleasant travel experience for passengers.

Level of Applicability

ANNEX F

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Annex F: - Causeway Benchmark

CAUSEWAY PRICE REFERENCE			
Name of the Project	Gran Manglar Causeway	Marine Causeway on the Coastal Strip	Haulover Bridge
Localization	Cartagena (Colombia)	Panamá City (Panamá)	Belize City (Belize)
Number of lines	4	4	2
Size	3,417 Mile (5.5 km)	0,9693 Mile (1.56 Km)	0,15534 Mile (0.25km)
Year of execution	2016–2018	2022-2024	2021-2024
Total Price	**120.000.000 USD**	**45.000.000 USD**	**15.000.000 USD**
Price per Feet / Km	**35.119.000 USD per Mile (21.818.181USD per Km)**	**46.400.000 USD per Mile (28.846.153 USD per km)**	**93.750.000 USD per Mile (60.000.000 USD per Km)**
Image of reference	 Reference: https://colombia.argos.co/viaducto-gran-manglar-un-proyecto-amigable-con-el-entorno/	 Reference:https://www.revistaeyn.com/centroamericaymundo/panama-inaugura-viaducto-marino-en-la-cinta-costera-CJ17786712	 Reference:httpshttps://www.linkedin.com/posts/alessio-gori_belize-and-the-new-haulover-bridge-finally-activity-7162900991007154176-4zC_/

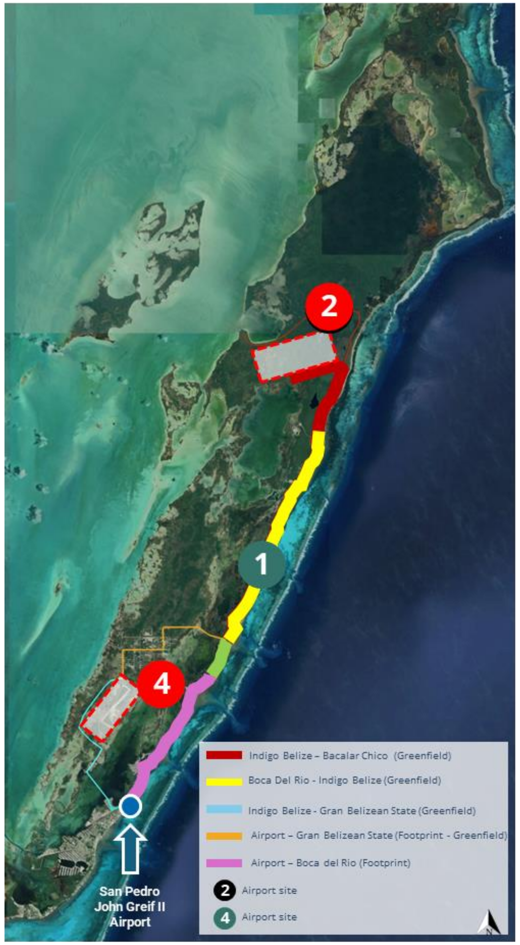
Causeway opportunities and weaknesses

New Road San Pedrito - Airport - Gran Belizean Estate	
Section	**Distance**
1 San Pedrito	0,30 Miles (0.49Km)
2 Causeway	0,87 Miles (1.40 km)
3 Aruna villas- Gran Belizean Estate	2,87 Miles (4.61Km)

OPPORTUNITIES	WEAKNESSES
A more **Direct Connection** between San Pedro, Aruna Villas, and Gran Belizean State, improving accessibility and facilitating transportation between these residential and commercial areas.	The environmental impact of the causeway and the proposed new route is high, as it involves passing through mangrove areas and the West San Pedro Lagoon.
Improvement in the Island's Mobility infrastructure, including the expansion of roads and the implementation of efficient public transportation systems to alleviate congestion and enhance access to different parts of the island.	Road expansions lead to increased development in the area, directing a significant portion of traffic towards the West San Pedro Lagoon zone.
Direct Connection to the proposed **Airport** location, ensuring convenient and fast access for residents and visitors, promoting economic and tourism development in the region.	The cost of the causeway is high, especially when factoring in the construction of the airport.
Decongestion of San Pedro's central area through the implementation of effective traffic solutions, such as new access roads and improved traffic regulations, to enhance flow and reduce travel times within the city.	A substantial investment in infrastructure is necessary, which poses both significant environmental impact and high costs due to the terrain conditions where it is planned.

