

**EAST COAST (ECP4) RECLAMATION PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT REPORT
FOR: GOVERNMENT OF SEYCHELLES**



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COVER LETTER

Au Cap
Mahe

09 June 2025

The Director General
Environment Assessment & Permit Section
Ministry of Agriculture, Climate Change and Energy
Mont Fleuri

Dear Director General,

EAST COAST PROJECT (RECLAMATION) ESIA FOR GOVERNMENT OF SEYCHELLES

Kindly accept this submission for the afore-mentioned project. The report has been submitted as a result of the conditions placed in the TOR as received on June 04, 2024. The report has also been revised based on the feedback received from MACCE dated October 29, 2024 and May 27, 2025.

The ESIA process for this project was specified as follows:

Project Location	ESIA Category	Notes
Zone 30	Class Two	No past ESIA's conducted on this site Socio-economic consultations concluded
Providence Laguna	Class One	No past ESIA's conducted on this site Rapid benthic assessment conducted at inception phase Socio-economic consultations concluded
Ile Aurore	Review to the Class One ESIA	Previous ESIA's conducted on this site Sediment modeling and marine assessment required Socio-economic consultations concluded

This report covers all three locations as proposed within the ECP4 project. We look forward to concluding the ESIA process to the next phase in order to prevent further undue delays for the Client.

Thank you.



Mr Nimhan Senaratne
Consultant – Eco Sol

EXECUTIVE SUMMARY

TITLE AND LOCATION OF PROJECT

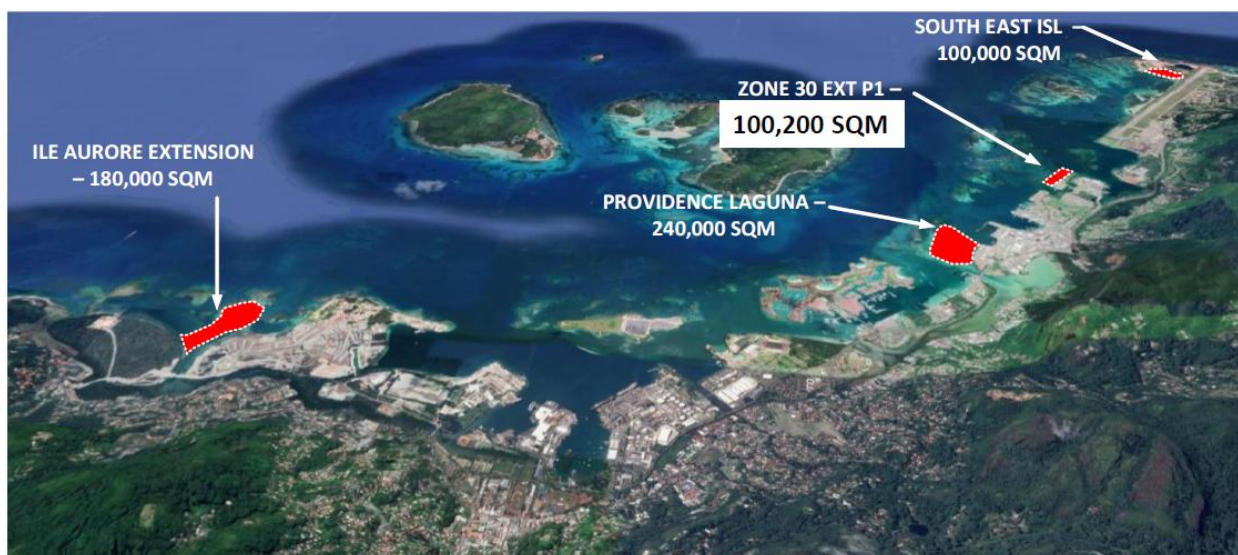
The Ministry of Lands and Housing on behalf of the Government of Seychelles is proposing three reclamation projects which are located at Ile Aurore, Providence Laguna, and Zone 30 Extension respectively.

BRIEF OUTLINE AND PROJECT JUSTIFICATION

The scarcity of land on the coastal plain is particularly visible in Mahé. As such, reclamation projects have been carried out and have long been associated with the economic development in Seychelles since the 1980s. Many key facilities, including the capital city, industrial area, roads, airport and housing estates are on reclaimed land. This project is the fourth one being proposed under the East Coast Project (ECP) umbrella, which entails a series of land reclamation projects on the east coast of Mahe Island.

ORIGINAL PROJECT SCOPE

The initial scope of the project was to dredge 10.02 hectares (100,200 sqm) at Zone 30, 24 hectares (240,000 sqm) at Providence Laguna and 18 hectares (180,000 sqm) at Ile Aurore and 10 hectares (100,000 sqm) at the Seychelles Airport aka South East Island:



Initial dredging scope

The project scope eventually culminated in the first three locations staying the same, and the proposed 7 hectares (70,000 sqm) reclamation at the Seychelles Airport was removed. This reclamation is to be treated as a separate EIA.

REVISED PROJECT SCOPE

Following a consultation on March 24, 2025 in the presence of the Minister of Lands and Housing, MACCE, SIB, SIA and ECO SOL, where the environmental survey findings were shared, a revised project scope was proposed to mitigate the impacts of reclamation.

It was proposed that the dredging scope would be reduced at Providence Laguna, which could possibly see the integration of a commercial waterfront and the offset would be compensated at Zone 30. The rationale for adjusting the scope of the dredge was based on the environmental survey findings (see below) which found Zone 30 to be already impacted by the previous dredging and showcased mostly dead coral boulders overgrown by macroalgae with an absence of seagrass meadows.

The final adjustment took the following dimensions:

For Providence Laguna, the overall dredge size was reduced from 24ha to 18ha (240,000 sqm to 180,000 sqm) following the modifications along the southern and eastern perimeters on account of the hard coral picked up during the marine survey exercise. This decision was taken by government as a direct result of the dive results to mitigate against the impact on this coral.

Government further proposed a zoning of the new shape to reflect a commercial and recreational zone along the edge facing Pangia Beach. Following that, it was proposed to have a zone of light industrial and then heavy industrial as the site moves further towards Providence. Additionally, along the bay that has been created along the western perimeter, government intends to have an F&B and retail zone as support facilities to the industrial zone.

For the Zone 30 Extension area, government increased the size of the original reclamation by 6ha (60,000 sqm) to compensate for the reduction in the Zone 5 proposal given that there is very limited marine life in this area, based on the marine survey results. The total area proposed for reclamation in Zone 30 is approximately 16 hectares.

The annex section of this report provides the coordinates of the three proposed reclamation sites.

SIA is also proposing that a modification be done to the road network in front of Sunshine House either in the form of a roundabout or a 3rd lane to allow entry or exit in a southbound direction. SIA will continue to explore the best option as they proceed with the reclamation development.

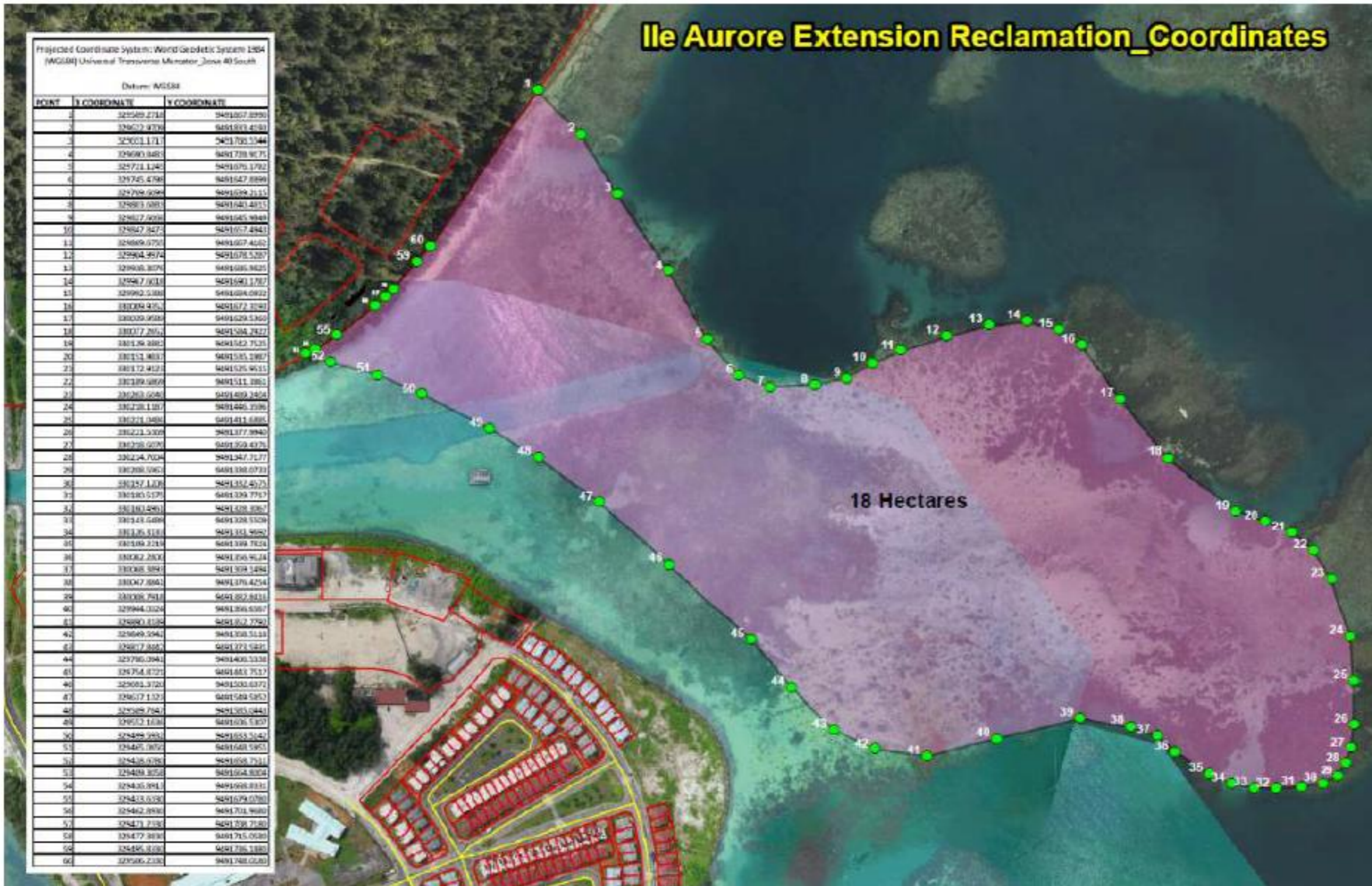
The next pages showcase the new reclamation sizes proposed:

Providence Laguna Initial scope



Providence Laguna revised scope





Ile Aurore revised scope



Legend

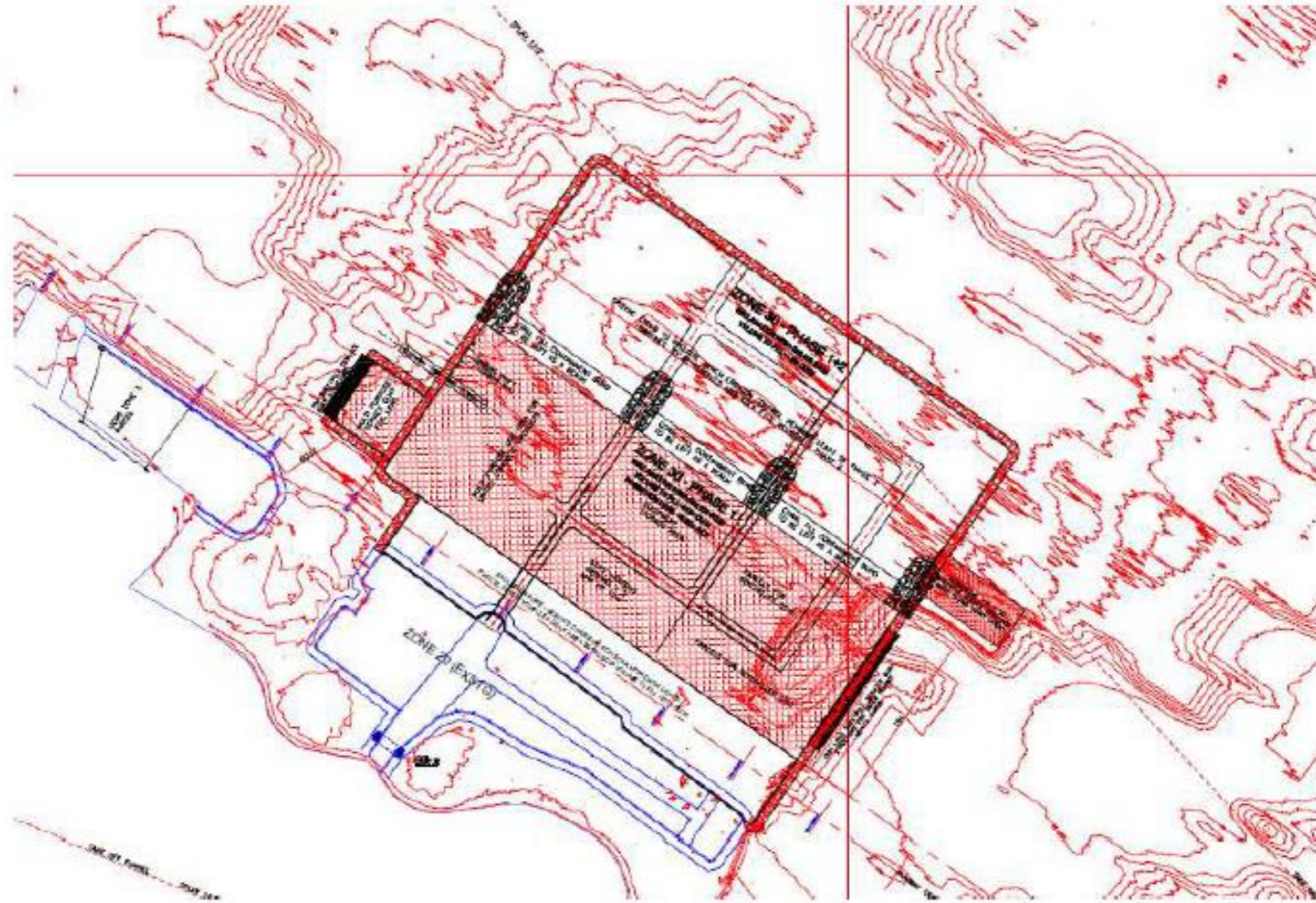
ts Ile_Aurore_Extension_Reclamation
 _Aurore_Extension_R

ORTHOPHOTO MAP - ILE AURORE EXTENSION RECLAMATION



" We Are All In This Together "

Zone 30 initial scope



Zone 30 revised scope



||

OFFSHORE SAND EXTRACTION METHODOLOGY

In 2023, an Environmental and Social Impact Assessment (ESIA) was completed for IDC's proposed offshore sand extraction project. IDC aimed to resume sand extraction activities in two previously approved borrow zones, where sand deposits are located at depths of 40m to 55m. The proposed viable dredging method is using a large trailing suction hopper dredger (TSHD) equipped with a deep-dredging installation (such as 'Vasco da Gama' or 'Christóbal Colón') to minimize environmental impact.

A TSHD is a self-propelled vessel designed to dredge, transport, and discharge seabed materials like sand and gravel. The dredging process consists of four main steps:

- Sailing empty to the dredge area
- Dredging and filling the hopper
- Sailing loaded to the discharge site
- Discharging via a floating pipeline

At the disposal site, water is injected into the sand to fluidize it for hydraulic pumping, preventing spills or blockages.

METHODOLOGY FOR RECLAMATION

The fill material to be used for the reclaimed land are to be dredged from a previously identified 'burrow area' approximately 2km off the North West Coast of Mahe, Seychelles, for which an Environment and Social Impact Assessment (ESIA) has already been completed and approved. This will be the 2nd time extraction of sand is being undertaken from this 'burrow area'

The dredging of the sand from the burrow area is to be done using a trailing suction hopper dredger (TSHD), in the form of hydraulic dredging, as per the approved ESIA for the sand extraction while a backhoe dredger will be used to create confinement bunds for the perimeter of the reclamations using coral-gravel to be dredged from within the proposed footprint of the reclamations. Once the confinement bunds are completed, the infill of the reclamation is to be done through the TSHD by pumping the sand and sea water contained within the TSHD into the area within the confinement bund. Intentionally elongated drainage channels as well as a system of weirs will be used to allow the sea water to drain out of the reclamation area to allow for maximum sedimentation within the footprint of the reclamation so that the water is clear of almost all fines by the time it drains back into the sea.

The external seaward surface of the bund is to be lined with a geotextile and rock armour to prevent the loss of fines and protection of the perimeter of the reclamations. While the rock armouring component of

the work are not in the scope of the dredging company, they will be done simultaneously with the construction of the confinement bund and therefore coordination of the works with the selected rock armouring contractor is necessary.

The rocks to be used for the rock armouring will be sourced from the only functioning quarry in Seychelles and will be transported to the locations of the 3 rock reclamation sites by sea using a barge.

ENVIRONMENTAL AND SOCIAL STUDIES

The ESIA process for this project was categorized as follows:

Project Location	ESIA Category	Notes
Zone 30	Class Two	No past ESIA's conducted on this site Rapid benthic assessment conducted Socio-economic consultations concluded
Providence Laguna	Class One	No past ESIA's conducted on this site Rapid benthic assessment conducted Socio-economic consultations concluded
Ile Aurore	Review/Addendum to the Class One ESIA	Previous ESIA's conducted on this site in March 2010 with an addendum in April 2010 Sediment modeling and marine assessment studies conducted Desktop research using past reports conducted Socio-economic consultations concluded

This report covers all three locations in the order shown above. More data was available for Ile Aurore than the other two locations. The reports include the below and can be found in the annex to this report:

- EIA report for Aurore Nouvelle
- Boat traffic impact assessment
- Marine Water Quality Assessment
- Wave Design Report
- Environmental Management Plan

Thus, this report showcases the following desktop and fieldwork surveys as required in the TOR for this project:

Task	Zone 30	Providence Laguna	Ile Aurore
Desktop Research	Not available	Not available	Available, conducted
Field Work/Surveys			
Marine surveys	Conducted	Conducted	Conducted
Dredge modeling	N/A	N/A	Conducted, only this location

			required modeling per the TOR
E&S, Risk Assessment	Conducted	Conducted	Conducted
Socio-economic consultations	Conducted	Conducted	Conducted

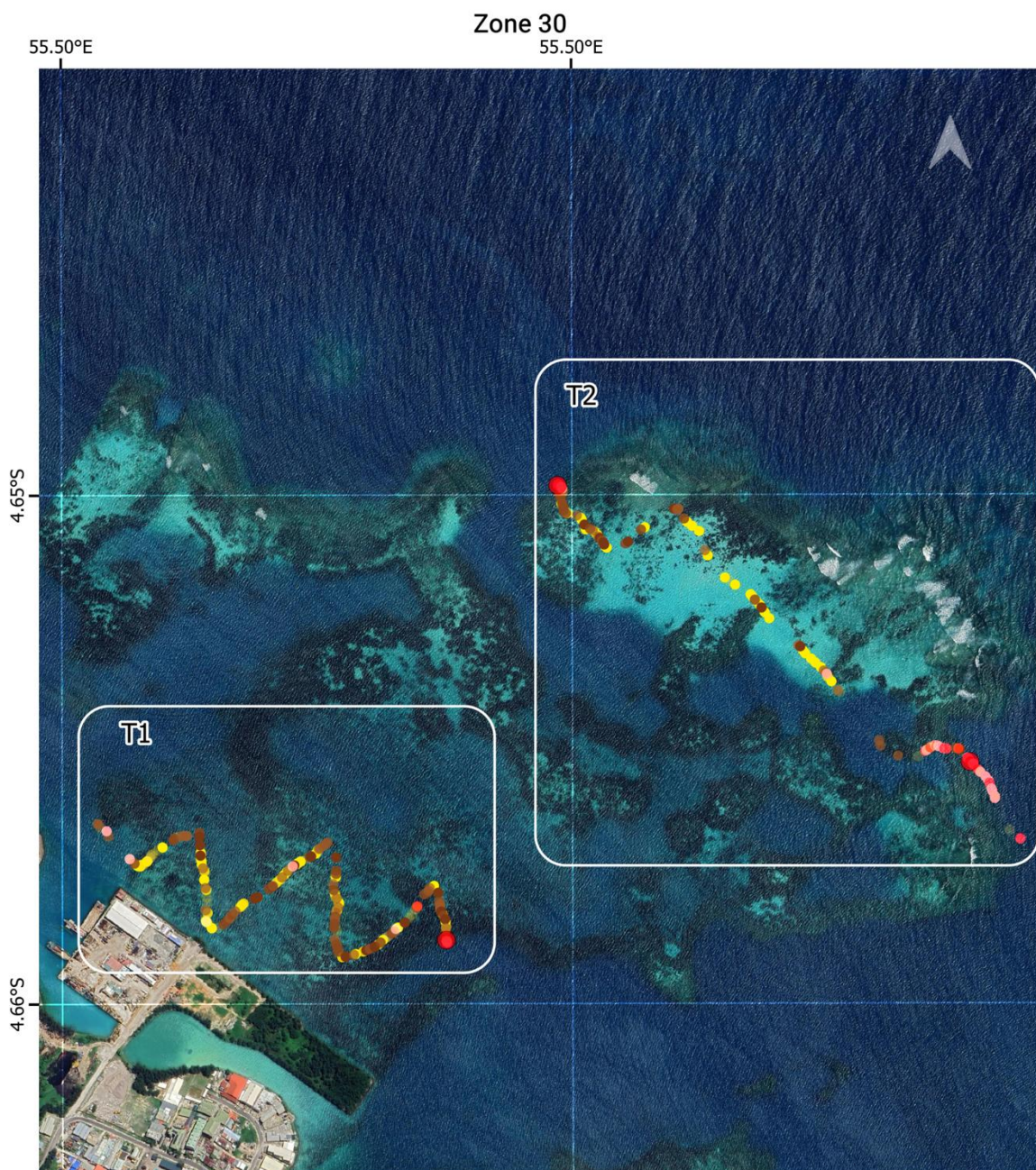
There is no public meeting component included in this ESIA. Instead, it was agreed that the government would hold a press conference to outline the proposed project details to the general public, and that the ESIA reports would be made available for public inspection. Furthermore, focus group discussions were conducted with key community stakeholders, including fisherman's associations.

SUMMARY OF SURVEYS AND ASSESSMENTS

MARINE SURVEYS

Surveys were conducted at all three locations, and the full report can be found in the annex section.

In brief, the survey of **Zone 30** revealed that the benthic environment is primarily dominated by macroalgal meadows, with significant ecological shifts away from coral-dominated structures. Transect T1, located within the proposed reclamation area, is extensively covered by *Sargassum* sp., with dead coral boulders overgrown by macroalgae. Seagrass meadows were absent due to high sedimentation rates, unstable substrates, and competition from macroalgae. Given these findings, sediment management strategies, coral transplantation efforts, and targeted conservation interventions should be prioritized to mitigate potential impacts from reclamation activities and promote reef resilience within Zone 30. Sediment control strategies, such as turbidity barriers and controlled dredging techniques, to minimize further sediment deposition on nearby coral reefs. Coral relocation programs, focused on transplanting viable coral colonies from impacted zones to stable reef structures in the northeastern and southeastern areas.



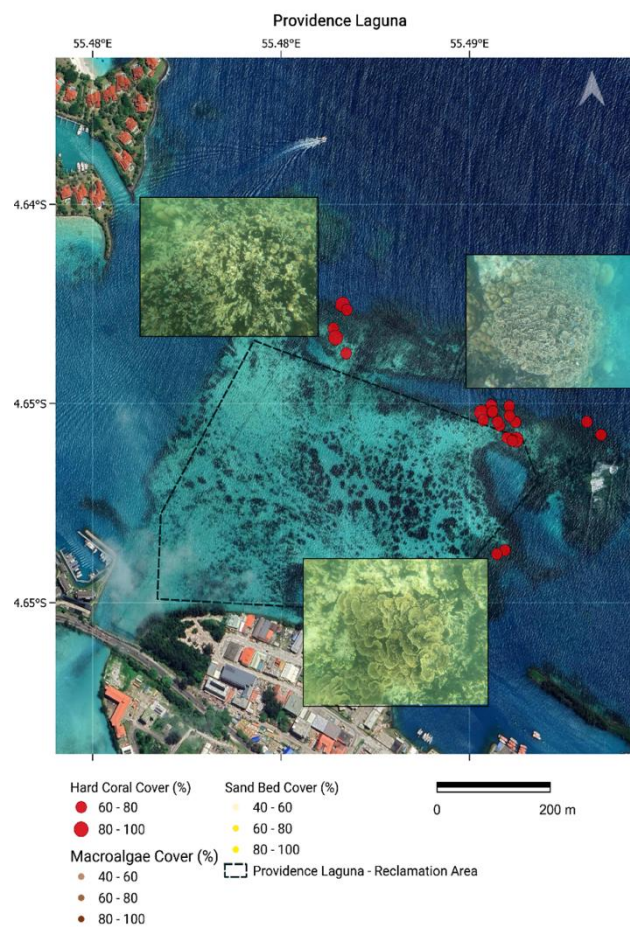
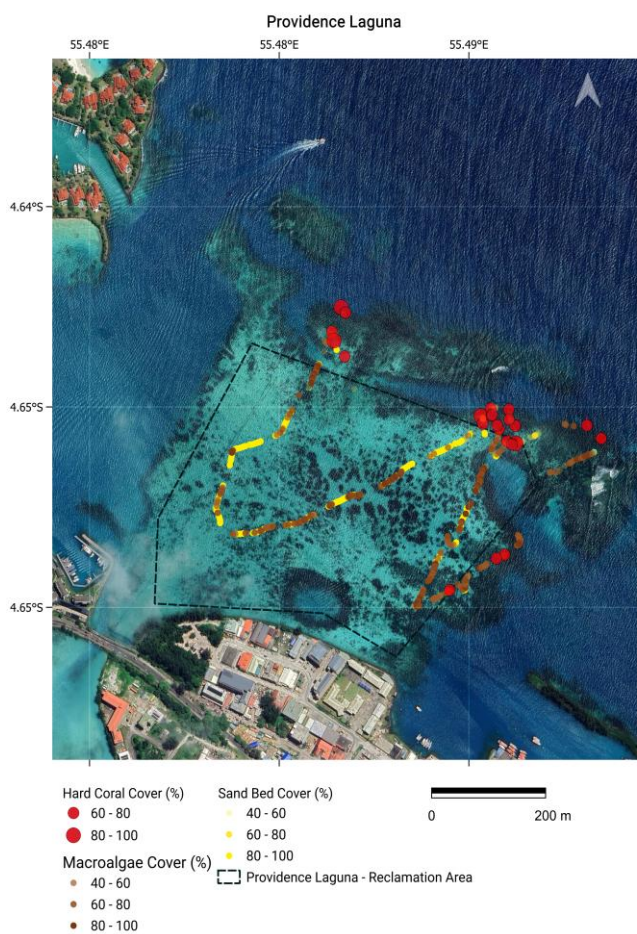
- | | |
|---------------------------|-------------------------|
| Hard Coral Cover % | Seagrass Cover % |
| ● 40 - 60 | ● 40 - 60 |
| ● 60 - 80 | ● 60 - 80 |
| ● 80 - 100 | ● 80 - 100 |
| Macroalgae Cover % | Sand Cover % |
| ● 40 - 60 | ● 60 - 80 |
| ● 60 - 80 | ● 80 - 100 |
| ● 80 - 100 | |



Published in Mahé, Seychelles
 December 2024
 Produced by Bee Ecological Consulting
 Data source: Field surveys in January 2025

The biodiversity survey at **Providence Laguna** identified 73 species across corals, invertebrates, macroalgae, and fish. Coral diversity was notable, with 14 genera from 9 families, particularly Merulinidae, which featured 4 genera, including large Echinopora beds. Among invertebrates, 14 species from 9 classes were recorded, with Holothuroidea (sea cucumbers) and Gastropoda (snails) being the most diverse. Macroalgae were well-represented, with 6 species from 3 families, particularly Halimedaceae and Sargassaceae. The fish community comprised 38 species from 20 families, with Chaetodontidae (butterflyfish) being the most diverse, followed by Labridae (wrasses). A single stingray species (Dasyatidae) was also observed. Of the recorded species, 28 are listed on the IUCN Red List, including 1 Near Threatened species (*Chaetodon trifascialis*), 2 Vulnerable species (*Pastinachus ater* and *Oxymonacanthus longirostris*), and 23 classified as Least Concern.

The habitat assessment showed significant differences between the proposed reclamation area and the surrounding 100-meter buffer zone. Coral cover within the reclamation area was low (6.1%), with macroalgae dominating (39.3%) and sand covering 42.2%, suggesting habitat degradation due to sedimentation, nutrient influx, and reduced herbivory. The buffer zone exhibited higher coral cover (25.5%), though macroalgae (26.1%) still posed competitive pressure. Structural complexity was greater in the buffer zone, with hard substrate at 18.6%, supporting coral recruitment and reef-associated organisms. No seagrass meadows were found, likely due to unsuitable substrate conditions and macroalgal dominance. While reclamation will not directly bury highly sensitive reefs, indirect impacts such as sediment plumes and increased turbidity could degrade surrounding coral ecosystems, including the nearby Saint Anne Marine National Park. To mitigate these effects, coral relocation programs could help preserve biodiversity by transplanting healthy colonies to stable sites. Additionally, sediment control measures and long-term monitoring of water quality and ecosystem changes are recommended to minimize further habitat decline.



Following the results of the semi-detailed benthic habitat mapping and associated environmental sensitivity analysis, the reclamation footprint for the **Providence Laguna project** was revised:

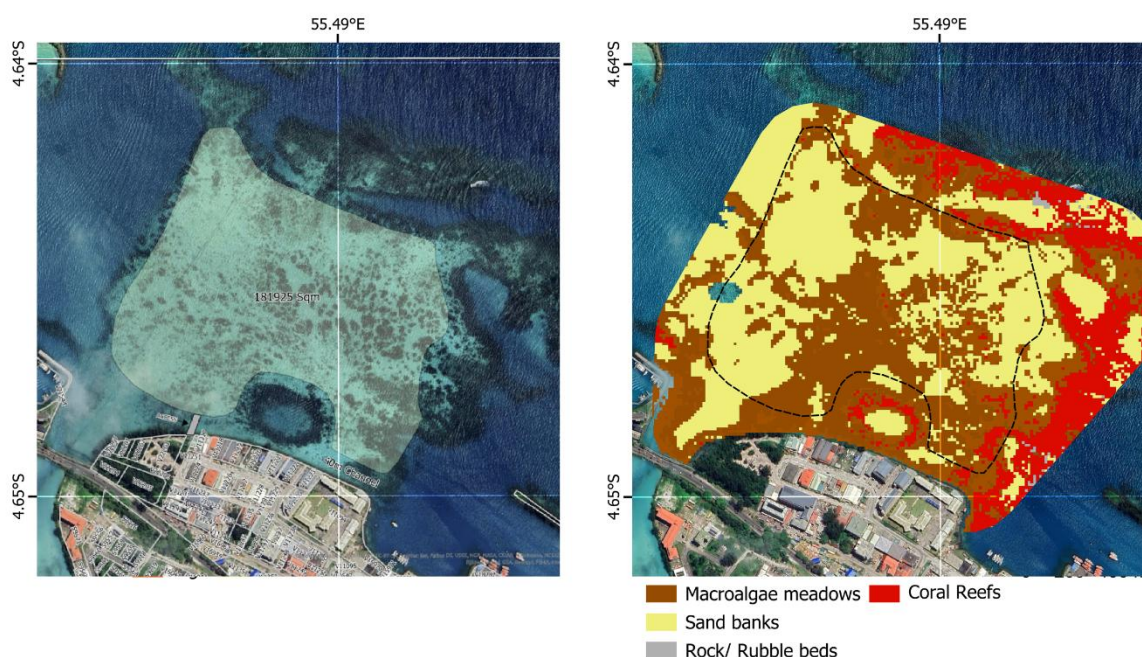


Figure: Comparison of the revised reclamation footprint and benthic habitat composition at Providence Lagoon. *Left panel:* Revised reclamation boundary (light green polygon) totaling approximately 181,925 m², showing exclusion of ecologically sensitive reef areas. *Right panel:* Benthic habitat classification map overlaid with the revised reclamation footprint (black dashed line), highlighting areas of coral reefs (red), macroalgal meadows (brown), sand banks (yellow), and rubble beds (grey). **The revised footprint now avoids direct overlap with high-value coral habitats, aligning reclamation activities with less sensitive sand and macroalgal-dominated zones.**

The updated boundary reflects a strategic reduction in spatial extent, particularly on the eastern and northeastern periphery, where coral reef habitats were previously at risk. The key modifications are outlined below:

1. **Avoidance of Coral Reef Areas:** The revised footprint now excludes most of the benthic zones classified as coral reefs (as indicated by the red polygons in previous habitat maps). These ecologically valuable areas have been preserved outside the active reclamation boundary.
2. **Concentration on Lower-Sensitivity Habitats:** The adjusted reclamation area now primarily overlaps with sandbanks and macroalgal-dominated rubble beds. These habitats are considered of lower conservation value compared to the previously included coral-rich areas.

Updated Risk Profile and Revised Mitigation Strategy

The table below provides a comparative overview of the key environmental risks before and after the revision of the reclamation footprint:

Impact Parameter	Original Assessment	Updated Assessment (Revised Scope)
Direct Coral Loss	Moderate–High (6.1% coral cover within footprint, including viable colonies)	Low – Coral habitats now excluded from direct reclamation activities
Macroalgal Dominance	High – indicative of ecological imbalance and reduced coral recovery potential	Moderate – Dominance remains, but fewer critical areas now impacted
Sediment Plume Impact	High – potential for downstream reef smothering, especially northeast of footprint	Moderate – Reduced footprint expected to lower plume dispersal potential
Seagrass Habitat	Absent	No Change
Mangrove Proximity	~200 m from reclamation site	No Change

The existing mitigation framework remains largely valid and applicable but can now be refined and scaled based on the reduced environmental risk:

Sediment and Water Quality Management: Silt curtain deployment should now be concentrated along the northern and central bund edges, with less intensive control required in the east.

Coral Relocation: Coral translocation is no longer a core mitigation requirement within the revised reclamation footprint. However, coral buffer monitoring and optional relocation may still be warranted if sediment dispersal models or water quality exceedance indicates risk to reefs just outside the footprint (north and northeast edge).

The biodiversity survey at **Aurore South** recorded 101 species across six major groups: birds, corals, invertebrates, macroalgae, seagrass, and fish. Three bird species were identified, indicating the ecological connection between coastal and marine habitats. The coral community was diverse, with 12 genera from eight families, including key reef-builders such as *Acropora* and *Porites*. Notably, large colonies of the endangered Pearl Bubble Coral (*Physogyra lichtensteini*) were observed. Among invertebrates, 19 species were documented across eight classes, with sea cucumbers being the most diverse. Macroalgae were abundant, comprising 16 species from eight families, while seagrass beds, dominated by *Thalassia hemprichii* and *Syringodium isoetifolium*, provided vital nursery habitats for juvenile fish. The fish survey identified 44 species of bony fish (Teleostei) from 25 families, with *Acanthuridae* (surgeonfish) and *Chaetodontidae* (butterflyfish) being the most diverse. Additionally, two species of cartilaginous fish (Elasmobranchii)—a stingray (*Pastinachus* sp.) and a shark (*Carcharhinus* sp.)—were recorded. The presence of commercially important fish species, along with active fish traps, highlights the area's significance for local fisheries.

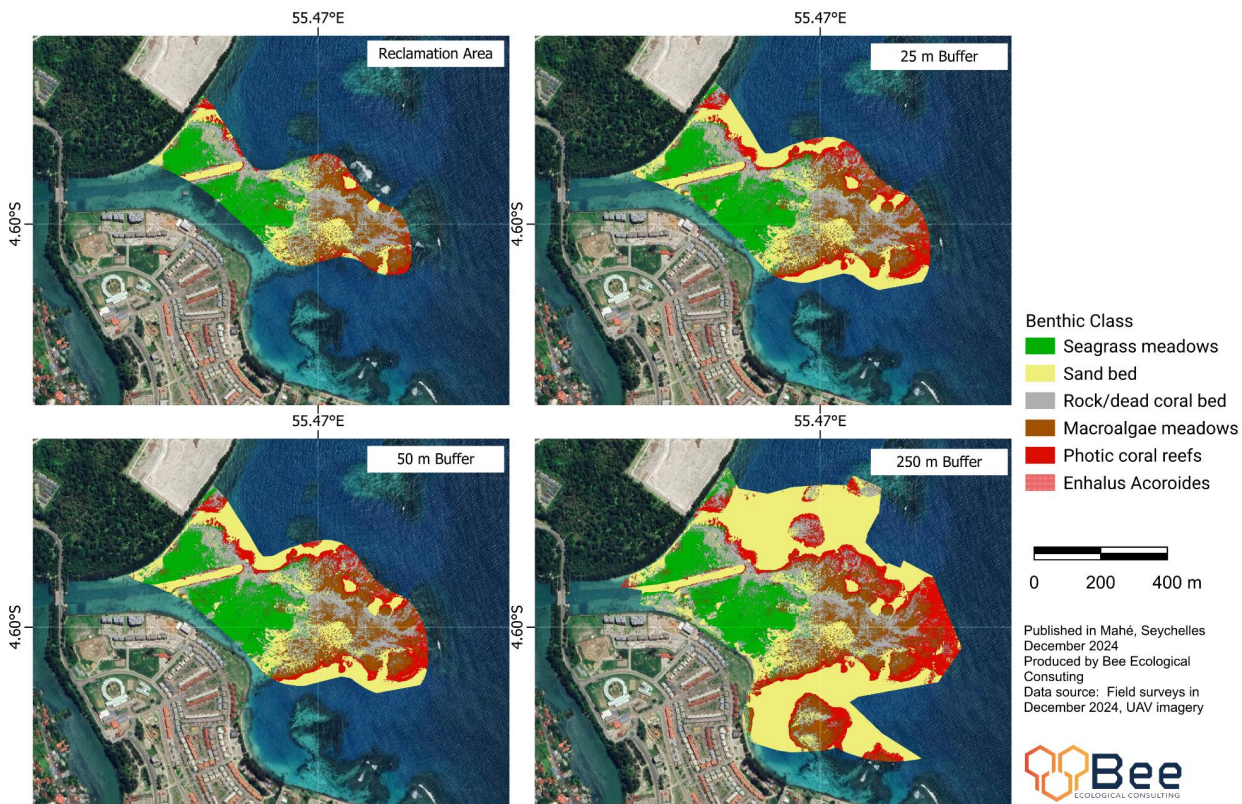
Environmental risks identified include increased coastal erosion potential due to altered wave patterns and sediment transport can threaten neighbouring shorelines. Air emissions from dredging operations contribute to CO₂ and NO_x pollution, impacting air quality and contributing to climate change, which can be mitigated by using fuel-efficient, modern dredging equipment and optimizing operational schedules.

Visual impacts from construction can degrade the aesthetic appeal of coastal areas, affecting local communities and tourism-dependent economies. Cumulative effects from past and present reclamations further compound environmental degradation, requiring an adaptive management approach to monitor and mitigate unforeseen consequences over time.

Beyond environmental risks, socioeconomic impacts are also significant. Noise pollution from construction activities may disturb residential areas and tourism operations, while heavy machinery and site access restrictions pose safety concerns. Moreover, fishing communities face disruptions due to reduced access to traditional fishing grounds and habitat degradation, leading to potential declines in fish stocks and recruitment rates. Engaging local fishers and implementing artificial reef projects could help mitigate these effects.

The broader physical, atmospheric, and socio-economic risks require integrated mitigation strategies to ensure the long-term sustainability of the project and its surrounding environment. A holistic environmental management approach that incorporates ecological, hydrodynamic, atmospheric, and human dimensions is essential to minimize long-term impacts and enhance ecosystem resilience.

Buffer Zone Analysis



ILE AURORE DREDGE MODELING STUDY

Ile Aurore is itself a reclaimed island and it lies to the north of Victoria among many other reclamations; however, it is also located near to a number of ecologically sensitive habitats. As part of the reclamation process, a >4m high coral bunding wall will be created around the perimeter of the proposed reclamation. The material for this bund will be taken from the seabed using a backhoe dredger. The dredging process will generate a suspended sediment plume as material is transferred from the seabed to the surface. The site is 'moderately sensitive' and consequently, a modelling investigation was required to establish the likely fate of dredged material resultant from dredging works and effects of the reclamation on local hydrodynamics.

A coupled wave and hydrodynamic model were developed to drive a subsequent sediment transport model. The model was used to simulate:

- The hydrodynamics before and after construction of the reclamation and
- The suspended sediment and sediment accretion associated with the dredging activity.