***The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

Economic Viability of Road Connection



Options	Description	Distance					Cost			
		Greenfield	Causeway	Footprint	Total Construction	Total Distance	Greenfield	Causeway	Footprint	Total
1	**North Convection (Airport Proposed Site # 3)** It includes the **READ (Greenfield)**, **YELLOW (Footprint)** and **GREEN (Footprint)** sections on the map	2,69 Miles (4.24 Km)	NA	6,92 Miles (11.1 km)	9,61 Miles (14.4 km)	13,44 Miles (21.6 km)	2.008.534 USD	NA	4.138.160 USD	6.145.696 USD
2	**Northeast Connection (Airport Proposed Site # 4)** It includes the **PURPLE (Greenfield)** **GREEN (Footprint)** and **BLUE (Footprint)** sections on the map	0,32 Miles (0,51km)	NA	4,94 Miles (7.9 km)	5,26 Miles (8.5 Km)	8,52 Miles (13.7 Km)	238.933 USD	NA	2.954.120 USD	3.193.053 USD
3	**Southeast Connection (Airport Proposed Site # 4)** It includes the, **ORANGE** section on the map	2,87 Miles (4.61Km)	0,87 Miles (1.40 km)	0,71 Miles (1.14km)	4,45 Miles (7.15 Km	4,45 Miles (7.15 Km)	2.143.000 USD	81.562.500 USD	424.580 USD	86.673.133 USD
Estimated Cost Per Mile (Greenfield)							746.667 USD			
Estimated Cost Per Mile (Causeway)							93.750.000 USD			
Estimated Cost Per Mile (Footprint)							598.000 USD espe			

* **Cost increase is estimated if the road passes through mangrove areas** due to the need to build **additional infrastructure** to stabilize the soil. This includes the use of specialized techniques and specific materials, as well as considering the environmental impact.

***The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

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Mobility Study Time and Demand

TIME FROM NEW AIRPORT (SITE 4) TO SAN PEDRO TOWN

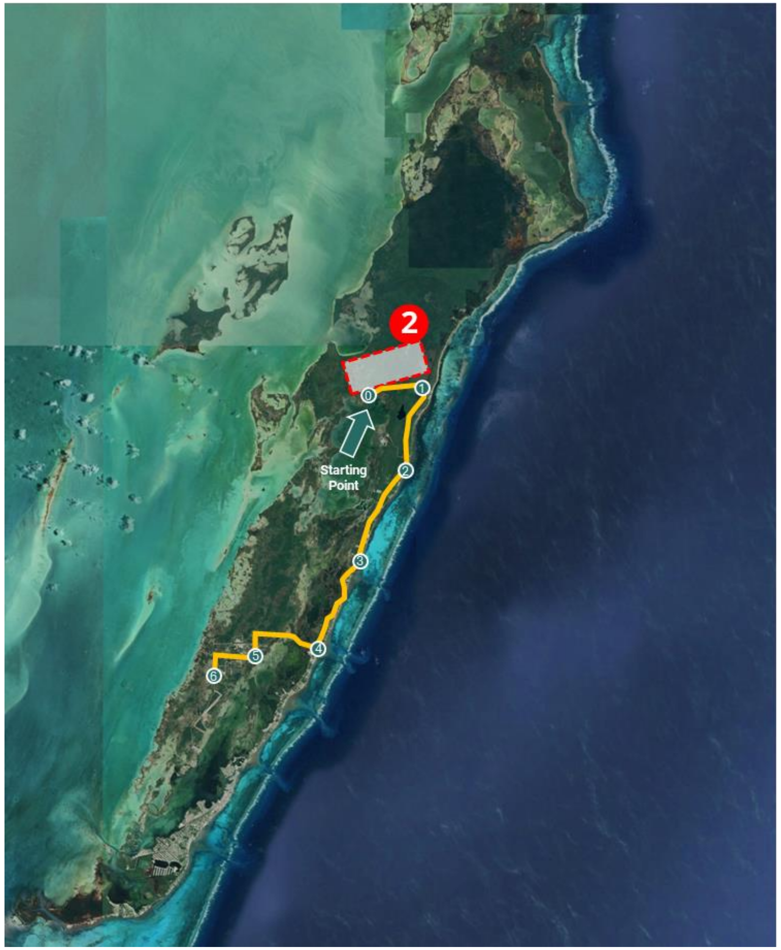
OPTION 1: **10 MINUTES** OPTION 2: **30 MINUTES**