The modelling was undertaken for the NW and SE Monsoon seasons. In both monsoon seasons, the differences in residual current speeds before and after construction are greatest near the reclamation but do not exceed 0.1 m/s. In the midfield vicinity around the reclamation, differences are in the range of 0.03 m/s.

The suspended sediment plume extends further south during the NW monsoon and further north during the SE monsoon. Since dredging is to largely take place behind the bund as it is constructed, much of the material remains confined within the bunded area. Even in the 99th percentile maps, the plume (>1 mg/L) is restricted to the surrounding waters of Perseverance Island and Ile Aurore.

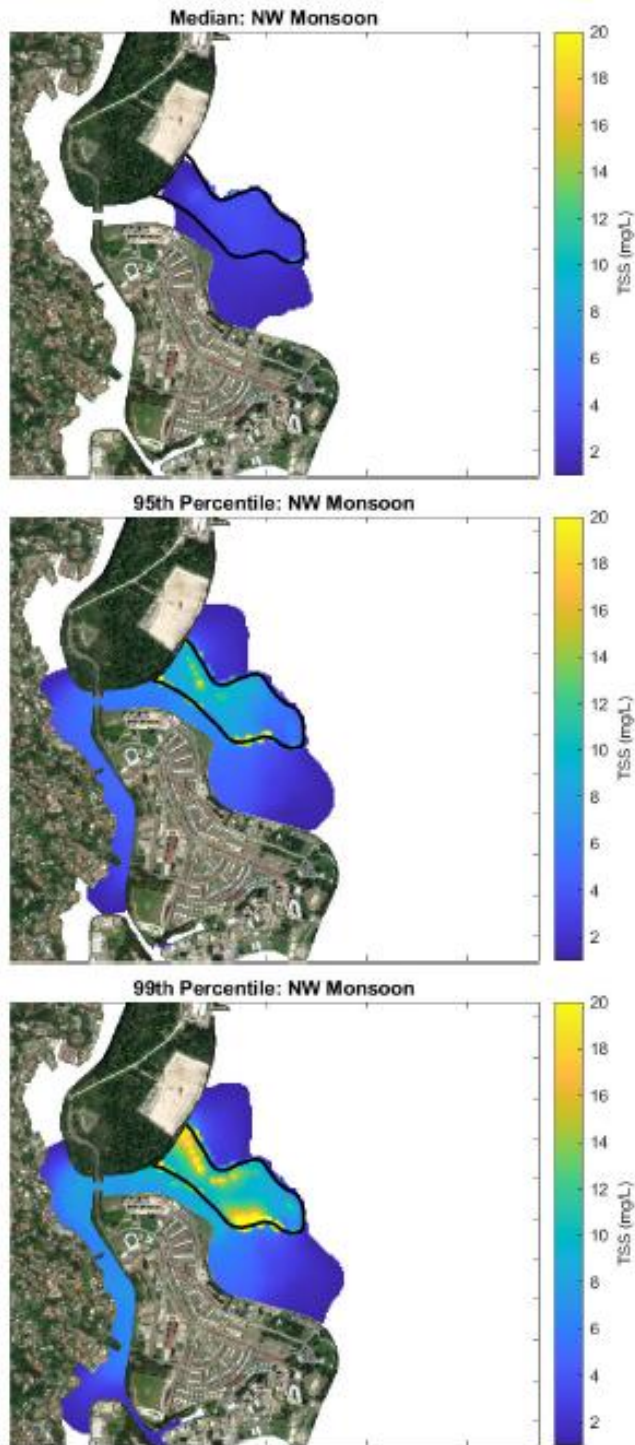


Figure 3.3: The plume of TSS (Silt) resultant from the dredging undertaken to construct the bund around the proposed reclamation assuming construction were to take place during the NW Monsoon. The plot only shows TSS concentrations above 1mg/L.

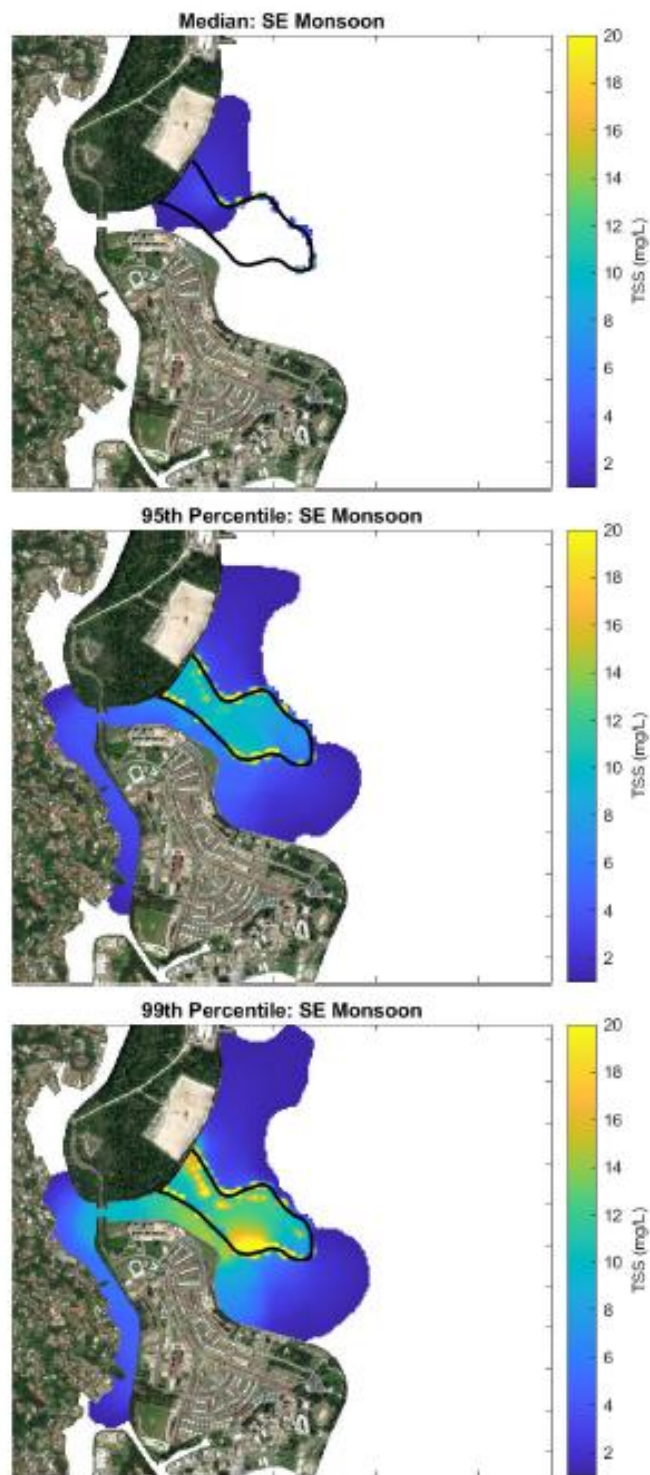


Figure 3.4: The plume of TSS (Silt) resultant from the dredging undertaken to construct the bund around the proposed reclamation assuming construction were to take place during the SE Monsoon. The plot only shows TSS concentrations above 1mg/L.

Sedimentation

The sediment transport accounts for settling and resuspension of sediment. For the two Monsoon seasons, sediment thickness resultant from the dredging activity was tracked throughout the model runs. The final sediment thickness is shown in Figure 3.5 for the NE and SE Monsoon periods. In both scenarios, the thickness of the layer of settled sediment is very small and except for very close to the dredging activity, it is less than 1 mm in thickness.

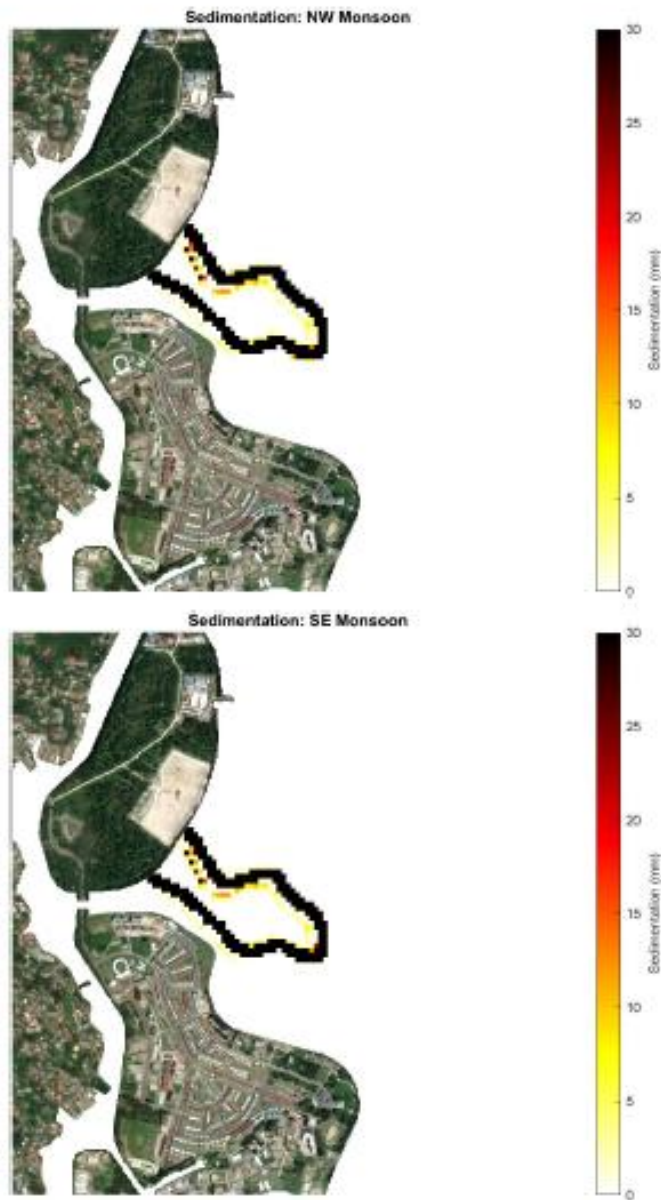


Figure 3.5: The thickness of the layer of settled sediment due to dredging activities carried out in the NW Monsoon season (upper panel) and in the SE Monsoon season (lower panel).

In conclusion, the study found that in both monsoon seasons, the differences in residual current speeds before and after construction are greatest near the reclamation but do not exceed 0.1 m/s. In the midfield vicinity around the reclamation, differences are in the range of 0.03 m/s. The suspended sediment plume extends further south during the NW monsoon and further north during the SE monsoon. Since dredging is to largely take place behind the bund as it is constructed, much of the material remains confined within the bunded area. Even in the 99th percentile maps, the plume (>1 mg/L) is restricted to the surrounding waters of Perseverance Island and Ile Aurore. In both seasons, the thickness of the layer of settled sediment associated with the dredge plume is very small and except for very close to the dredging activity, it is less than 1 mm.

POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

This ESIA identified several key environmental risks. During pre-construction, the main concerns relate to any land clearance, labor force mobilization, and early-stage community impacts. Construction phase risks include marine habitat disturbance from dredging, sediment dispersal, noise and vibration affecting communities and structures, and traffic safety concerns. The post-reclamation impacts involve changes to coastal hydrodynamics, potential increases in flood risks, and socio-economic opportunities and challenges for local communities. Through comprehensive mitigation measures, such as controlled dredging, protection of sensitive infrastructure, improved traffic management, and community engagement strategies, the residual risks are expected to be reduced to low or manageable levels. Ongoing environmental and socio-economic monitoring however, will be essential to ensure compliance and adaptive management.

On the socio-economic side, significant benefits were identified. The projects could act as catalysts for economic growth by converting reclaimed land into valuable real estate. This expansion increases land supply, enabling the development of new commercial and industrial areas. The resulting economic activity generates higher tax revenues, which can be reinvested in public services, further strengthening the economy. Government has further consulted with the Industrial Estates Authority (IEA), who confirmed that there is a growing demand from businesses in Seychelles for industrial land, further underscoring the importance of the project in meeting current and future economic needs.

These projects also create substantial employment opportunities, from the construction phase to long-term business operations in the newly developed areas. Jobs span multiple skill levels, benefiting workers in engineering, architecture, retail, and service industries, ultimately reducing unemployment and improving household incomes. Additionally, reclamation projects support future development by expanding infrastructure capacity, accommodating population growth, and integrating modern, eco-friendly technologies. They also enhance a country's attractiveness to international investors, ensuring sustained economic progress.

While the projects clearly offer economic benefits, they also pose significant socio-economic risks. One major concern that was raised during the consultation phase is the impact on fishing communities, as reclamation may destroy critical marine habitats, reducing fish stocks and threatening livelihoods. Fishermen have already raised concerns and requested compensation, fearing financial instability and the loss of cultural heritage tied to traditional fishing. It must be noted that ongoing negotiations are taking place with the fishing community regarding the potential loss of fishing grounds. It was suggested that, much like the Eden Island development, the newly-built environment could also attract marine life, partially mitigating these effects.

Another issue is the potential employment of foreign labor for this project, which can limit job opportunities for locals and strain infrastructure such as housing and healthcare. Social tensions may arise if foreign workers outnumber local hires, leading to inequality and potential unrest. To mitigate this, government should ensure that contractors provide proper facilities for foreign workers to reduce pressure on local resources. Without careful planning, these projects could create lasting socio-economic challenges, highlighting the need for balanced, well-regulated approaches that address both development and environmental concerns.

CONCLUSION

The Environmental and Social Impact Assessment (ESIA) of the proposed reclamation projects highlights both opportunities and risks associated with large-scale development. While reclamation can drive economic growth, increase land availability, and create employment opportunities, it also presents significant ecological, social, and economic challenges. The potential loss of critical marine habitats, disruption to fisheries, increased sedimentation, and long-term environmental degradation must be carefully managed to ensure sustainability.

To mitigate these impacts, a comprehensive environmental management plan is essential and has been provided in this report, incorporating habitat conservation measures, stakeholder engagement, and sustainable planning. A balance between development objectives and environmental protection is critical to maintaining the ecological integrity of the region while fostering long-term economic benefits. By adopting a proactive approach, the project can contribute to national development while safeguarding biodiversity, local livelihoods, and coastal resilience.

1. INTRODUCTION

1.1. OVERVIEW

The Ministry of Lands and Housing on behalf of the Government of Seychelles is undertaking an exercise to assess the viability of 3 new reclamation projects along the east coast of Mahe. The project is overseen by the Seychelles Infrastructure Agency (SIA). The proposed reclamation projects are located at Ile Aurore, Providence Laguna, and at the Zone 30 Extension.

1.2. PROJECT HISTORY AND JUSTIFICATION

The scarcity of land on the coastal plain is particularly visible in Mahé. As such, reclamation projects have long been associated with the economic development in the Republic of Seychelles since the 1980s. Many key facilities, including the capital city, industrial area, roads, airport and housing estates are on reclaimed land. This project is the fourth one being proposed under the East Coast Project (ECP) umbrella, which entails a series of land reclamation projects on the east coast of Mahe Island. The ECP1-3 reclamation projects already accommodate large numbers of residential areas, industrial areas, and other critical infrastructure such as the central power station, telecommunication hub, and other vital services. Through this project, the government aims to further stimulate economic development, as consultations with the IEA have highlighted a growing demand for industrial land among businesses in Seychelles.

The table below showcases the past East Coast Project (ECP) reclamations. The initial phases of land reclamation in Seychelles began in the 1980s and early 1990s. The first major project, known as Phase I, was completed in 1986, followed by Phase II in 1990. In 1998, the government initiated the East Coast Land Reclamation Project, Phase III (ECP), described as the largest public sector project in the country's history at that time. This project aimed to reclaim approximately 360 hectares (3,600,000 square meters) of land off the northeastern coast of Mahé, near Victoria.

Since then, EIAs/ESIAs pertaining to reclamations have been undertaken in Seychelles. The data below showcases additional information pertaining to reclamations in Seychelles:

No.	Document / Project Title	Year	Status / Notes
1	CL1_ ECP 3 East Coast Reclamation Phase 3	1998	
2	MOU between GoS and JNDL	2006	
3	CL 1 ESIA_2007 WSP ILE AURORE NOUVELLE DEVELOPMENT	2007	

4	CL 2 ESIA_Offshore Sand Extraction	2008	Submitted to MACCE Cleared to NOA
5	CL 1 ESIA_2008 PINNACLE POINT GROUP: ILE AURORE NOUVELLE DEVELOPMENT CONSTRUCTION WORKS	2008	
6	CL 2 ESIA_IIE ANONYME Marina and Dredge	2014	
7	CL 1 ESIA_SPA Port Authority Dredging	2021	Stalled
8	CL 1 ESIA_SEAFRONT Development & Reclamation	2021	Submitted to MACCE Cleared to NOA
9	CL 2 ESIA_Offshore Sand Extraction Phase 2	2023	
10	CL 2 ESIA_SPA Maintenance Desilting	2023	Ongoing

Fig 1.2_1: Reclamations EIAs/ESIAs in Seychelles summary

1.3. OBJECTIVE OF THE ESIA

The ESIA process is aimed at assessing potential environmental and social impacts of developing and operating the project components and propose mitigation recommendations. Specifically, the study aims to:

- Conduct baseline environmental investigations at the project site
- Conduct consultations with relevant stakeholders, including potentially affected persons, to obtain their views and suggestions regarding the environmental and social impacts of the proposed project
- Propose mitigation measures to address potential negative impacts; and
- Prepare an EIA report incorporating results of environmental and social findings

The EIA process in the Seychelles is depicted the sketch of figure 1.3_1.

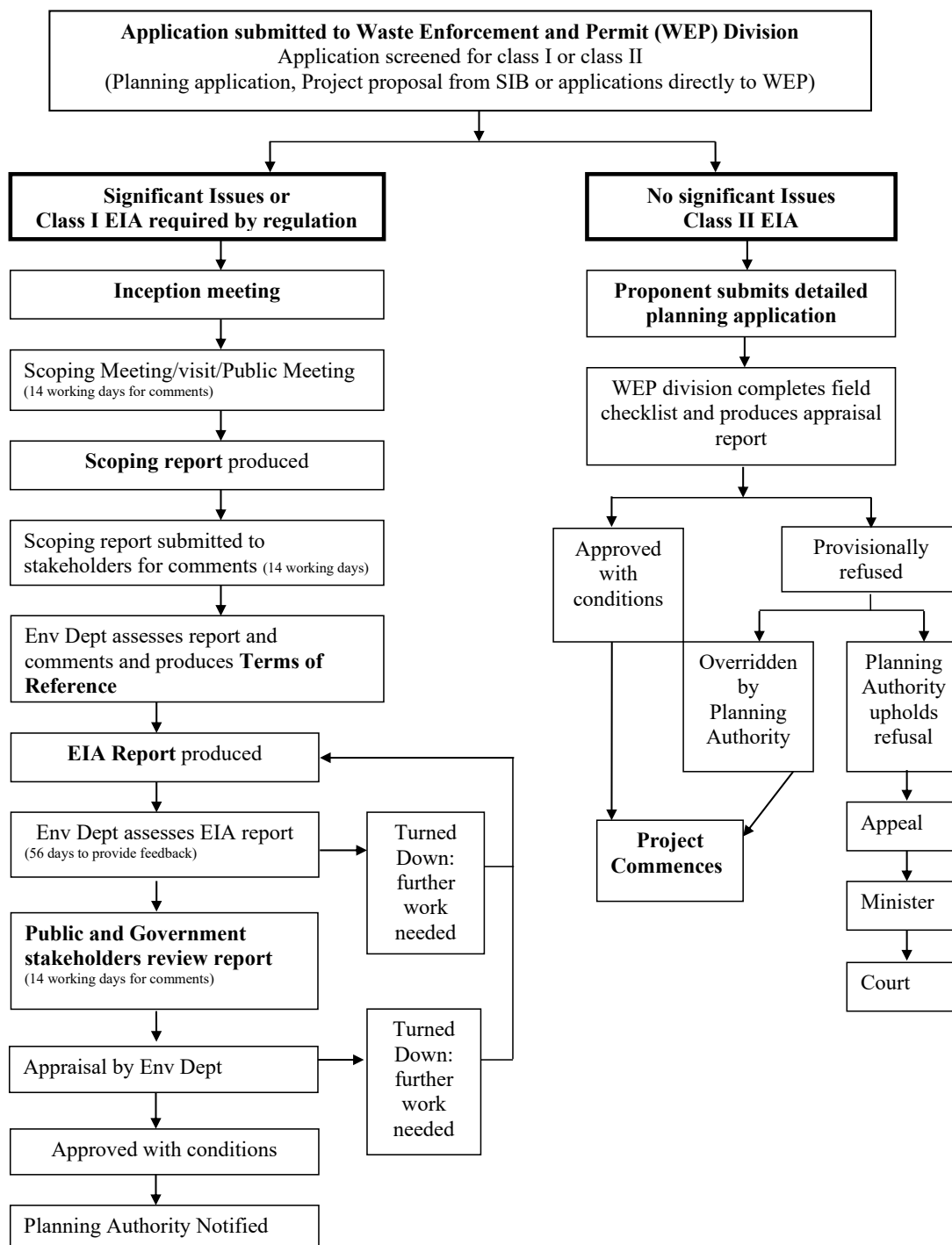


Fig. 1.3_1 - ESIA process in Seychelles

1.3.1 CATEGORISATION OF THE ESIA

In Seychelles, an ESIA is categorized as either a Class One or Class Two EIA. In the case of this project, the EIA consultant was directed by MACCE to undertake the ESIA's for the three locations are follows:

Project Location	ESIA Categorisation	Notes
Providence Laguna	Class One	No past ESIA's conducted on this site Rapid benthic assessment conducted at inception phase Socio-economic consultations concluded
Zone 30	Class Two	No past ESIA's conducted on this site Socio-economic consultations concluded
Ile Aurore Extension	Review/Addendum to the Class One ESIA	Previous ESIA's conducted on this site Sediment modeling and marine assessment required Socio-economic consultations concluded

Table 1.4.1_1

1.4. PROJECT TEAM

The proposed project is being undertaken by the Government of Seychelles, under the direction of the Seychelles Infrastructure Department (SIA). The appointed EIA Consultant is Eco Sol Consulting Ltd.