SOCIAL VALUE TIME COST PER TOURIST	TOURISTS PER DAY	MONEY SAVINGS PER TOURIST	TOTAL DAILY SAVINGS OF ALL TURISTS
7 USD BY HOUR	148	2.4 USD	357 USD

Based on the analysis, implementing the Causeway (**Option 1**) results in a travel time of **10 minutes** from the proposed airport site 4 to downtown San Pedro, achieving a **20-minute reduction** in travel time compared to the alternative route via Gran Belizean State to downtown San Pedro (**Option 2**), which takes a total of **30 minutes**.

Given that each tourist saves 20 minutes per day due to the Causeway, translating to a value of 2.4 USD per tourist per day, the cumulative daily savings for all tourists amount to 357 USD. However, despite this time savings, the construction cost of the Causeway, estimated at 86,673,133 USD, is significantly higher than other alternatives.

The daily time savings per tourist do not economically justify the construction expenditure when evaluated solely based on tourist consumption. Therefore, the task force must investigate alternative financing mechanisms to fund the Causeway's construction.



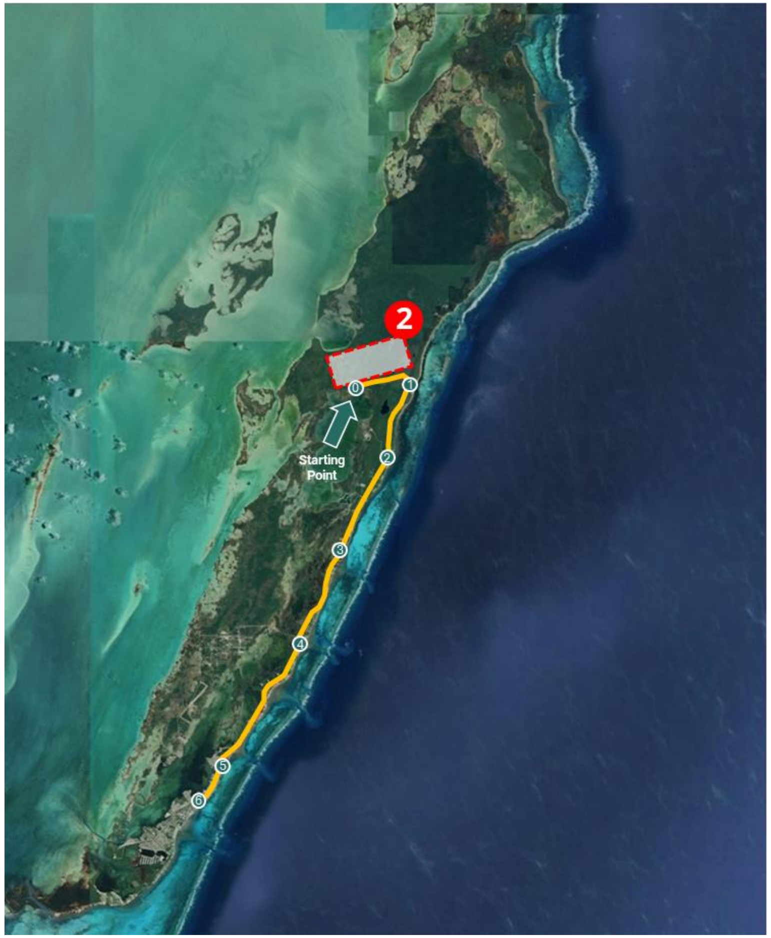
Option Route 1 Airport Possible Site (Cayo Francés)					
Year	2022	2030	2035	2040	2045
Number of Passengers per week	318	496	633	808	1031
Number of Cars per Week	80	124	159	202	258