1.5. REPORT OUTLINE

The ESIA Report is structured with the following main chapters:

Chapter	Summary Overview of Each Chapter
Chapter One	A background of the assignment along with the objectives for the ESIA study
Chapter Two	Legal and regulatory framework related to the project
Chapter Three	Project Overview and components
Chapter Four	Baseline environmental conditions of the project sites
Chapter Five	Consultation and Participation
Chapter Six	E&S and Mitigation Assessment
Chapter Seven	Analysis of alternatives for the proposed project
Chapter Eight	Environmental Management Programme
Chapter Nine	Conclusion
Annex	Supporting documents to the report

Table 1.5_1

2. LEGAL, REGULATORY AND INSTITUTIONAL FRAMEWORK

This section provides an overview of the national policies, the legal and administrative frameworks to which the proposed project should comply regardless of the categorization of the EIA, key being the Environmental Protection Act (2016) and its associated regulations. Existing, new or updated National Plans, Strategies and Regulations are outlined, along the international conventions to which Seychelles is a party.

In Seychelles, key legislations governing the conduct of the EIA is the Environmental Protection Act (2016). The Act charges the Ministry of Agriculture, Climate Change and Environment (MACCE) with responsibility to ensure compliance with the EIA process in planning and execution of projects.

In this regard, the specific objectives for the review of these policies and instruments are:

- to identify which policies that are relevant to the environmental, human health and safety, maritime safety and the social aspects of the Project, and to the conduct of the EIA
- to identify environmental standards (such as waste management, construction standards and air emissions, etc.) prescribed under the national legislation that are relevant to the Project
- to identify existing and new international conventions to which Seychelles is a signatory that are relevant to the Project

2.1 PLAN AND POLICY FRAMEWORK

Seychelles National Development Strategy (2024 – 2028)

The rationale for Seychelles shifting from an environment plan to a Sustainable Development Strategy was derived from extensive multi-stakeholder consultations associated with the review of the Environment Management Plan of Seychelles (EMPS 2000-2010). Sustainable development principles form a core part of the new strategic plan, which should be reflected in the vision and overall objective of the new strategy and plan.

In 2024, this revised strategy was launched in the form of the SSDS, built upon a foundation of sustainable development-where stakeholders note is one not only environmentally responsible but also economically viable and socially equitable. The strategy aims to propel Seychelles on its next stage of development, with emphasis being on transformation, diversification and sustainable growth. In this context, this project aligns with several of the country's priority areas, particularly in relation to the pillars of Economic Transformation and Diversification, Infrastructure Development, and Environmental Sustainability.

Blue Economy Framework (2018)

Seychelles has adopted a strategic development agenda built conceptually on the blue economy, which recognises the challenges of reconciling economic growth while maintaining the integrity of socio-ecological

systems. The concept was formally launched at the First Blue Economy Summit co-hosted by Seychelles and Abu Dhabi in 2014 with Seychelles formally announcing its Blue Economy Roadmap in 2018. A focus on the blue economy aims to support implementation of the Paris Climate Change Agreement and Sustainable Development Goal 14 on the Oceans, and its related targets. The Department of Blue Economy is also supporting the development of new ocean-based economies, in particular renewable energies, marine biotechnology and aquaculture. This framework should be considered in the context of the project's locations.

2.2. LEGAL FRAMEWORK AND REGULATORY STANDARDS

Seychelles Constitution of the Third Republic (1993), Cap 42

Article 38 of Constitution of the Third Republic (1993), Chapter 42

The State recognizes the right of every person to live in and enjoy a clean, healthy and ecologically balanced environment and with a view to ensuring the effective realization of this right, the State undertakes:

- To take measures to promote the protection, preservation and improvement of the environment;
- To ensure a sustainable socio-economic development of Seychelles by a judicious use and management of the resources of Seychelles;
- To promote public awareness of the need to protect, preserve and improve the environment.

The Constitution is placed in this section for context as it is relevant to the project in that it requires the promoters to comply with the regulations set therein.

Environmental Protection Act (2016)

The Promoters, contractors and associated entities of the implementation of project need to adhere strictly to the provisions of the Environment Protection Act No 9 of 1994, revised in 2016. The below further elaborated are legal obligations of the proponent in meeting the national norms for such a venture. It is further well noted that the implementation of the Project can only begin once the necessary administrative clearances from MACCE and Planning Authority.

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Environmental Impacts Assessment Regulations (1996)

The Environmental Impact Assessment (EIA) Regulations governs the procedures for EIAs in Seychelles prior to the commencement of any project or activity as prescribed in the Schedules of the Environmental Impact Assessment Regulations 1996. This law is administered by the Ministry responsible for the environment, which collects and assesses data on the state of the environment and physical nature resources. It also supervises

and provides assessment for projects or development that are likely to have an impact. It also undertakes appraisal of ad-hoc EIAs and recommendations for the Town and Country Planning Authority (now defunct), the Project Appraisal Committee and other government organizations.

The Environmental Authorization and Permits Section (EAPS) of the Department of Environment (DoE) is responsible for the EIA process. The section which will be involved in this project as well is the Coastal Adaptation and Management Section (CAMS) which oversees all activities along the coast and in the marine environment.

Effluent Discharge Quality Standards (2023)

Seychelles standards of effluent discharge are prescribed under the EPA 1994 (revised), and the Environmental Protection (Standards) regulation are relevant to the project in ensuring its effluent monitoring program is well established and capable of meeting all national standard set. Moreover, emergency and mitigation activities must be prescribed in the case of effluent or discharges not meeting the standard during operational testing. Standard Operating Procedure's (SOP) are to be integrated into the Construction Environmental Management Plan (C.E.M.P) as and when contractors for site are hired and official commissioning begins. The Ministry is mandated to also prevent, control or abate water pollution from natural causes or from abandoned works or projects or activities.

The operational testing of effluent discharge includes parameters that evaluate the quality and environmental impact of effluents before they are released into water bodies or onto land. Key parameters tested typically encompass physical, chemical, and biological properties of the effluent, such as pH Levels - to measure acidity or alkalinity, temperature - to ensure thermal compliance with water ecosystems, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) - to gauge organic pollutant levels and the oxygen required for their breakdown and Total Suspended Solids (TSS) - indicating the concentration of undissolved particles, amongst others.

Noise and Ambient Air Quality Standards

Under the EPA, the Noise Emission Standard and regulation 1999 cover the limits of sound pressure in Db (A) that needs to be met at varying levels and hours of construction. Extensive and prolonged noise with certain frequency can have detrimental effect on wild life and human settlements. The surrounding population need consideration and mitigation measures have been described to this effect. Moreover, the Environmental Monitoring Program is to be run parallel to the operation phase, ensures decibel recordings during construction phase allowing for maintaining acceptable levels of Noise Emission from site.

Suspended solids in air columns and gaseous emission are key contributors to reduction in localized air quality. Therein, mitigation measure akin to site hoarding, watering and dust suppression techniques will be used. Moreover, careful timing of works for seasonal climatic conditions, shall allow the project to meet the attached standard being those adopted from WHO 2002 ambient air quality guidelines.

Seychelles Infrastructure Agency Act (SIA)

The proponent for this project, under the purview of the Ministry of Lands, is guided by this Act. The object of the SIA is to provide technical services for civil engineering and construction projects to all government ministries, departments and agencies other than those specified in the Schedule of this Act, and to provide maintenance to government properties. Further information about the SIA's mandate is provided further below.

Health Act, Cap 194

Under the Public Health Ordinance Chapter 194, strict regulatory frameworks are placed for the cleanliness, disease prevention and sanitation controls. It is geared to maintain and improve the public health of work force, surrounding human populations and immigrant work force while on the job. This is important for the Project given that it is understood that attention must be given to the role and responsibilities of health officers on site, the obligation of the promoter to ensure adequate measures are taken to prevent mosquito and vermin related diseases from entering or spreading outside the site confines, and to provide basic sanitary and ventilation needs for temporary work force. Under this Act, Health officers are tasked with monitoring and enforcing public health standards on-site, including controlling mosquito and vermin populations. Health officers may inspect premises, identify health risks, and ensure that sanitation and waste management practices reduce breeding sites for pests. Promoters or property owners are responsible for maintaining cleanliness and minimizing conditions that attract mosquitoes and vermin.

The PUC Act & PUC supply regulations

This act provides for unlawful contamination of treated water by breakage or external entry. This is relevant in so much that the use of the PUC water network is also being proposed for the development and thus onus is placed on project contractors in ensuring that MEP connectivity is strengthened against possible break in and contamination. Two regulations are outlined below in brief as they relate to the project:

PUC Sewerage regulations

This Regulation makes provision for controls and regulation permitting to sewerage connections outside the sewer network areas of greater Victoria and Beau Vallon. If private sewerage disposal units are owned project promoters are responsible in meeting all the requirements of the Public Utilities Corporation (PUC) for its implementation. This regulation will become relevant during the operations stage of the project and the requirements of the developments (e.g housing, commercial buildings etc) that will emanate as a result of the project. Moreover, administrative clearances are needed by the Seychelles Bureau of Standards (SBS) and standard testing for its operational continuance at agreed frequency of sampling.

The functions of the Corporation are:

- (a) The supply of electricity;
 - (b) The supply of water;
 - (c) Provision of sewerage;
-

(d) Such other functions as may be conferred on the Corporation by any other Act or by regulations made under this Act.

Physical Planning Act 2021

The Physical Planning Act (2021) is now the new law that will guide Physical Development and land use management in the country. Its basis is derived from the Town & Country Planning Act (1972) (which has guided physical development in the country for nearly 50 years) but the new Act will modernize the operations and functions of the Planning Authority so as to make provisions to deal with today's dynamic construction industry.

Land Reclamations Act

The Land Reclamation Act outlines the process for authorizing land reclamation. The President may in accordance with the provisions of this Act, authorise the reclamation of land or the performance of other works over and upon the foreshore or the seabed irrespective of the ownership of land bordering on or of whether any land borders on such foreshore or seabed. This Act is of direct relevance to the project given the nature of activities being proposed.

Removal of Sand and Gravel Act

The Act emphasizes the need for a license for the abstraction and removal of any sand or gravel. This includes areas such as beaches, rivers, and streams, which are often sensitive ecosystems. The Act's relevance to this reclamation project lies in its control over the extraction of materials commonly used in land reclamation.

Maritime Zones Act

The Act provides for matters relating to Seychelles' territorial waters, the continental shelf, the exclusive economic zone and others. It defines the rights of the Seychelles over all resource and economic uses in these marine spaces.

Seychelles Employment Act (1995, revised 2023)

The Ministry of Employment and Social Affairs is guided by this Act. Amended in 2023, the Act regulates labor relations, ensuring fair practices and worker protections. It covers standard working hours, overtime compensation, leave entitlements, termination procedures, and provisions like the thirteenth-month pay. Recent updates focus on enhancing employee rights and clarifying employer responsibilities. It will be of relevance to this project during the time of construction and operation.

2.3 INTERNATIONAL TREATIES, CONVENTIONS AND CHARTERS

The Small islands state of Seychelles is an active member of a number of international treaties and conventions that are mainly focused towards the general social protection and enhancement of Seychelles pristine environment, biodiversity and overall natural asset protection. Listed below are some key international treaties and conventions that become relevant to the setting of this project.

United Nations Sustainable Development Goals

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges faced, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. The SDGs are part of Resolution 70/1 of the United Nations General Assembly: "Transforming our World: the 2030 Agenda for Sustainable Development."

UN Framework Convention on Climate Change (UNFCCC)

Adopted in 1992, the Convention provides a global framework for addressing climate change through mitigation, adaptation, and sustainable development efforts. It emphasizes reducing greenhouse gas emissions and enhancing resilience to climate impacts. Its relevance to a port expansion project lies in the need to align infrastructure development with climate-friendly practices. This includes minimizing carbon footprints, protecting coastal ecosystems, and ensuring the project adheres to the environmental impact assessment. By aligning with UNFCCC principles, the project can ensure long-term resilience and sustainability.

United Nations Convention on the Law of the Sea (UNCLOS)

Adopted in 1982, UNCLOS is an international treaty that defines the rights and responsibilities of nations regarding the use of the world's oceans. It sets legal frameworks for marine resource management, environmental protection, and territorial boundaries.

MARPOL 73/78

This convention is aimed at preventing marine pollution from ships, focusing on the prevention of pollution by oil, chemicals, sewage, garbage, and air emissions. The convention sets strict regulations on the discharge of pollutants into the sea and promotes cleaner shipping practices. Its relevance to the project lies in ensuring that the facilities comply with MARPOL standards, particularly in managing waste, minimizing pollution risks, and adopting environmentally friendly technologies.

2.4 INSTITUTIONAL ARRANGEMENTS

The project will fall under the purview of certain institutions once approval is received:

Ministry of Agriculture, Climate Change and Environment (MACCE)

The Environment Protection Act provides the Ministry of Agriculture, Climate Change and Environment as the principal agency responsible for coordination, monitoring and supervision of environmental conservation activities. Specifically, the Environment Assessment & Permit Section within the Ministry is mandated to oversee the conduct of EIA through issuance of the EIA guidelines, regulations and registration of practitioners. It reviews and approves environmental impact assessments through the issuance of a Notice of Acceptance (NOA).

The section also includes an enforcement branch that is responsible for ensuring that promoters comply with the various environmental regulations and standards. The Ministry is linked to sectoral lead agencies that are charged with implementation of environmental programs and integration of environmental concerns in sectoral policies, laws, regulations and programs. Relevant agencies are considered stakeholders in the Project and will provide input during the process. For the purpose of this project, the EAPS Section of the Ministry will review and approve the EIA prepared through a Notice of Acceptance.

Ministry of Lands and Housing

The mission is to facilitate the national socio-economic development through sustainable and efficient use of land resources for habitat, economic, social and infrastructure needs through effective policy framework, regulations and provision of ancillary technical services to the clientele. The Ministry envisions having the necessary tools and framework to be a dynamic agent for promoting sustainable and responsible development of Seychelles.

The core functions of the Ministry of Lands and Housing are;

- Management of all state land including Acquisitions, Sales and Leases;
 - Implementation of Land Bank Project as per Capital Budget allocations;
 - Administration of Immovable Property (Transfer Restriction) Act and the responsible for the processing of all applications for purchase or lease of an Interest in Immovable property including corporate shares dealings;
 - Responsible for land policy and land related legislation and timely review thereof;
 - All survey related Infrastructure including cadastral surveys and registration to tiles;
 - Developing the Geographic Information System (GIS) Centre of the Ministry and ensuring the efficient use of acquired digital data throughout Government with the set objective of improving performance and decision - Preparation of land Use Plans and Urban development guidelines;
 - Responsible for housing and provision of decent and affordable shelter as per requirements of the Seychelles Constitution and Government housing policy;
 - Management of the land and Housing Application Database.
-

Within the Ministry, the Seychelles Infrastructure Agency (SIA) was newly created in 2022, following the National Assembly's approval of the Seychelles Infrastructure Agency Bill. SIA is envisioned as a centralised infrastructure agency to take charge of all construction projects and maintenance works on behalf of the government, to assist with the planning of infrastructure development in a more strategic manner.

Its functions include:

- advise on strategic planning of infrastructure and physical development projects
- advise on the financial and cost implications for infrastructure and physical development projects, and on maintenance and property management requirements
- provide surveys and assessments of physical conditions for government infrastructure and buildings;
- provide technical support for procurement and supervision of services for maintenance of government infrastructure and buildings
- advise on quality standards and policies for government infrastructure and buildings, and for construction services utilised by the government;

Local Government Administration Structures

The Seychelles operates a partial de-centralised governance and devolution of certain central government functions. Such administrations are to be considered as stakeholders in the Project and will have input in to the EIA process as well as subsequent monitoring.

3. PROJECT DESCRIPTION

3.1 PROJECT LOCATION

The Ministry of Lands and Housing on behalf of the Government of Seychelles is undertaking an exercise to assess the viability of 3 new reclamation projects along the east coast of Mahe. These are located at Ile Aurore, Providence Laguna, and Zone 30 Extension. Each of these reclamations are independent of each other and are expected to be used for different purposes in the future:

1) Ile Aurore

The Extension to Ile Aurore to the South East of the existing island is being considered for a potential Tourism and High-end Residential Development with some commercial and entertainment activities to support these developments. The planned area for reclamation is approximately 18 hectares (180,000 square meters) and the intention is for a single investor to undertake the entire development. It is possible that the eventual developer will reshape the reclamation to suit their development, but this will be done within the footprint of the reclamation detailed below. There has previously been 2 ESIA's done in this area for much larger proposals and these will be used as a basis for this ESIA whereby the current process will be a review/addendum to the previous ESIA's.



Figure 3.1_1

2) Providence Laguna

The proposed reclamation in this location is to create an island to be developed primarily for light to medium industrial activities. Its proximity to Providence makes this the ideal location for additional activities of a similar nature while still maintaining a sufficient distance from residential developments. It is being proposed that this reclamation will be 18 hectares in total and it is expected that the land will later be subdivided and leased to developers wishing to undertake industrial activities. The drawing below shows an approximate outline of the proposal.



Figure 3.1_2

3) Zone 30 Extension

This proposal further extends the existing Zone 30 area seawards into the area where the first set of runway lights are located. Proposed at 10.2 hectares, this reclamation would also be used for industrial activities as is the case with the existing Zone 20 and Zone 20 Extension reclamations. Previous proposals by a private developer to reclaim this area did not materialize though it did confirm that the area is suitable for such a project. However, the proposed reclamation being considered today will not be to the extent of the previous proposal and will be slightly less than 50% of the size as seen in the drawing below. Discussions with the Environment Department have resolved that a Class 2 ESIA would be sufficient for this location.