Section	Distance	Time
0-1	1,40 Miles (2.25 km)	6 Min
1-2	1,8 Miles (2.93 Km)	7 Min
2-3	3,14 Miles (5.1 km)	13 Min
3-4	2,25 Miles (3.65 km)	9 Min
4-5	2,09 Miles (3.36 Km)	8 Min
5-6	1,54 Millas (2.48 Km)	6 Min

Section	Distance	Time
0-1	1,40 Miles (2.25 km)	6 Min
0-2	3,2 Miles (5.1 Km)	12 Min
0-3	6,34 Miles (10.20 Km)	25 Min
0-4	8,59 Miles (13.82 Km)	34 Min
0-5	10,68 Miles (17.18 Km)	42 Min
0-6	12,22 Miles (19,77Km)	49 Min

It is important to clarify that the times were measured by taking an average speed of 25 miles per hour (40 km/h) and that exact travel measurements were taken in all sections.

*The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.



Option Route 2 Airport Possible Site (Cayo Francés)					
Year	2022	2030	2035	2040	2045
Number of Passengers per week	318	496	633	808	1031
Number of Cars per Week	80	124	159	202	258

Section	Distance	Time
0-1	1,40 Miles (2.25 km)	8 Min
1-2	1,8 Miles (2.93 Km)	7 Min
2-3	3,14 Miles (5.1 km)	13 Min
3-4	2,25 Miles (3.65 km)	10 Min
4-5	3.76 Miles (6.05 Km)	16 Min
5-6	1,04 Miles (1.67)	6 Min
Section	**Distance**	**Time**
0-1	1,40 Miles (2.25 km)	8 Min
0-2	3,2 Miles (5.1 Km)	12 Min
0-3	6,34 Miles (10.20 Km)	25 Min
0-4	8,59 Miles (13.82 Km)	34 Min
0-5	23,29 Miles (37.4 Km)	56 Min
0-6	24,33 Miles (39.1 Km)	58 Min

SPEED LIMIT 25

It is important to clarify that the times were measured by taking an average speed of 25 miles per hour (40 km/h) and that exact travel measurements were taken in all sections.

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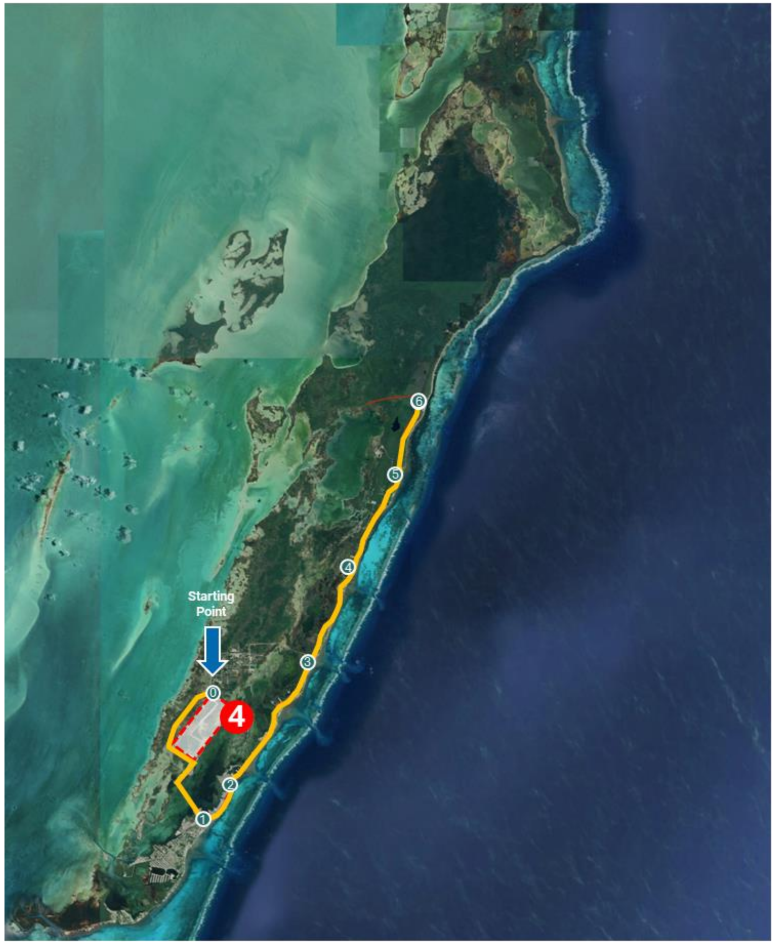