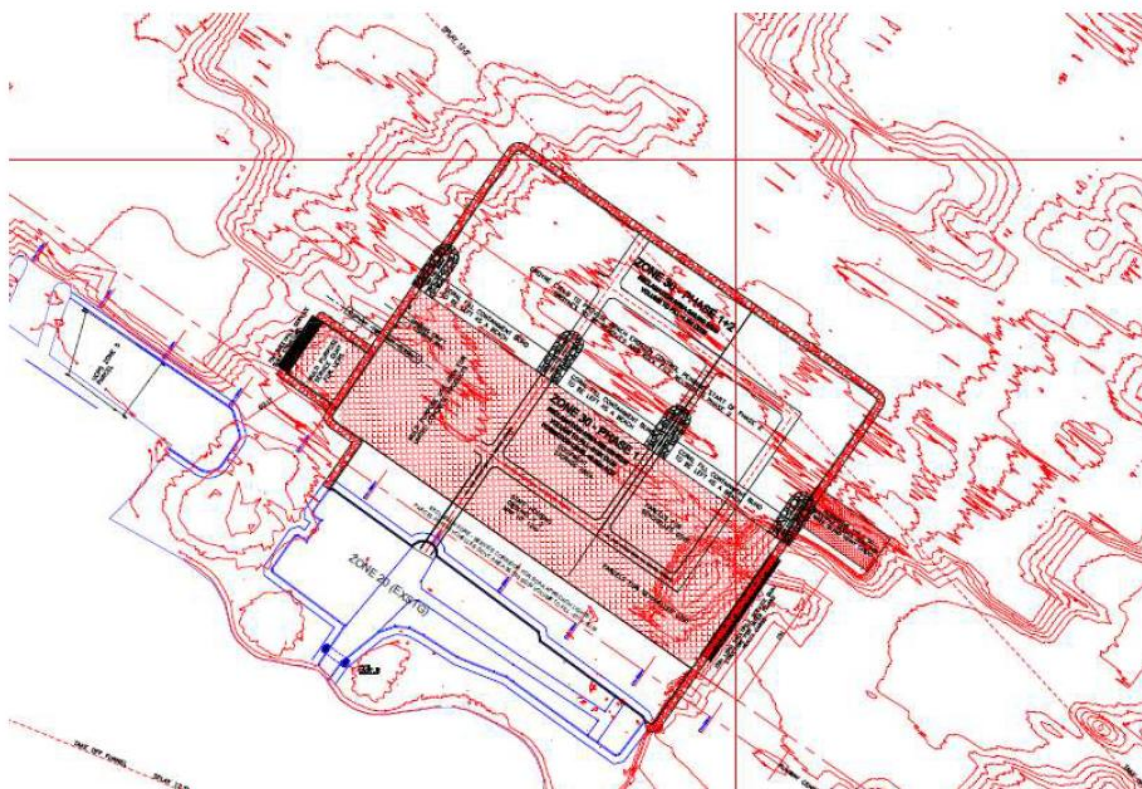


Figure 3.1_3

3.2 PROJECT RATIONALE

This project is the fourth of its kind and falls under the ECP reclamation projects in Seychelles. Under the ECP1 – ECP3 projects, the country has reclaimed a total of 7.4 km² of land to date.

Reclamation projects allow a small country like Seychelles to increase the diversification of its Land Use Plan (LUP). Further, it increases to Mahe's land mass as an adaptation measure, in view of the islands' steep topography and land constraints.

Furthermore, reclamation provides a number of benefits to the country, including but not limited to:

- Provision of Housing, Commercial and Industrial,
- Educational and Tourism zones
- Provision of Strategic Growth, Job and Wealth creation as well as spill over benefits for long term generations

With the upcoming national sand replenishment project, government believes this presents an opportune moment to optimise the high mobilisation and demobilisation costs typically associated with such large-scale operations. As such, it is considered prudent to explore the feasibility of undertaking additional projects, provided they are found to be technically and financially viable.

However, given that reclamation activities are known to have adverse environmental impacts - particularly in island states like Seychelles, which boast rich marine biodiversity - it is essential that an Environmental and Social Impact Assessment (ESIA) is carried out. This will help assess the extent of potential impacts and support more informed decision-making by Government. The proposed locations for possible reclamation have been selected based on the fact that previous reclamation activities in these areas have already altered local biodiversity, and it is believed that further work in such zones would likely result in the least additional environmental disruption.

3.3 REVISED PROJECT SCOPE

Following a consultation on March 24, 2025 in the presence of the Minister of Lands and Housing, SIA, MACCE, ECO SOL and SIA, where the environmental survey findings were shared, a revised project scope was discussed to mitigate the impacts of reclamation.

It was proposed that the dredging scope would be reduced at Providence Laguna, which could possibly see the integration of a commercial waterfront, and an additional 6 hectares (60,000 sqm) would be dredged at Zone 30. The rationale for adjusting the scope of the dredge was based on the environmental survey findings (see below) which found Zone 30 to be already impacted by the previous dredging and showcased mostly dead coral boulders overgrown by macroalgae with an absence of seagrass meadows.

The final adjustment took the following dimensions:

Providence Laguna: the overall size was reduced from 24ha to 18ha (240,000 sqm to 180,000 sqm) following the modifications along the southern and eastern perimeters on account of the hard coral picked up during the marine survey exercise. This decision was taken by government as a direct result of the dive results to mitigate against the impact on this coral.

Government further proposed a zoning of the new shape to reflect a commercial and recreational zone along the edge facing Pangia Beach. Following that, it was proposed to have a zone of light industrial and then heavy industrial as the site moves further towards Providence. Additionally, along the bay that has been created along the western perimeter, government intends to have an F&B and retail zone as support facilities to the industrial zone.

Zone 30 extension: Government increased the size of the reclamation by 6ha (60,000 sqm) to compensate for the reduction in the Zone 5 given that there is very limited marine life in this area based on the dive results. The total area proposed for reclamation in Zone 30 is approximately 16 hectares.

3.4. PROJECT COMPONENTS

The proposed land reclamation initiative is a major coastal development project aimed at creating approximately 620,200 square meters of new land—equivalent to 8.3% of the current total landmass of 7,400,000 square meters. This strategic expansion underscores the government’s continued efforts to optimize land availability in response to growing development pressures.

The original reclamation works were expected to span 126 days, encompassing key phases such as bunding, sand filling, and mobilization between sites. To achieve this, the project will utilize an estimated 3,170,000 cubic meters (CBM) of sand sourced through offshore extraction, along with approximately 86,000 tons of rock for structural stability and shoreline protection.

The scale and complexity of the operation will require a specialized fleet of machinery, including a large Trailing Suction Hopper Dredger (TSHD), backhoe dredgers, smaller excavators, dumpers, trucks, as well as floating pipelines and pumps to facilitate efficient sand transfer and placement.

This comprehensive development marks a significant investment in sustainable land management and coastal infrastructure, setting the foundation for future growth and resilience.

The table overleaf provides the technical specifications for each location as originally envisaged:

Project Location	Fact Sheet	Technical Specifications
Ile Aurore	<p>Moderately Sensitive Site Path reefs/Seagrass and Peripheral Social Infrastructure 20 M wide and deepened Navigation Channel left Part of Pre Planned Nouvelle Aurore Ext since 2007 180,000 SQM of land gained Mixed Use Island ranging from High end Tourism, Luxury Residences, Villas, Marina MAIN FINANCING DRIVER FOR REMAINDER RECLAMATION</p>	<p>Priority # 1 on timeline Volume Sand : 750,000 cbm Rock Tonnage : 32,100 Tons Proposed LUP :High end Tourism, Marina, Villas Time Frame Perimeter bunding: 10 D mob 20 D for bunding Time Frame Reclamation : 5 D mob 25 D sand pumping</p>
Zone 30 Extension	<p>Less Sensitive Site Extension of an already Reclaimed Zone 20 100,200 SQM of land gained Within heavily Disturbed/Reclaimed/Landfill zone SCAA runway lights will be integrated LUP will compliment the light Manufacturing & Industrial sector as is ongoing at Zone 20</p>	<p>Priority # 3 on timeline after Aurore Volume Sand: 570,000 cbm Rock Tonnage: 17,650 Tons Proposed LUP: Light Manufacturing & Industrial (I40) Time Frame Perimeter bunding: 10 D mob 11 D for bunding Time Frame Reclamation : 5 D mob 19 D sand pumping</p>
Providence Laguna	<p>Moderate Sensitivity Site Extension of previously Reclaimed Providence 240,000 Sqm of land gained 40 m wide & deepened circulation channel left Within heavily Disturbed/Reclaimed/ Tourism and Medium Sized Industry zone CERF Island Submarine Cable will be integrated LUP will compliment via additional Light Manufacturing Industrial sector zonation</p>	<p>Priority # 4 on timeline after Aurore Volume Sand : 1,350,000 cbm Rock Tonnage : 32,100 Tons Proposed LUP : Light Manufacturing & Industrial (I40) Time Frame Perimeter bunding: 10 D mob 20 D for bunding Time Frame Reclamation : 5 D mob 45 D sand pumping</p>

Table 3.4_1

METHODOLOGY

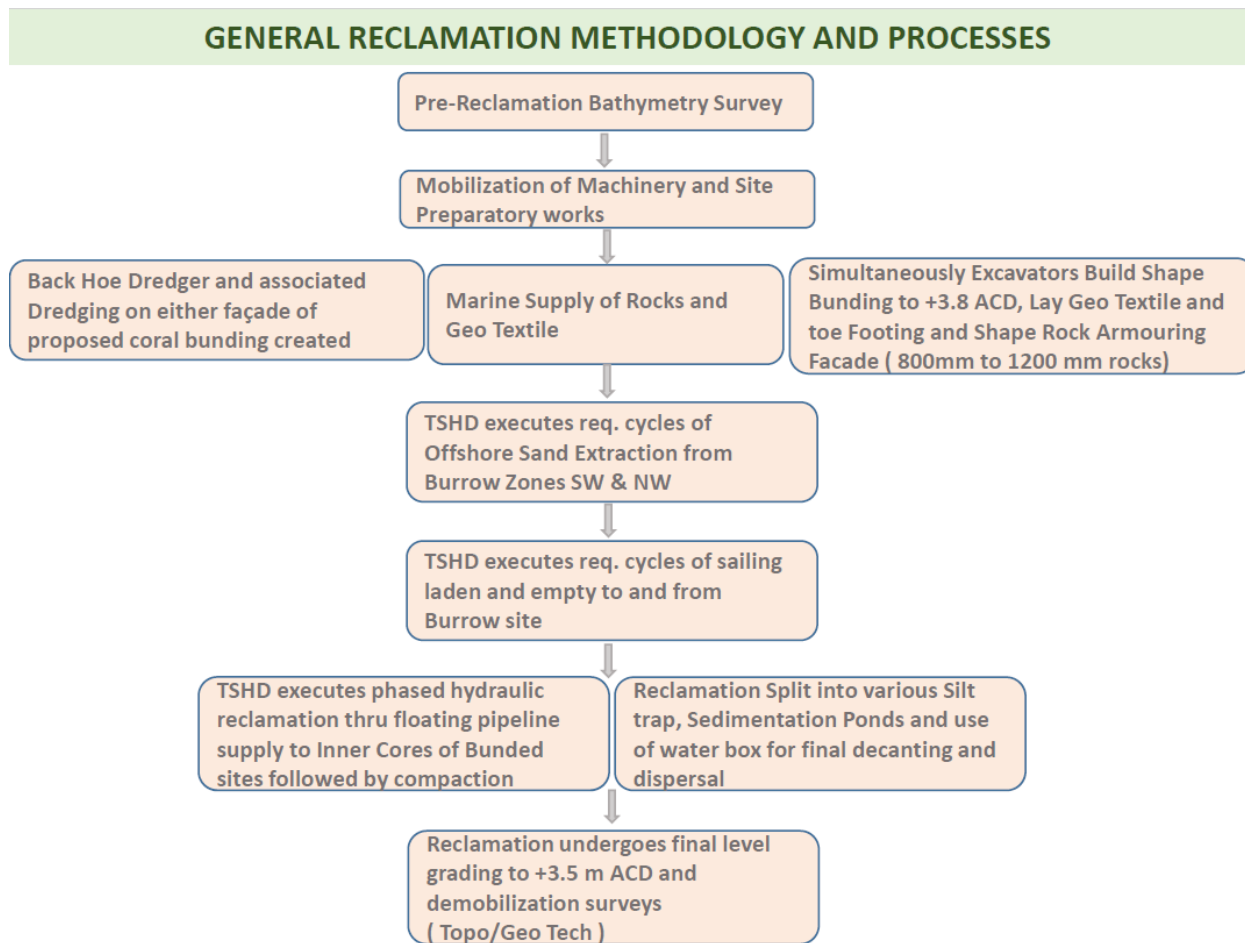
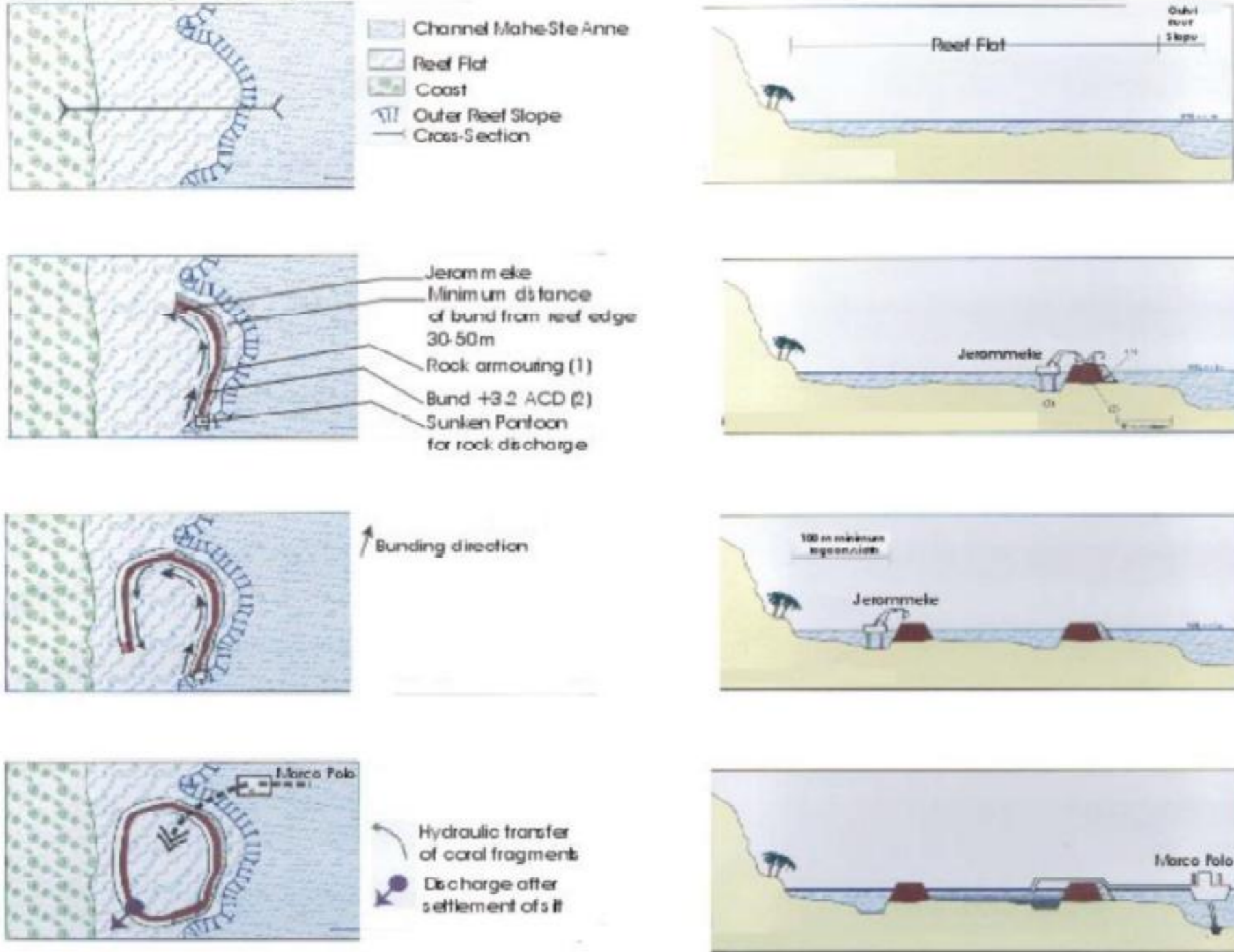


Figure 3.4_1

GENERAL RECLAMATION METHODOLOGY AND PROCESSES

Figure: Scheme showing Bunding Strategy



3.5. OFFSHORE SAND EXTRACTION

In 2023, an ESIA was completed for IDC's proposed offshore sand extraction project. IDC wished to re-engage with offshore sand extraction in the two previously studied and approved borrow zones.

These are depicted below:

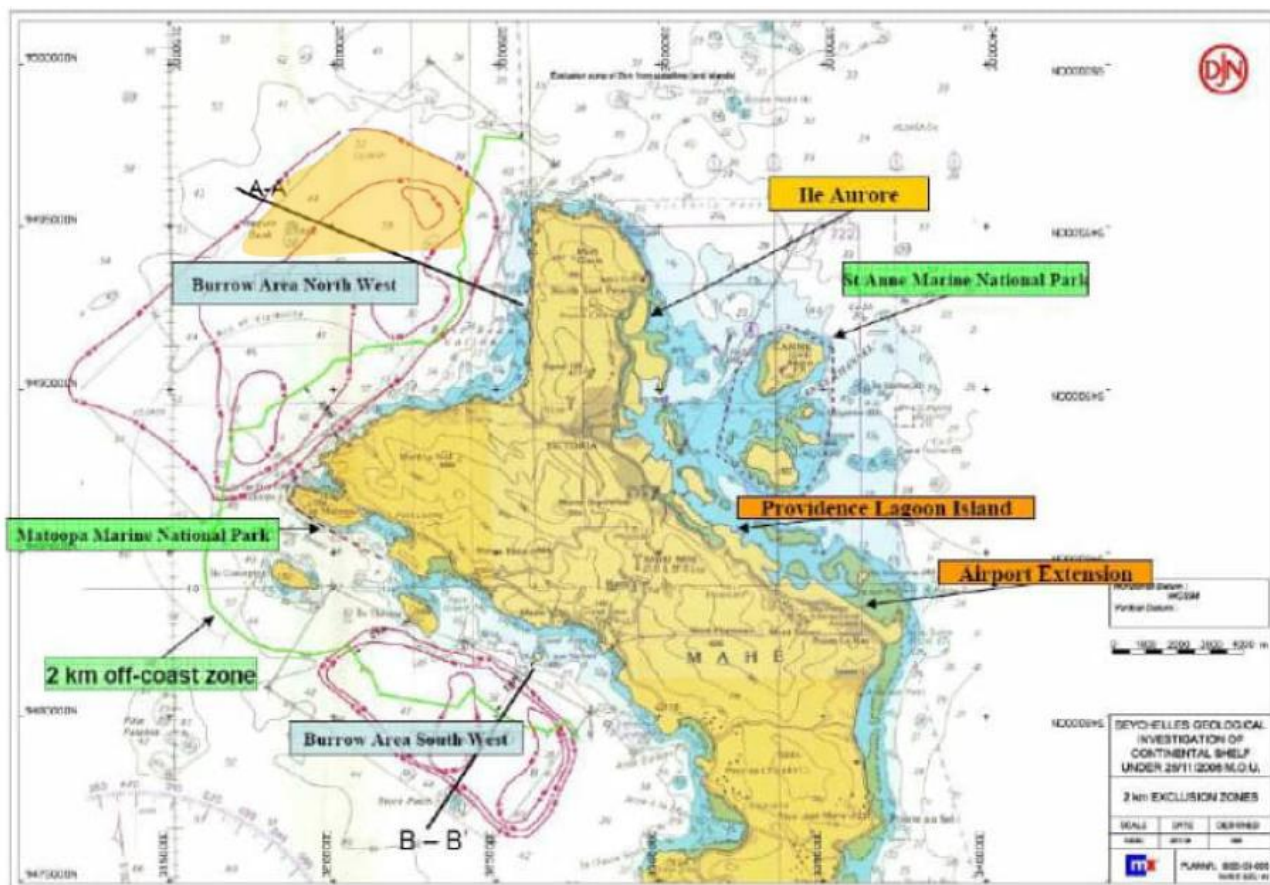


Fig 3.5_1 Borrow zones

Given the links between that project and this one, this section will outline a brief summary of the proposed dredging methodology to be undertaken:

Given the technical requirements of the project, the proposed method for sand extraction relies on the use of a Trailing Suction Hopper Dredger (TSHD). This type of vessel is purpose-built for dredging operations and is particularly suitable for deep-sea conditions. The sand deposits at the borrow sites are located at significant depths, ranging from 40 to 55 metres below chart datum. Due to these depths, only a large TSHD equipped with a deep dredging installation can efficiently and effectively carry out the required works while minimising environmental impact.

The TSHD operates by trailing a drag head along the seabed. This drag head is the only part of the vessel that makes direct contact with the seabed and is fitted with teeth and high-pressure water jets to loosen the sediment. As it moves, the dredger mixes the seabed material—mainly sand—with seawater to create a slurry. This slurry is pumped via a system of suction pipes, supported by centrifugal and sometimes underwater pumps, into the hopper or cargo hold of the vessel.

During dredging, the vessel systematically covers the entire borrow area in overlapping tracks to avoid creating furrows. Each pass removes a thin layer of sediment, ensuring that the seabed is disturbed as little as possible. TSHDs are fitted with hydraulic swell compensators to maintain firm and consistent contact between the drag head and the seabed, even in challenging sea conditions.