Option Route 1 Airport Possible Site (West San Pedro Lagoon)					
Year	2022	2030	2035	2040	2045
Number of Passengers per week	318	496	633	808	1031
Number of Cars per Week	80	124	159	202	258

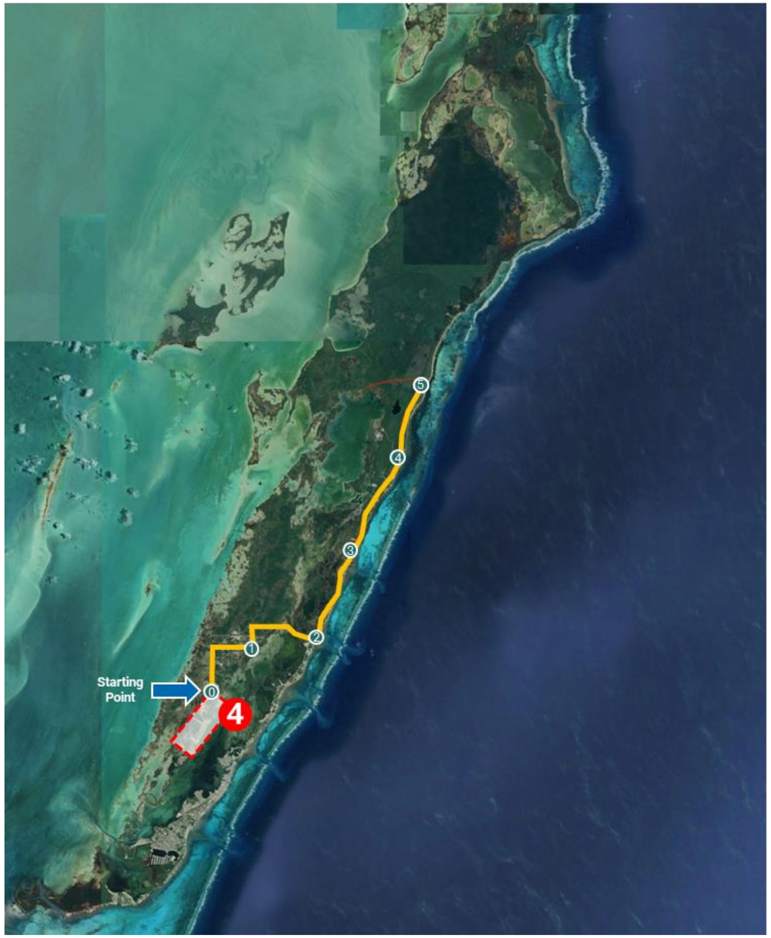
Section	Distance	Time
0-1	4,5 Miles (7.3 Km)	10 Min
1-2	1,8 Miles (2.93 Km)	7 Min
2-3	3,14 Miles (5.1 km)	13 Min
3-4	2,25 Miles (3.65 km)	10 Min
4-5	3.76 Miles (6.05 Km)	16 Min
5-6	1,04 Miles (1.67)	6 Min
Section	**Distance**	**Time**
0-1	4,5 Miles (7.3 Km)	10 Min
0-2	6,3 Miles (10.13 Km)	15 Min
0-3	9,4 Miles (15.12 Km)	22 Min
0-4	11,69 Miles (18.81 Km)	28 Min
0-5	15,45 Miles (24.86 Km)	37 Min
0-6	**24,33 Miles (39.1 Km)**	**62 Min**

SPEED LIMIT 25

It is important to clarify that the times were measured by taking an average speed of 25 miles per hour (40 km/h) and that exact travel measurements were taken in all sections.

***The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.**

*** Cells in yellow indicate the section that includes the causeway.**



Option Route 2 Airport Possible Site (West San Pedro Lagoon)					
Year	2022	2030	2035	2040	2045
Number of Passengers per week	318	496	633	808	1031
Number of Cars per Week	80	124	159	202	258

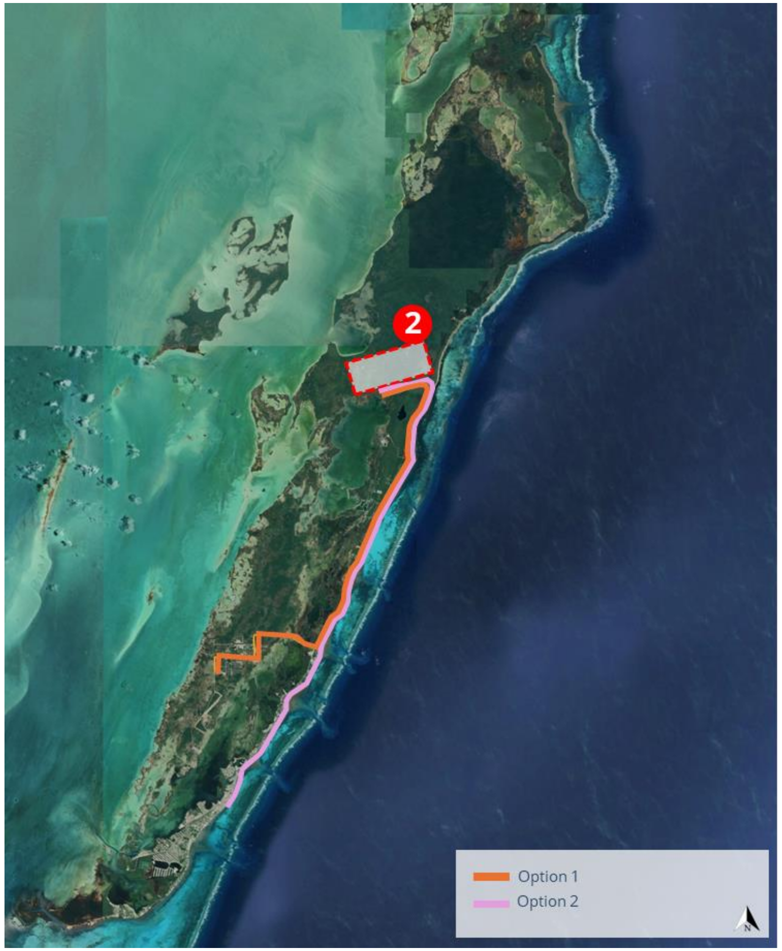
Section	Distance	Time
0-1	1,69 Miles (2.72 Km)	4 min
1-2	2,08 Miles (3.35 Km)	5 min
2-3	2,25 Miles (3.65 km)	5 Min
3-4	3.76 Miles (6.05 Km)	9 Min
4-5	1,04 Miles (1.67)	2 Min
Section	**Distance**	**Time**
0-1	1,69 Miles (2.72 Km)	4 min
0-2	3,77 Miles (6.06 Km)	9 Min
0-3	6,02 Miles (9.6 Km)	14 Min
0-4	9,78 Miles (15.73 Km)	23 Min
0-5	**10,82 Miles (17.4 Km)**	**25 Min**