An important environmental consideration in this process is the control of turbidity, or suspended sediment in the water column. While some sediment plume is generated during dredging, modelling included in the ESIA indicates that the plume does not reach nearby shorelines or ecologically sensitive zones. Additionally, no overflow will be applied during dredging to further reduce environmental impact. Overflow is typically used to discharge excess water during hopper loading, but its omission in this case is a mitigation measure. The operational cycle of the TSHD includes four main stages:

- Sailing empty to the borrow site
- Dredging
- Sailing loaded to the discharge location
- Discharging the dredged material

The vessel is expected to complete up to three trips per day, including a night run, with a target volume of 500,000 cubic meters of sand to be transported. Once the hopper is full, the drag head is lifted on deck and the vessel sails to the designated discharge location near Ile Aurore. Because of the vessel's draft when loaded, the sailing route may differ slightly from the outbound journey.

Upon arrival, the TSHD connects to a floating pipeline system to offload the material. The vessel is equipped with a dynamic positioning system, using stern and bow thrusters to maintain its position without anchoring. Before pumping, water is re-injected into the sand to fluidize it, allowing for smooth hydraulic transport through the pipeline to the confined upland disposal facility. The re-hydrolyzing process is critical and must be carefully managed to prevent issues such as pipe blockages, spills, or timing conflicts with tidal cycles.

Only pipeline-based offloading will be used in this project. Methods such as direct dumping or rainbowing - where material is sprayed in an arc from the vessel - are explicitly excluded due to environmental

concerns. Localised turbidity may occur during offloading, and containment booms are recommended around the vessel to control any sediment spread.

Once the hopper is emptied, the pipeline is disconnected, and the TSHD resumes the cycle for the next load. This methodology supports the project's goal of efficient sand extraction while implementing best practices to mitigate environmental risks associated with offshore dredging in a marine-sensitive context like Seychelles.

The use of the TSHD and associated pipeline-based offloading directly supports the proposed land reclamation activities. The extracted sand will be transported and deposited with precision into a confined upland disposal facility adjacent to the reclamation area, enabling controlled fill placement and compaction. This method ensures a steady and consistent supply of suitable fill material to shape the new landform, while reducing spillage, sediment dispersion, and marine habitat disruption near the development site. The seamless integration of dredging and reclamation operations also enhances the efficiency and environmental integrity of the overall project.

METHODOLOGY FOR INSIDE ILE AURORE

The following works were programmed for the Ile Aurore sand receiving and stockade site.

It must be noted that IDC has secured permits/leases for:

- Land lease from government for occupation of area for commercial purposes
- Tree clearing exercises
- Earthworks and land clearing permits (see Annex).

A clear distinction here is made between the reclamation site and the stockpiling site. The sand stockpile plot is at -4.5945 degrees S and 55.3633 degrees East and is approximately 80,000 sq. metres in size (Fig 2 and 3 below, extracted from the ESIA report). The IDC upland disposal facility (approximately 8 ha) is situated on the Eastern part of Ile Aurore, Mahe East Coast:



Fig 2: Ile Aurore reclaimed island off the East coast of Mahe.
Sourced from https://www.webgis.gov.sc/map_default.phtml?config=default on 24 Feb 2023.



Fig 3: Depth contour at survey site, Ile Aurore, Seychelles. Sourced from [Navionics ChartViewer](#), 24 Feb 2023.

Figure 3.5_2 below shows the overall location



Site Preparation:

The initial phase of site preparation consisted of the below tasks:

- Early entry, demarcation of land boundary by survey team, placement of beacons
- De-grubbing and clearing access road to the allocated site from existing earth track within Ile Aurore's unpaved circulation. The project will require the construction of an access road from the existing main road of La Retraite linking Ile Aurore to allocated stock pile site. There will be controlled access through the way bridge and monitoring systems in place.
- Large scale tree felling of exotic casuarinas as identified in the vegetation survey
- Stacking of de-limated logs, creation of minor pits within the ground and subsequent open pit burning



Picture One

- There is an allowance for a 3-meter setback from the rock armored edge where green existing tree cover shall be retained, additionally for wind-blown and aesthetic reasons.
 - Use of excavators and digging equipment to commence the perimeter drainage channel excavation works
-



Picture Two

- Excavation works for the creation of peripheral bunding boundary all around the project site in order to contain the sand stock supply from the barge (refer to cross sections)
 - Excavation works will be done to reach the required depth in the middle of property zone in order to acquire Coral Fill for the creation of a sand Bund/Mount or Bunkering all around the 4 corners of the allocated land area on Aurore.
-

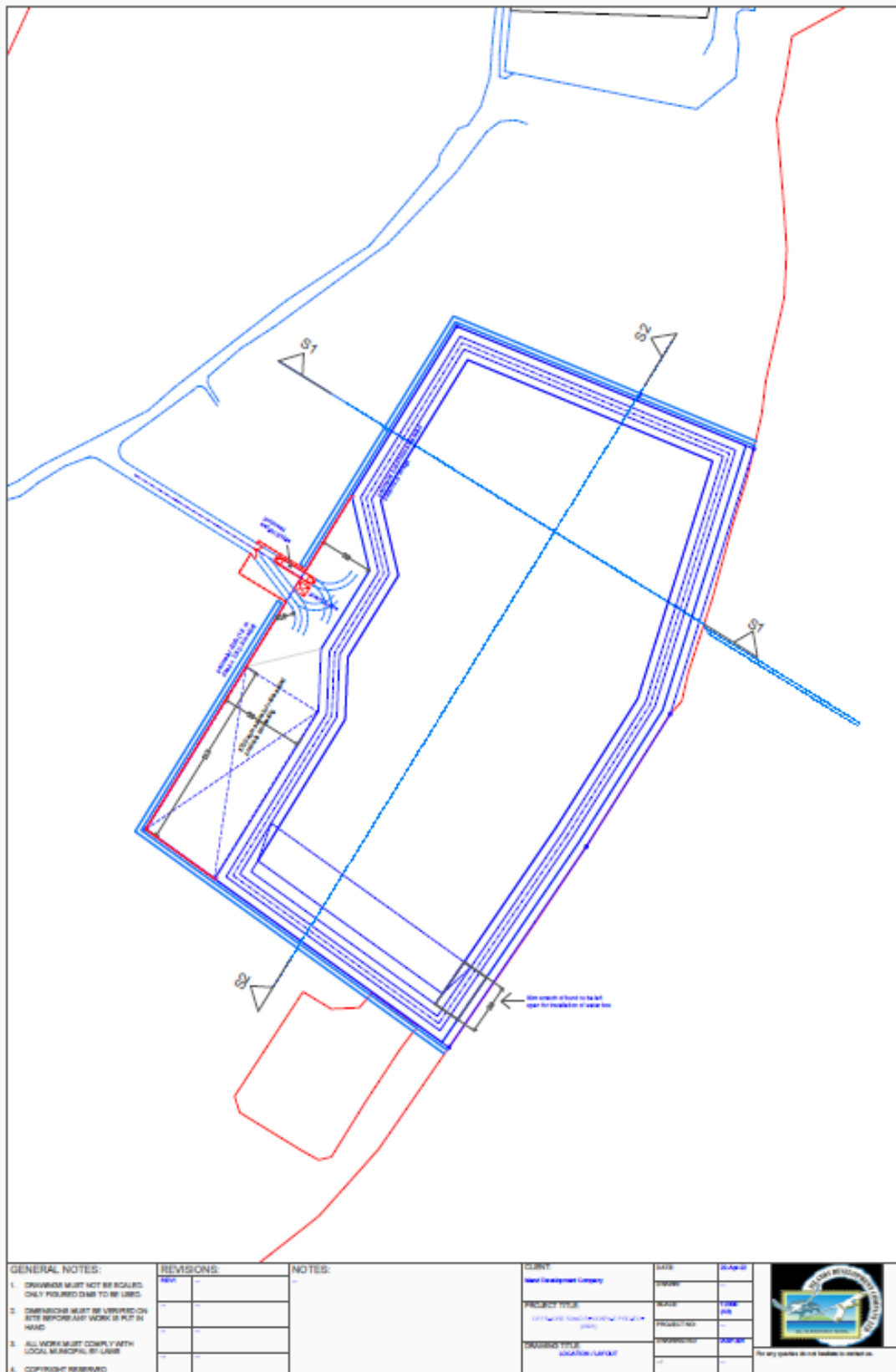


Picture Three

- The main bunding zone is projected to have a 16m base width and 6m top width, on 1:1 slope at 2.9m height. The perimeter drainage ditch will have dimensions of 2.9 m wide by 1.5m height.
- The sand stockpile site itself will first be loaded onto the dugout zones (1.5 m depth) where the majority of slurry and deposits occur via natural filtration through the islands coral fill stratum. As the stockpile grows, it will be heaped in the manner described through the cross-section diagram overleaf whereby the average sand stock pile height (for 500,000 m³) will be 9.5 high.
- The final outfall will be a water Box/Water Filtration for the final settlement and evacuation of the clarified and settled run off. This structure serves as the terminal treatment point before any runoff is discharged. Functioning similarly to a passive sedimentation basin, the Water Box facilitates the final settlement of fine particles not captured during initial infiltration and clarification of residual slurry or turbid water.

The following diagrams further clarifies the above:

Figure 3.5.3 _ Outfall



3.6. METHODOLOGY FOR RECLAMATION

The fill material to be used for the reclaimed land are to be dredged from a previously identified 'burrow area' approximately 2km off the North West Coast of Mahe, Seychelles, for which an Environment and Social Impact Assessment (ESIA) has already been completed and approved. This will be the 2nd time extraction of sand is being undertaken from this 'burrow area.'

The dredging of the sand from the burrow area is to be done using a trailing suction hopper dredger (TSHD), in the form of hydraulic dredging, as per the approved ESIA for the sand extraction while a backhoe dredger will be used to create confinement bunds for the perimeter of the reclamations using coral-gravel to be dredged from within the proposed footprint of the reclamations. Once the confinement bunds are completed, the infill of the reclamation is to be done through the TSHD by pumping the sand and sea water contained within the TSHD into the area within the confinement bund. Intentionally elongated drainage channels as well as a system of weirs will be used to allow the sea water to drain out of the reclamation area to allow for maximum sedimentation within the footprint of the reclamation so that the water is clear of almost all fines by the time it drains back into the sea.

The external seaward surface of the bund is to be lined with a geotextile and rock armour to prevent the loss of fines and protection of the perimeter of the reclamations. While the rock armouring component of the work are not in the scope of the dredging company, they will be done simultaneously with the construction of the confinement bund and therefore coordination of the works with the selected rock armouring contractor is necessary.

The rocks to be used for the rock armouring will be sourced from the only functioning quarry in Seychelles and will be transported to the locations of the 3 rock reclamation sites by sea using a barge.

4. ENVIRONMENTAL BASELINE CONDITIONS

4.1. GENERAL CLIMATE CONDITIONS

4.1.1 TEMPERATURE

The climate of the Seychelles archipelago is strongly influenced by the ocean, especially through changes in monsoonal winds, ocean currents and sea surface temperature patterns, hence a tropical maritime climate exists in the country. This is characterized by temperatures that are consistently high throughout the year, ranging from 20° to 35° C (68° to 95° F). Temperatures are slightly higher during the wet season and lower during the dry season.

4.1.2 RAINFALL

The inner granitic islands of Seychelles are exposed to two main seasons, being the Northwest Trade Winds and the Southeast Monsoon. The Southeast Monsoon – May to October, is a relatively drier, cooler and windy dominated by rather strong Southeast trade winds which reach their peaks during the months of July and August. The Northwest Monsoon occurs between December and March and it is characterized with occasional heavy rainfall.

The temperature seldom drops below 24oC or rises above 32oC. During the northwest trade winds from October to March, the sea is generally calm and the weather is warm and humid, with average winds of 8-12 knots. During January and February, the islands receive rains, rejuvenating the rivers and streams. The months between May and September bring drier and cooler weather, bring winds of approximately 10-20 knots.

The climate experienced in the islands has been described as tropical maritime, the major moderating influence being the surrounding ocean and the major disturbing influence being the movement either side of the equator of the Inter Tropical Convergence Zone (ITCZ). The amplitude of movement of the ITCZ over the Seychelles archipelago is less than that over the East African landmass. As a result, the Seychelles annual rainfall pattern exhibits one annual peak in contrast to the two experienced on the African mainland at the same latitude.

4.1.3 WIND AND WAVE CLIMATE

The 'Coastal Processes Study: North East Point, Mahé Island, Seychelles' provides extensive information on the wind-wave climate of Mahe. In summary, a rose plot of the wind data record is presented in the

figure below and clearly shows the two different wind seasons, namely the southeast monsoon and northwest monsoon.

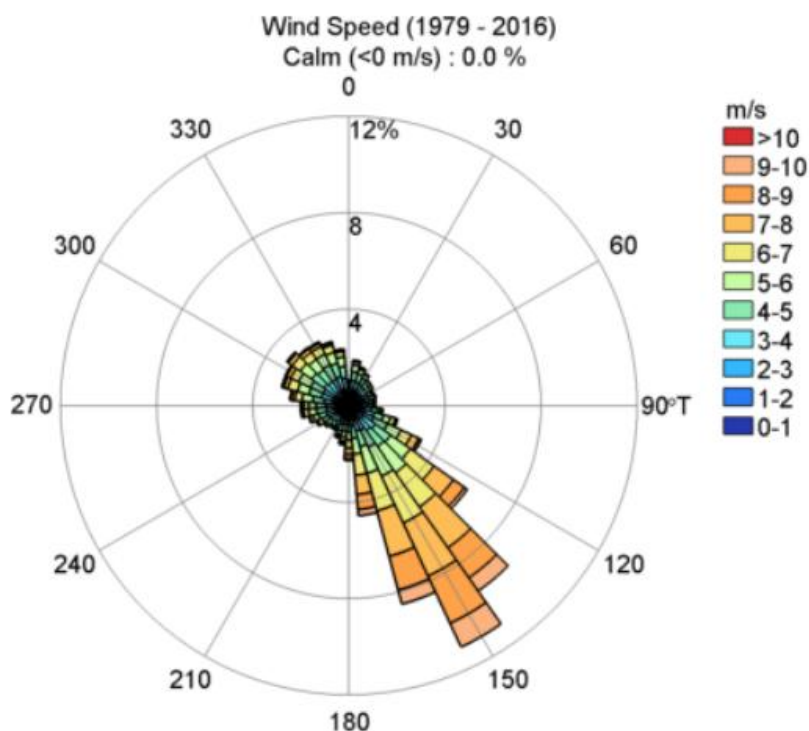


Fig 4.1.3_1 Rose Plot of Long Term Wind Data

The wave climate of Mahé reveals that most of the wave energy comes from the southeast with heights generally less than 3 m. Peak periods from the southeast are typically between 8 and 10 seconds. There is essentially no long period swell coming from the northwest quadrant. However, on the wind wave component, there is a clear signature of the shorter period wind waves generated by the NWM. The occurrence of tropical cyclones in the Seychelles is low. These cyclones move in a band south of the Islands.

For the NWM, the winds are more variable and generally lighter than in the SEM. When the winds do blow from the northwest, they are associated with short period wind waves coming from that direction. For the swell wave component, there is still an appreciable amount of wave energy coming from the southeast. Turning to the SEM, the south-easterly winds dominate during the months of April – October and are responsible for the strong southeast wind-wave signature. In addition, the increased storminess of the southern Indian Ocean during winter months is the source of the stronger swell wave signature.

4.2 SEYCHELLES AND CLIMATE CHANGE

The islands are particularly vulnerable to the impacts of climate change. The low-lying islands of Seychelles are also extremely prone to the impacts of rising sea levels, ocean acidification and changing weather patterns. Rising temperatures are increasingly impacting the country's people, economic activities, and ecosystems.

According to a 2014 JICA report on Coastal Erosion and Flood Control Management in Seychelles, the future predictions around climate change for the country are grim. The regional sea level in the southwest Indian Ocean is expected to rise between +0.4 to +0.6 m in 2070-2100 as compared with the period from 1960-1990. This gives a mean sea level rise rate of 6.6mm/year for the country. If this rate remains constant this century, the sea level will rise +0.3m by 2050 and +0.6m by 2100 as compared with 2010.

Furthermore, offshore waves are mainly dominated by the northwestern monsoon and southeastern trade winds in Seychelles. Therefore, the wave climate will not be altered to a significant extent unless the patterns of the monsoons change. Even if offshore wave conditions do not change, greater wave energy will reach the coastal zones of Seychelles with the significantly higher sea level losing less energy due to the deeper water depth. It will cause more severe coastal erosion and higher wave run-up than at present.

The more recent Seychelles' Climate Change policy aims to make the country climate resilient, sustainable and low-carbon. Its objective is to facilitate a coordinated and effective response to the local, regional and global challenges and opportunities presented by climate change. Seychelles is also a signatory to the Paris Climate Change Agreement (2015). Under this Agreement, the country has committed to submitting updated national climate plans, officially called Nationally Determined Contributions (NDCs).

4.2. STATUS OF PROJECT SITES

4.2.1 ZONE 30

Zone 30 is simply an extension of already reclaimed land. It is heavily sensitive in terms of the heavy commercial and industrial maritime works that take place in the area. It lies within already impacted, heavily disturbed and reclaimed land. The reclamation would align to the government's extension of Light Industry and manufacturing. Moreover, it also aligns to Pre Planned Zone 30 Extension 1 and 2.

In terms of biodiversity, the area comprises of coastal vegetation and exotic casuarina. It is significantly far from any heavy population and community, most of which is limited to the periphery.

The area has low sensitivity in terms of marine benthos, featuring a couple of patches of seagrass that was picked up during a rapid dive survey in 2022. There are some fisheries on the very reef edge of the drop off. Internally, the middle areas are quite silted showing broken rubble coral, pockets of seagrass and exposed sand and silt. A minor issue would be the proximity of this site to Seychelles' runway and airport. The minor seagrass patches would undergo 100% loss if reclamation is to be undertaken. The area is in proximity to the runway and Airport Operations and there would be a negligible impact to fishers if reclamation was undertaken.

Zone 30 Ext Phase 1 : Marine Site Introduction



Fig 4.2.1_1



Fig 4.2.1_2

4.2.2 PROVIDENCE LAGUNA

Providence Laguna shows that while the site is shallow and from benthos viewpoint does not show interesting findings, there are socio-economic and commercial developments occurring near the site. It is therefore moderately sensitive and well within a heavily disturbed, pre-impacted reclaimed zone. The LUP aligns to the extension of Light Manufacturing and Light Industry Zone as well as government's intention to extend the LUP.

The cable that passes to Cerf Island would need to be considered within the reclamation area. The additional reclamation shows the channel passing between Pangea and proposed area shows low visibility and is very silted. In terms of the marine environment, the longer transect (T3) shows interesting drop offs but the middle area is rubble and sand. The very edge of the shallow drop shows a plethora of pipeline and would need assessment as to whether they are functional and operational. There would be minor seagrass losses as a result of the reclamation, with minor impacts to fisheries and artisanal fishermen.

In terms of biodiversity, the site comprises of Coastal Vegetation and Exotic Casuarina on landward side. Socio-economic considerations showcase the proximity of Providence businesses and Commerce/Retail in the area.