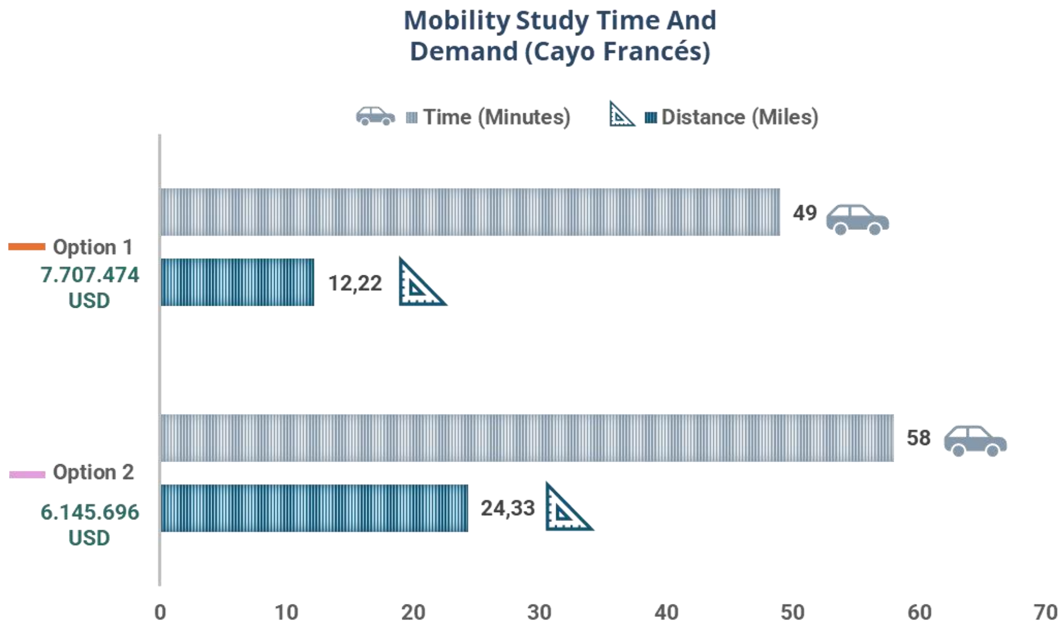
SPEED LIMIT 25

It is important to clarify that the times were measured by taking an average speed of 25 miles per hour (40 km/h) and that exact travel measurements were taken in all sections.

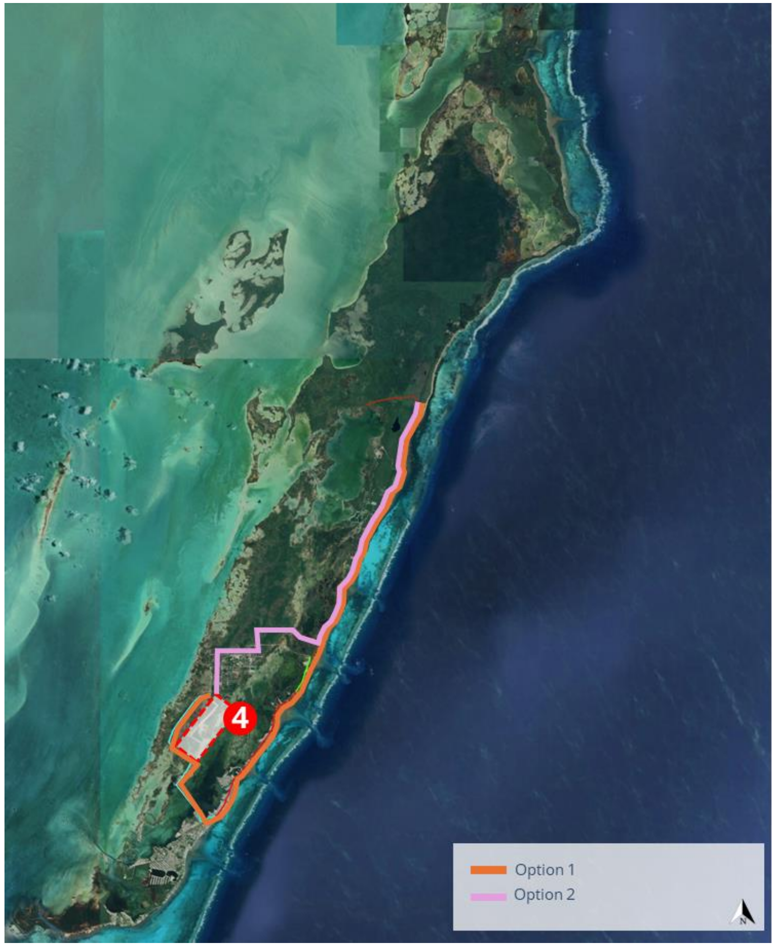
The final decision and location and of the new airport will be subject to detailed pre-feasibility and feasibility studies.