Therefore, the main impacts to this area would revolve around:

- Noise and Aesthetic Issues
 - Vibrations/Dust
 - Loss of Partial View
 - Short term Impact to Water quality
 - Impacts to Eden Island + Marina
 - Short term Marine Traffic impacts
-

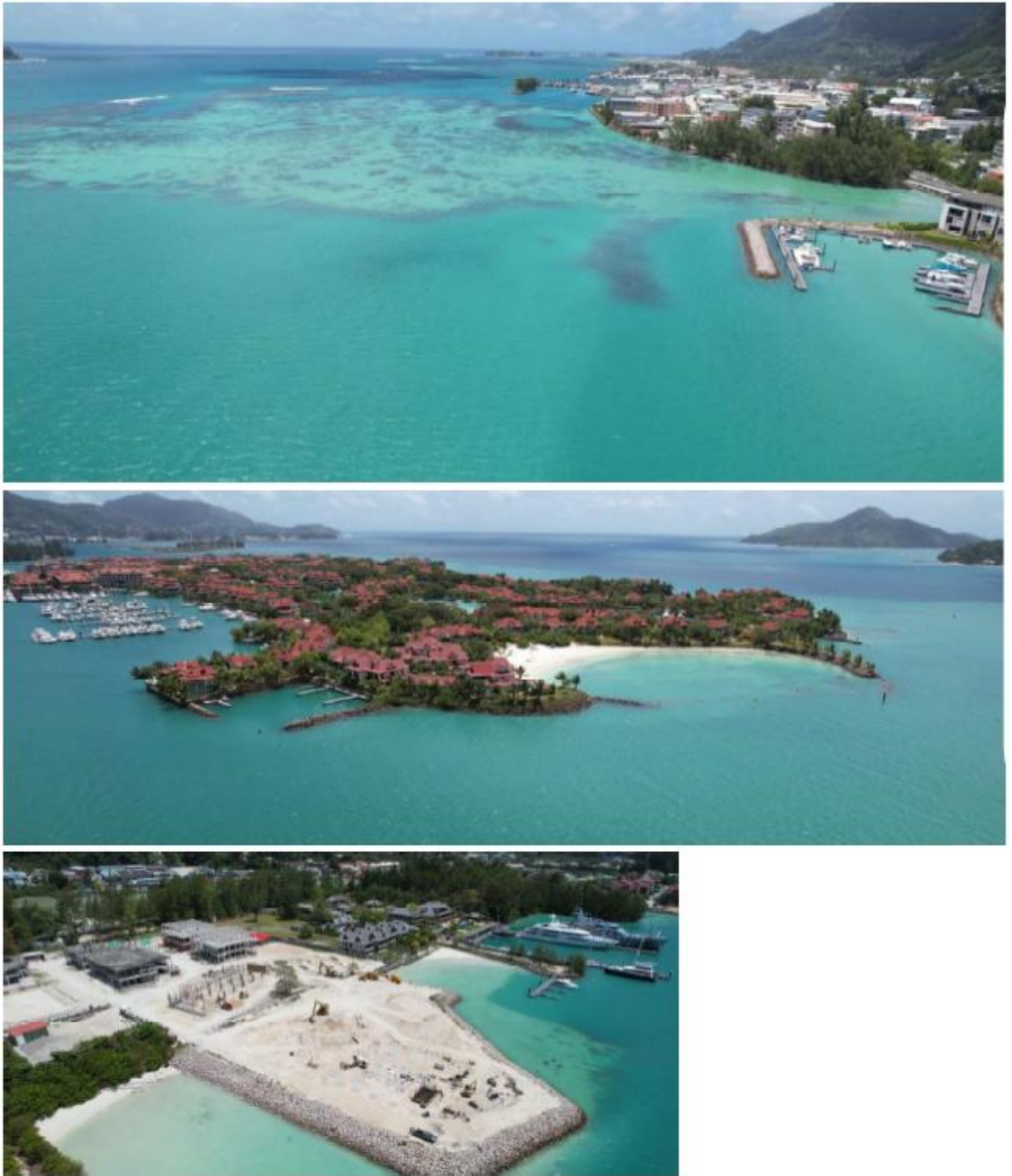


Fig 4.2.2_1

4.2.3 ILE AURORE

Ile Aurore is noted to be a finance mechanism driver for the project. The site can be categorized to be of moderate sensitivity, as it lies within a pre-reclaimed area. It also aligns to government's LUP Extension to High End Tourism encompassing Resorts, villas and marina, but on a much smaller scale. IDC's existing stockpile bunding is also awaiting offshore sand extraction.

The proposed Aurore reclamation site is only more sensitive than the other sites, due to the small patches of seagrass benthos in the area and the live coral cover. The dive survey showed the inner channels dredged out shows mostly silted with heavy mud layer. There are some coral rubbles on the edges of two embankments of the channel and some patchy seagrass formations. The most interesting part is the middle extent of Aurore which shows coral rubble, algal patches while the drop off shows live coral cover. It is safe to say this benthos will have 100% loss if reclamation is approved.

In terms of biodiversity, the site comprises of coastal Vegetation and Exotic Casuarina on the landward side. The other sensitivity present on this site is that there is a housing scheme under development at Perseverance and future impacts to the LUP for Aurore currently under review (but mixed use is envisaged). The presence of a housing community as well as PUC and Emergency Housing buildings means the following impacts will need to be mitigated:

- Noise and Aesthetic Issues
 - Vibrations/Dust
 - Loss of Partial View for the Condos
 - Moderate to High Seagrass losses
 - Some impact to fisheries and Artisanal Fisherman
 - Some Impact to Marine Traffic
-



Fig 4.2.3_1

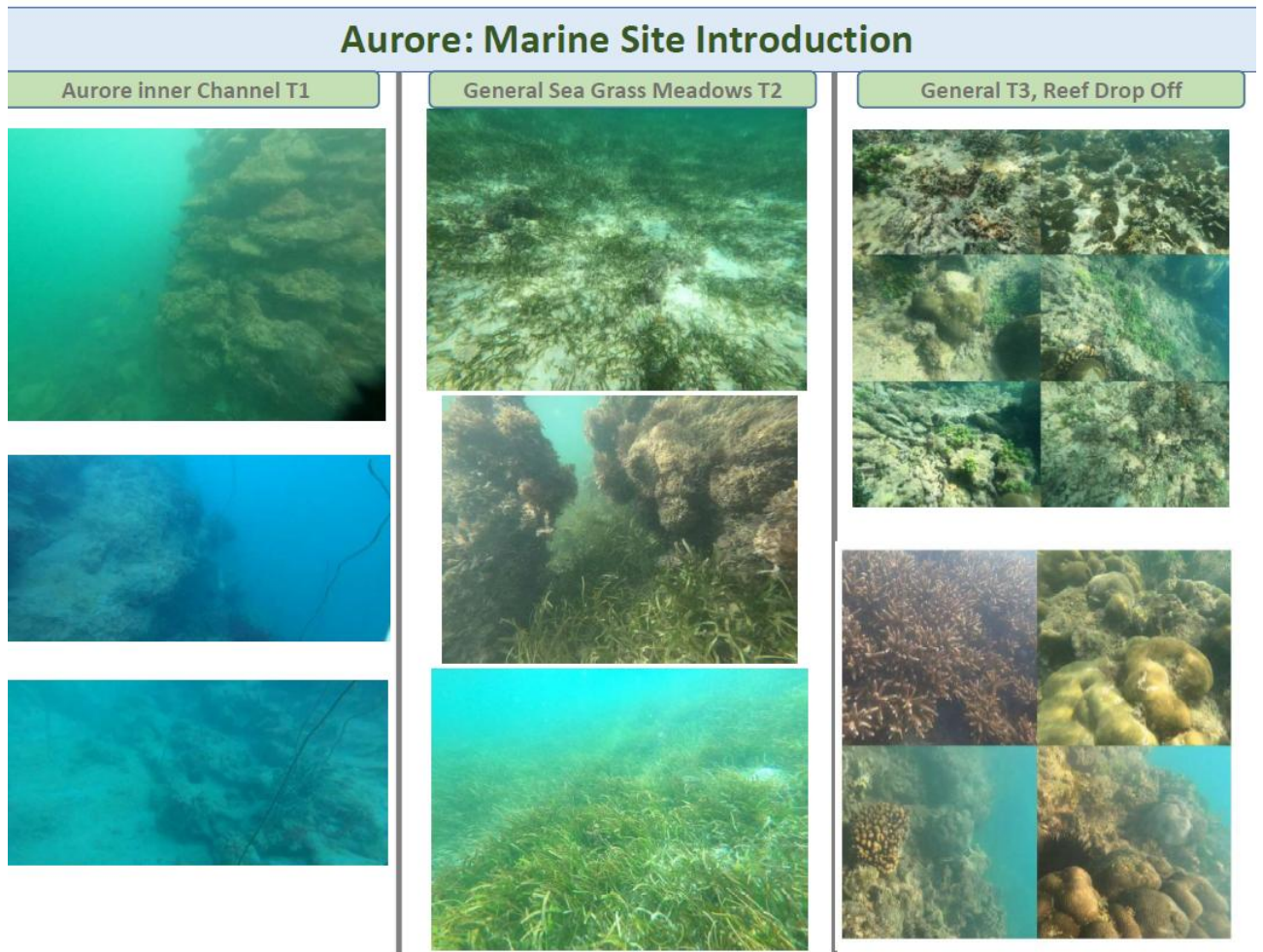


Fig 4.2.3_1

4.3. DESKTOP REVIEW FOR ILE AURORE

Two EIAs were commissioned for the proposed reclamation project of Ile Aurore. As such, this section provides a brief overview of the studies conducted and the outcomes of the risk assessments therein.

Ile Aurore is predominantly levelled with the exception of some large coralline spoil deposits. Casuarina trees, which cover the majority of the island, were planted as seed after the island was reclaimed in order to stabilise the fill and prevent erosion.

4.3.1 Biodiversity Assessment as completed under the IDC Sand Extraction project

Terrestrial and plant diversity

A total of 31 species: 31 plant species were inventoried during this current survey. This includes 16 exotic and 15 native plant species (16 exotics and 15 natives in total). In terms of plant species conservation, the site contains no important patches of endemic palms or trees. The native coastal woodland trees distribution and density inside the project plot is insignificant in terms of total number of individual trees present. One or two individuals for Porse, Bois De Rose, and Bonnet-Carré-Bord De Mer were recorded, whilst only a small patch of Veloutier was recorded on the southern part of the project plot.

DISCUSSIONS

Impacts onto the biodiversity

Impact on habitat and species

Impact on native and endemic vegetation

Minimal impact onto the biodiversity is expected from the proposed sand stockpiling project, as the project site is completely dominated by exotic woodland tree species consisting of immature and mature Casuarina trees. The majority of the coastal plants consisting of Badamier, Porse, Bois De Rose, Veloutier and Bonnet-Carré-Bord De Mer occurs near the man-made hard engineering rock armoring coastline and are sparse in densities. Therefore the sand stockpiling project will have minimal impact onto the individual native trees as they are already rare.

RECOMMENDATIONS

Reducing impact to the individual coastal woodland trees closer to the man-made coastline

Individual coastal woodland trees consisting of Badamier, Porse Bois De Rose, Veloutier and Bonnet-Carré-Bord De Mer occurs inside the project plot where the sand stockpiling project will take place. However, impacts from the sand-stockpiling activities can be detrimental to their survival, and thus they have to be protected. It is thus recommended that these native trees not be removed or felled as most of them do not fall within the proposed sand-stockpiling areas.

CONCLUSION

The proposed Island Development Company (IDC) Sand Stockpiling project site on Ile Aurore falls within areas that are dominated by exotic plant species that offers very little in ecological or biological importance for birds and reptile species. The individual coastal woodland trees consisting of Badamier, Porse Bois De Rose, Veloutier, and Bonnet-Carré-Bord De Mer will not be touched or altered in any way as they fall well outside the proposed sand stockpiling areas. In conclusion, the proposed Island Development Company (IDC) Sand Stockpiling project site on Ile Aurore, will not damage the natural assets of the property, which comprises individual native trees. Measures will be put in place to ensure that the environment is not polluted and that all terrestrial ecosystems will not be interfered with.

4.3.2 Boat Traffic Impact Assessment

It is common for boats to moor at different places depending on the amount of shelter which they can get from the two monsoons. The Northwest monsoon would usually blow from November to March and during this period, the sea on the Northern coasts of the island of Mahe is generally rougher than elsewhere. The South West monsoon would usually blow from April to October and the sea would be rougher in the southerly coasts

of the island than elsewhere. Hence boats which are not in areas well sheltered all year round would tend to shift their mooring seasonally in more sheltered areas such as in bays, jetties and behind nearby islands.

At the two mooring sites of NE1 and SE, the number of boats moored remains unchanged seasonally compared to NE2. This seasonal variation in the form of an increase, happens at NE2 even though all three mooring sites are well sheltered from both the Northwest and Southeast monsoon.

Of the total of 18 boats which were usually moored at NE2 during the monitoring, 5 come from a small mooring location, more northerly of NE2 which is called Machabee. Since Machabee is more exposed to the Northwest monsoon and during this period the seas is generally more rough there, the boats from there would moor at NE2 and then go back to their Machabee mooring once the south west monsoon starts blowing again. The Machabee are boats moored at NE2 because it is the closest mooring site to the owner's residence compared to NE1 and SE.

From interviews with the fishermen, it can be safely predicted that the number of traffic movement would tend to decrease during the South West monsoon depending on the severity of the weather. The seas would generally be much rougher outside the lagoon and the fish are generally less abundant than in the other monsoon season. Some fishermen may also decide not to go out sometimes in view of the scarcity of fish and bad weather though some would still take the risk.

Potential Impacts	Mitigation Measures
With the reclamation of the inland lagoon for the proposed by pass road there is great concern that the existing and widely used navigation channel along the western perimeter of the island will be negatively impacted upon and at the worst be completely eliminated	prior to the reclamation of the land for the by pass road along the Western perimeter of the island, a new navigational channel of appropriate dimensions and depth is dredged to allow uninterrupted navigation whilst the by pass road is being constructed
With the almost doubling in size of Ile Aurore, this will mean that boats leaving will have to make a longer journey in order to reach reefs and fishing grounds as they will have to travel around the island and for a longer period before reaching the open sea	Whilst it must be acknowledged that nothing can be done as regards to the loss of the fishing grounds in this proposed project, it is proposed that the developer considers compensating the affected fishermen by increasing their monthly fuels subsidy to cater for the increased cost and lengths of fishing trips. The incremental costs could be calculated by the Seychelles Fishing Authority. Another proposal put forward informally by some of the fishermen anectodally which needs to be further considered is to make available to them funds in the form of soft and subsidized loan for the purchase of bigger and more economical boats fitted with modern fishing equipment which will allow them to fish further out and bring in more revenue.
The area to be reclaimed to make way for additional land for the proposed development will involve reclaiming two important coral reefs for the local fishing community.	As above

Table 4.3.2_1 Summary of impacts discussed

4.3.3 Marine Ecological Assessment

The marine ecological resources in the study area were required to serve as a basis for assessing potential impacts arising from the construction and operation of the development. As a result a Marine Field Survey was conducted between the 29th of November and 2nd of December 2007.



Fig 4.3.3_1

Semi-quantitative marine field survey

A number of different kinds of habitat were identified during the semiquantitative marine field survey in the WSP report (see annex for full report). These include:

Coastal and Shoreline (Intertidal) Habitats

- _ Beach crest vegetation
- _ Sand beach habitat
- _ Granite sea defences (Rocky shore)
- _ Intertidal mudflats (Delta)
- _ Mangrove Habitat

Subtidal Habitats

- _ Mixed seagrass meadow
- _ *Enhalus acoroides* patches
- _ Various types and grades of coral habitat

4.3.4 Beach crest vegetation

The most abundant plant species on the island is the casuarina tree, *Casuarina equisetifolia* (Figure 4.8, right). Typical pioneer species of the coastal zone of this region have also spread across the island. For example, the creeping convolvulus, *Ipomea pescaprae*, often the first of the beach pioneers, is found throughout the island (Figure 4.8, left). A few individuals of the larger shrubs typical of beach-crest vegetation such as the *Scaevola*, *Scaevola sericea* are also established. Saplings of *Alstonia macrophylla* are present on the island, these are invasive weed-trees that colonise dry areas. Other invasive weedy plants identified include *Lantana camara*.

The Anse Etoile river flows out on the north side of the causeway connecting Ile Aurore to Mahe. Figure 4.9 shows the extensive area of mudflats associated with this delta at low tide.

The sandy beach areas that are located within the study site are only exposed at low tide. Sand has accumulated along the base of the breakwaters on the seaward side of the island. Shorebirds were observed feeding in these areas when exposed

The granite armour rock that surrounds the reclaimed island of Ile Aurore provides rocky shore habitat with typical organisms such as limpets, gastropods and rock crabs present

Within the study area mangroves are restricted to a few small collections of plants on the inside Channel, north of the Causeway (Figure 4.13, left). This mangrove was made up almost entirely of the white mangrove (*Avicennia marina*) with three specimens of red mangrove, *Rhizophora mucronata*, also present (Figure 4.13, right). The white mangrove is the most widespread and common mangrove of the granitic islands.

Notable species of Epifauna include the mud creeper (*Terebralia palustris*) present in abundance within the mangroves and on the surrounding areas of mudflats, and fiddler crabs (*Uca sp.*).

A large seagrass meadow is present in the channel between Ile Aurore and Ile Perseverance at water depths of between 0 and -2.0m CD. The substrate in this area ranged from fine silty sand to coarse sand with the occasional scattered rubble and boulder. Within this area, seagrass cover ranged from 5% to almost 100% of the area, except within a narrow dredged channel which skirts along the southern edge of Ile Aurore where seagrass was absent.

Coral reef is found throughout the study site in various conditions. For the sake of discussion coral habitat has been divided into the following types based on physical features and condition:

- _ Reef flats (<5 to 25% live coral cover);
 - _ Reef slope (<5 to 25% live coral cover); and
 - _ Reef slope (>5% live coral cover).
-

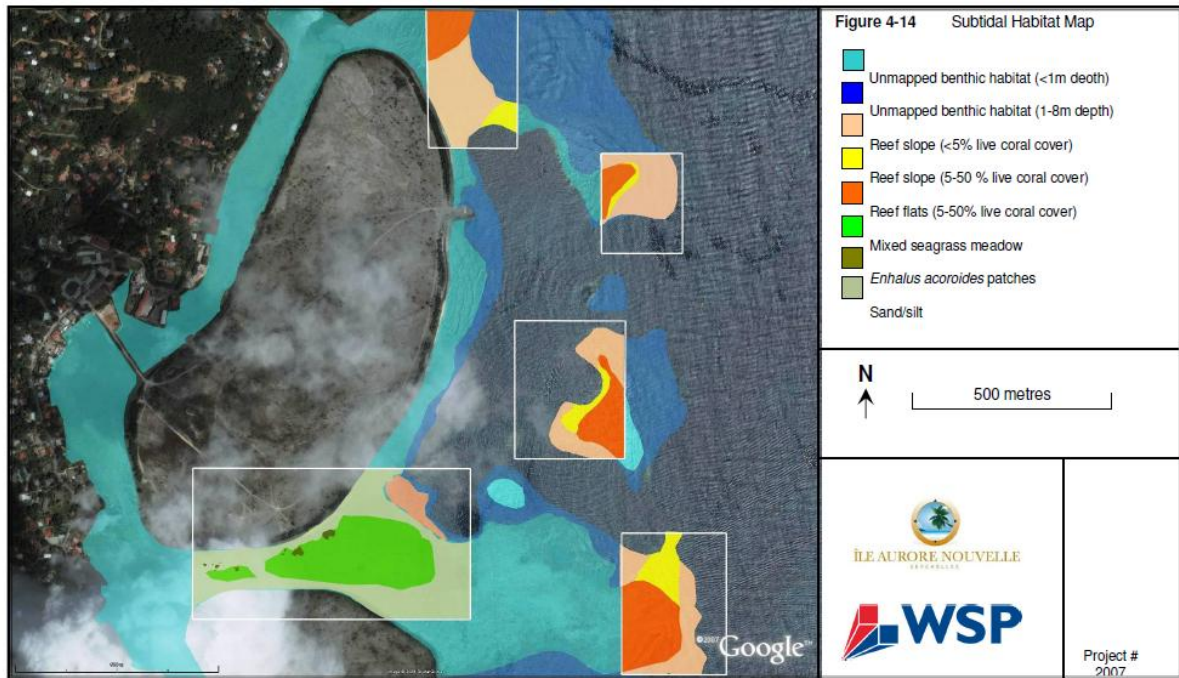


Figure 4.3.4_ 1: extracted from the WSP report: Habitat map

4.3.5 Quantitative Marine Field Survey

This survey assessed areas of coral habitat only; with 5 of the 6 sites selected being outside of the immediate project footprint. These 5 sites were selected to provide a baseline measurement against which future construction and operation EMP monitoring studies can be assessed. The other site (T4) was selected to provide a comparative site within the project footprint.

Beach crest vegetation, beach, granite sea defences (rocky shore) and intertidal mudflats (delta) have all been classified as having a low level of sensitivity to impacts and therefore no further assessment of these habitats is required. Due to its ecological potential and existing anthropogenic pressures, the Mixed Seagrass Meadow within our study has site has been assigned a medium sensitivity to impacts score. Based on the above, the sensitivity of the mangrove habitat within the study to impacts has been classified as being low-medium.

It should be noted that the reef situated in front of Ile Perseverance appeared to be in superior condition to the majority of that in front of Ile Aurore with greater live coral cover and structural diversity.

The receptor sensitivity of this habitat has been assessed to be medium-high. A high score has not been assigned due to the already highly impacted nature of this area.