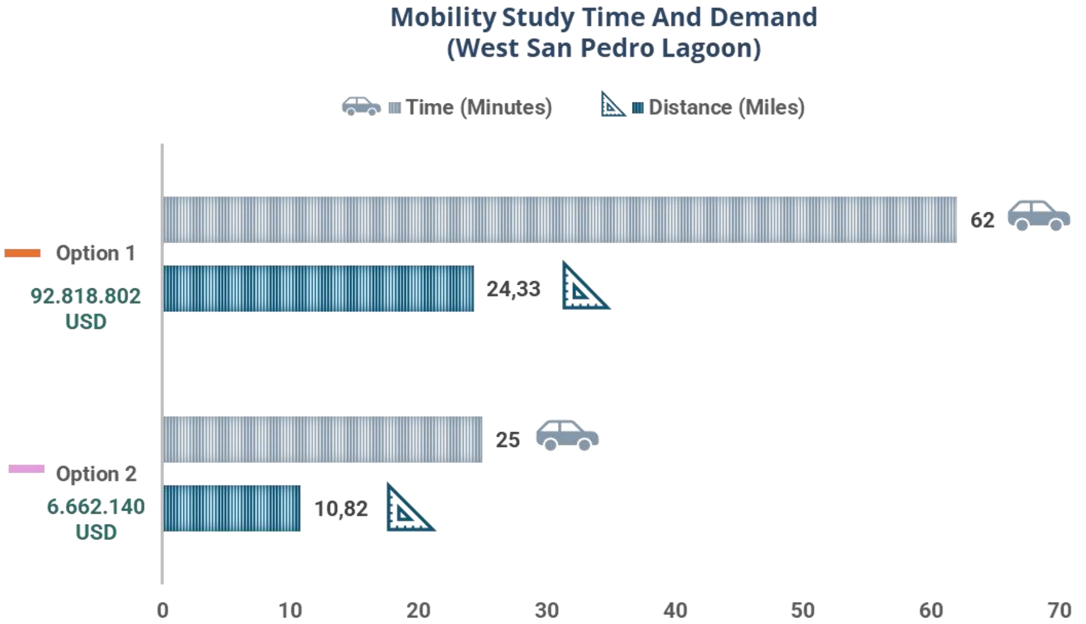
Mobility Study Time and Demand Conclusion





- In option one, it can be observed that the **investment needs to be higher** because the road is currently in an unpaved state, which means the entire road needs to be constructed. This option has a **shorter travel time**, with a total of **12.33 miles** and an estimated time of **49 minutes** from point 0 to point 6.
- It can be observed from the graph that option two, although having a **longer distance**, requires a **smaller investment** because a part of the road is already fully constructed near the center of San Pedro. However, it takes **more time** for vehicle travel, with a total of **24.33 miles** in an estimated time of **58 minutes** from point 0 to point 6.





- In option one, it can be observed that **the investment needs to be considerably higher due to the construction of a causeway** connecting Aruna Villas and San Pedrito. Additionally, it involves **a longer distance**, with a total **of 24.33 miles** and a travel time of **62 minutes**. This is because the road must pass through the center of San Pedro, connecting point 0 to point 6, with point 6 being the final point of the tourist infrastructure.
- It can be observed in the graph that in option two, the travel time between point 0 and point 6 is shorter. It should be noted that in all cases, point 6 is the final point where the tourist infrastructure is planned, with a total distance of **10.82 miles** and a travel time of **25 minutes**. Additionally, the investment is lower because, although the entire **road needs to be constructed**, it does not involve high costs or complex infrastructures.

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