4.3.6 The Rapid Marine Survey Study Methods as undertaken for the IDC Sand Extraction Project

As a precautionary measure, there was a request for a marine survey in order to assess the marine environment in the vicinity of the project site. The approach to do so included;

- The development of a snapshot understanding of the nature of the sites in term of the proposal and other history of development in the areas.
- Background literature reviews from the East Coast reclamation phases and their EIAs, as well as sand mining proposals were carried out to understand the history of the site, potential impacts of the activities and to identify other anthropogenic influences in the areas.
- Characterisation of the site was carried out through a rapid marine survey of the physical and biological environment. A qualitative approach was used to carry out the rapid assessment at the site using the Dhal method (ref).

Percentage cover was used to class coral, seagrass and macro-algae as sparse, low, medium or high as per the table below:

	Classification category			
	Sparse	Low	Medium	High
Coral	<5%	5-15%	16-50%	>50%
Seagrass	<5%	5-40%	41-70%	>70%
Macro-Algae	<5%	5-40%	41-70%	>70%

Recommendations are made within the report with regards to the measures that may be taken to mitigate the potential impacts on the marine environment. The rapid marine survey was carried out on the 22nd February 2023 by snorkel at mid tide. Based on historic data and confirmed by observations at site, it was evident that the proposed development site sits in a highly modified habitat. To assess the current state of the habitats found within the proposed area, a rapid marine survey was carried out using rapid, qualitative assessment techniques on snorkel and recorded on camera to assess and document the current marine habitats and biological communities and abiotic benthos composition. The shallow habitat was surveyed as per the Dhal method by snorkelling to conduct rapid assessment of the habitats encountered and record live coral cover and algae, seagrass density. The surveyor snorkelled the reef structures to conduct rapid assessments of biotic and abiotic composition and to note information on diversity and health. Families of fish species and other fauna was also recorded.

Survey Results

The reef structure may be described as a fringing reef with typical zonation of a reef flat, crest and drop. Poor visibility and a high level of silt and sedimentation was observed at the site on the day of the survey.

The reef flat can be divided into two zones. The inner reef flat, closer to the high-water mark, consisted of a narrow (<5m) belt of medium to high density seagrass on an abiotic substrate of primarily sand and low rubble (Fig 6).

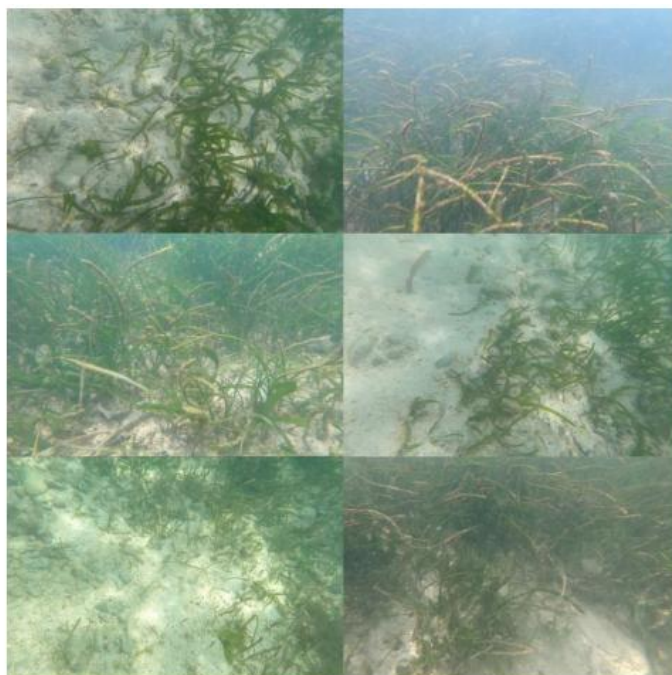


Fig 6: Medium to high density seagrass on sand and rubble on the inner reef flat, Ille Aurore.

The middle of the reef flat transitions from seagrass to brown and green algae on primarily limestone and rubble with some sand. Some small coral bommies are also observed on the reef flat and primarily massive and submassive species (Fig 7).

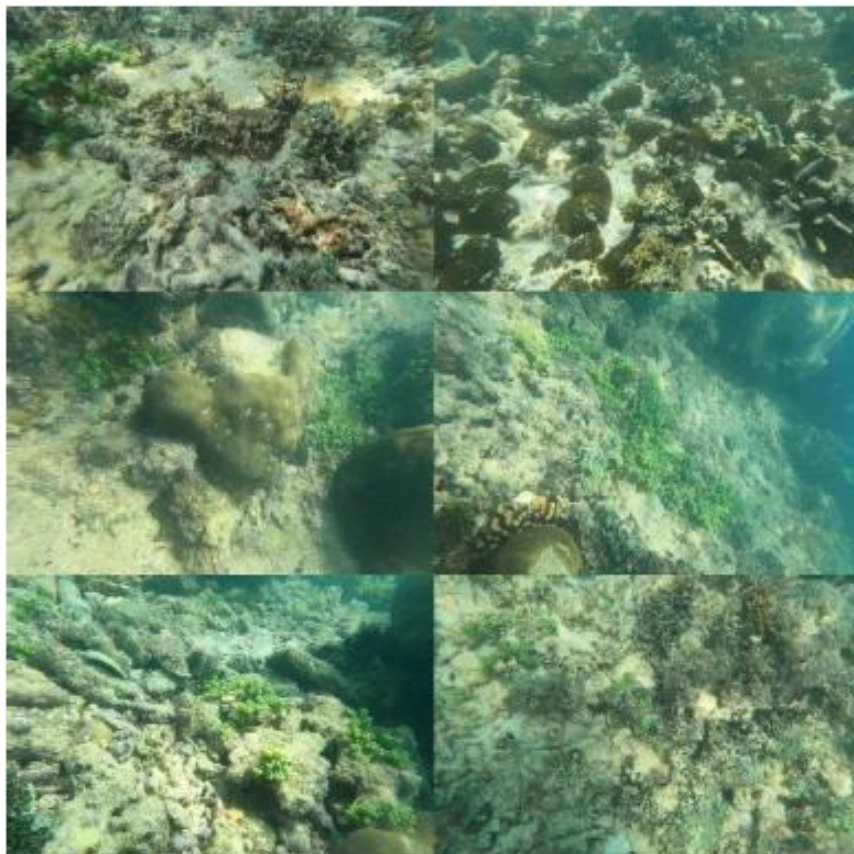


Fig 7: Algae on limestone and rubble, sand on the mid reef flat, Ille Aurore.

The reef crest is characterised by high live coral cover of mostly branching coral (*Acropora*) on the southern part of the reef. The mid and northern crest are medium live coral cover of massive and submassive corals, primarily *Porites*. The substrate base is limestone (Fig 8)



Fig 8: High to medium live coral cover on the reef crest, Ille Aurore.

The channels on both sides of the survey site were primarily sand and rubble substrate and, in some sections, low to medium algal cover (Fig 9)

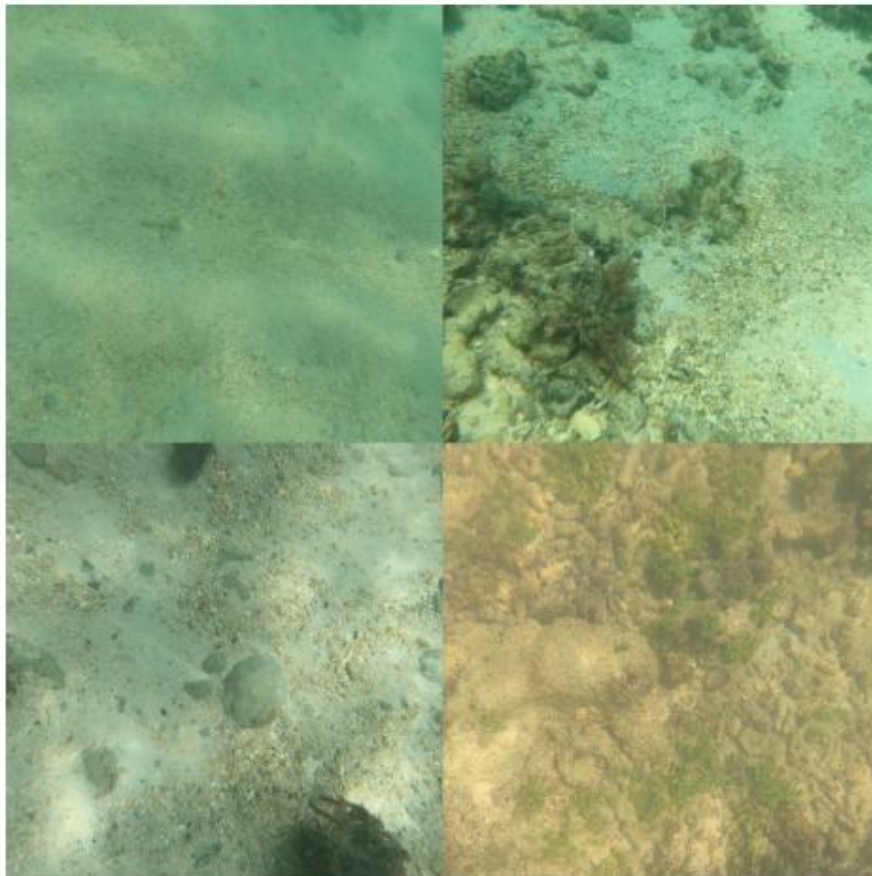


Fig 9: Sand and rubble substrate in channels of the study site, Ille Aurore.

The fish diversity on the reef was low and consisted mostly of juveniles. The recorded families of fish included Scarids (Parrotfish), Acanthurids (Surgeonfish), Pomacentrids (Damsel fish) and Chaetodontids (butterflyfish). Other fauna species observed included Holothurians (Sea cucumbers) and Echinoderms (Sea urchins).

Discussion and recommendations

The site is located near an extensive reclaimed area. Although the ecosystem may be relatively new, the reef may also consist of remnants of the fringing reefs before the reclamation which is slowly recovering judging by the size of some of the coral colonies on the reef crest and drop.

The rapid marine assessment show that the southern section of survey site with high density live coral cover, is potentially the most sensitive part of the reef in terms of potential impacts and its proximity to the outfall/water box. Impacts from laying of anchorages to support the input pipe for direct offloading onto the site may also occur but would be minimal as this is in the northern section of the survey area, over primarily rubble and sand. The process of fluidisation for resuspension is a critical phase of the offloading process because improper resuspension can cause spills, blockages of the pipes and in some cases miss operational windows such as tides (EIA, 2009). The impacts of a potential sediment plume may be mitigated for by placement of booms around the hydrolysis area and/or pipe if there is a leak. The overall long-term impacts of the proposals at the site can be described as low to medium given the comparative live coral cover, history of reclamation at and around the site, and the low index of diversity of marine organisms recorded. Nonetheless, the site is in close proximity to residential areas and this needs to be taken into consideration. The site is also used by the artisanal fishery sector (Fig). Effective communication strategies with the sector are recommended prior to implementation. This could take the form of using participatory mapping to identify important fishing or recreation zones and providing mechanisms for ongoing feedback (e.g. a contact point or grievance redress mechanism (GRM) system). It is further recommended that government begin engagement before implementation and maintain communication with affected stakeholders throughout the process, by providing regular updates via community meetings and local radio bulletins.



Fig 10: Artisanal fishing vessel operating adjacent to the survey site, Ile Aurore.

Other potential impacts include:

1. Noise (day and night) and light-pollution (night) due to operations at and around the stockpile area on Ile Aurore (ecological and socio-economic impact)
2. Air-quality impacts related to the above-mentioned machineries

3. Water-quality due to turbidity increase (dispersion of fines) and overflow at the hydrolysing and stockpile/outfall area

4. Impacts on Water-traffic

Noise

The environmental monitoring report on sand burrowing in the Northwest Area of Mahé by Charlette (2012) found that noise levels at the Perseverance stockpile area remained largely unchanged with or without active stockpiling. The most significant variation in noise decibels was observed in close proximity to the work site, indicating that the primary impact of noise is localised and diminishes with distance. It was also noted that environmental conditions - such as monsoon patterns and wind direction - can influence noise levels during stockpiling operations.

These findings are directly relevant to the proposed reclamation project, as similar stockpiling and offloading activities are anticipated. The prior assessment suggests that while noise impacts may be limited in spatial range, they could still affect nearby residents, particularly under certain climatic conditions. Therefore, incorporating buffer zones and natural noise barriers, such as maintaining or planting tall casuarina trees around the stockpile perimeter, remains a key mitigation strategy. Applying these learnings to the current project can help manage potential noise pollution and reduce its impact on adjacent communities.

Table 1: Noise Levels (dB) During and Without Stockpiling Activities

Location No.	Location description	During stockpiling (dB)	No stockpiling (dB)
1	Northern side of Stockpile area	55-85	40-45
2	Southern side of Stockpile area	50-80	40-45
3	Roundabout near causeway	40-44	40-43
4	Main road exit leading to stockpile	44-50	39-48
5	National Assembly	46-50	43-51
6	Union Vale, uphill of SBC radio station	50-60	49-61
7	Majoie	50-60	50-60

Note: Noise level 10m to 20m from work face was 70 to 85dB

Figure 3: Location Map for Noise Measurement



Fig 11: Excerpt of the Environmental monitoring report of Sand Burrowing in Northwestern Area of Mahe in 2011 showing noise levels during and without stock piling activities in Perseverance stockpile area (Charlette, 2012)

Hydrodynamic modelling at both sites can be considered in order to predict changes in sediment flow and water circulation at the overflow/outfall point, especially in consideration of potential changes (and impacts) during the different monsoons. The effect of particular seasonal variations on sediment suspension, dispersion and deposition will need to be considered.

Any potential impact can be reduced by extending the outfall point inside the channel between Ile Aurore and Perseverance for greater mixing. From the bathymetry (Annex), it would take a relatively short distance to reach the reef drop point from the HWM and hence it should be feasible to extend a discharge pipe to a point beyond the reef where greater mixing occurs. In addition, the channel between the two reclaimed islands, Ile Aurore and Ile Perseverance is an area of low wave and wind exposure, sheltered from the effects of the winds by the islands. The area should experience a high volume of water flow through the channel but seeing as the channel is over 100m wide, the tidal currents will not be of a high magnitude in the area. Having the outfall point in this channel could ensure mixing and minimising the potential impacts from sedimentation and siltation. Water sampling at various distances to the outfall during overflow to measure total solids concentration can be applied to monitor the impacts.

The Environmental monitoring report of Sand Burrowing in Northwestern Area of Mahe in 2011 showed that the sediment plume from the sedimentation pond was easily contained within the Victoria Bay and that it did not spread further than 200-300mm from the discharge point and did not affect the surface of water within the navigation channel from/to Victoria Port (Charlette, 2012).

It is important to note that this marine survey was only carried out at one point in time and to track any impacts on the reef through time, an impact monitoring protocol could be established to provide further basis for effective mitigation.

4.3.7 Water Quality Report

This report concluded that there was a small difference between the surface and bottom temperature and salinity recorded in waters to the east of Ile Aurore which indicates that the water in the channel and along the reef edge is a well mixed, homogenous water body with no stratification. Water temperature increases and salinity decreases in the back lagoon towards the causeway.

The increase in temperature is due to shallow water and a slow flushing time whilst the decrease in salinity can be attributed to the Anse Etoile river north of the causeway and groundwater discharge to the south of the causeway.

A marked difference was noted in physio chemical properties of the water to the north and the south of the causeway. To the north of the causeway the back lagoon has a clear signature of the Anse Etoile River which is indicative of runoff from land. The river water contained high nutrient concentrations leached from decomposing vegetation on the slopes of Mahe and a low pH as a result of the acidic soils (Red earth) formed by the weathered granite. The signature of the river water is reduced quickly with distance from the source and has completely mixed out by the northern entrance to the back lagoon.

The salinity on the south side of the causeway also indicates an input of freshwater despite the proposed lack of flow across the causeway. Further evidence of this lack of flow is indicated by the difference in nutrient concentrations and pH on either side of the causeway. It is therefore likely that the lower salinity on the south side of the causeway is caused by a groundwater flow through the calcareous sand platform at the base of the granite cliffs.

The high turbidity in the back lagoon is due to an algal bloom. This is mirrored in the high chlorophyll-a concentrations and the supersaturated dissolved oxygen indicating that primary production is taking place. The turbidity and chlorophyll-a concentrations are highest directly to the north of the causeway due to the point source of nutrient inputs from the river. This is indicative of what may happen to the general marine environment if nutrient inputs from the development especially the golf course are not carefully controlled. The turbidity decreases northwards in the back lagoon as the nutrients are used and the river water is mixed with the low nutrient sea water. The turbidity in the back lagoon is similar to that seen in the back lagoon at Eden Island where sechi depths between 1.05m and 1.32 m were recorded (The Potential Impact on the Marine Environment of the Development of Eden Island, Seychelles, Pisces Environmental Services. August 2004).

Ammonium was the only nutrient that recorded concentrations above detection levels in all of the samples. Differences in the ammonia concentrations between the back lagoon and the sea were however small and were significantly lower than the mean concentration of 2390ug/l for the north east coast of Mahe recorded

in the International Centre for Ocean Development (ICOD) report. The main findings from this report indicated elevated nutrients and a general deterioration in water quality in the vicinity of Port Victoria and surrounding urban settlements including elevated metal concentrations in the vicinity of the commercial key and the Providence landfill. Evidence of pesticide contamination has not been recorded, according to the water quality study report. The report further states that the water in the back lagoon closest to the settlement at Anse Etoile has the lowest ammonia concentrations, indicating that there is no significant seepage or discharge from the septic tank systems.

The water in the back lagoon closest to the settlement at Anse Etoile has the lowest ammonia concentrations, indicating that there is no significant seepage or discharge from the septic tank systems. The pH at SY21 is slightly lower than samples from the back lagoon and reef edge which could be an indication of leachate from the nearby waste site. This is however no evidence of this in the other parameters.

Temperature

- _ The average seawater temperature was 27.5°C
- _ A maximum water temperature of 35°C was recorded in the back lagoon.
- _ No thermocline or stratification of the water column was present.

Salinity

- _ Salinity in the back lagoon is lower than that of the sea with the lowest salinity recorded at SY19 (31.00psu) at the Anse Etoile River mouth with the second lowest recorded on the southern side of the causeway at SY22 (32.4).
- _ Samples SY23 (34.8psu) and SY21(34.7psu) at the northern and southern entrances of the back lagoon reflect similar salinities to those recorded at stations in the channel and at the reef edge.
- _ Salinities at the reef edge and in the channel increased in the first 2m of the water column.

Turbidity

- _ The Secchi depth increased with the distance from the reef edge with the maximum depth recorded at the control site at the Saint Anne Marine Park (6.5m).

Dissolved oxygen concentrations were higher in the back lagoon than at the reef edge.

- _ There is very little difference in dissolved oxygen concentrations to the north and south of the island with samples SY1 and SY3 recording 6.44 and 6.47mg/l respectively.
- _ Dissolved oxygen in the back lagoon was higher to the south of the causeway than the north.
- _ The surface waters on the reef edge and in the channel were saturated and the waters in the back lagoon are super saturated.

Peak chlorophyll-a concentrations were recorded in the back lagoon.

_ Sampling stations situated over areas of health reef recorded higher chlorophyll-a concentrations in the bottom waters than the surface waters. .

_ The maximum concentration was recorded at SY19 (1.741ug/l) where the Anse Etoile river enters the back lagoon followed by SY22 (0.539ug/l) to the south of the causeway.

_ Chlorophyll-a was low at north and south entrances to the back lagoon but increases offshore to the north and south of Ile Aurore. Very low nutrient concentrations were recorded with the majority of samples recording concentrations of nitrate, nitrite and phosphate below detection levels.

_ High nitrate, ammonium and phosphate were recorded in the Anse Etoile River with high phosphate indicated at SY19 at mouth of the river.

_ Ammonium was lowest in the back lagoon to the south of the causeway and second lowest at mouth of the Anse Etoile River.

_ Similar ammonium were concentrations recorded along the reef edge with an increase at the offshore sample SY2 (45 ug/l) and SY3 (50ug/l).

_ No traces pesticides were found to be present in the water at the site.

Wave Climate

The wave climate at the Seychelles is complex, with waves generated from a number of offshore sources. The influence of these sources changes with the seasons. However, at Ile Aurore, the highest waves clearly occur during the South East Monsoon period, particularly from June to August. As local wind waves were found to have an influence on wave heights, periods and directions, it is **recommended that the predicted wave conditions including wind effects be included and that these conditions are used for the design of structures to protect the island.**

These indicate an estimated maximum nearshore 1:100 year significant wave height of 2.3 m, which occurs at the northern edge of Ile Aurore

Impacts

The proposed Ile Aurore Nouvelle project will give rise to a number of environmental issues that require detailed environmental assessment with the identification of appropriate mitigation measures. On the basis of the internal and external consultations to date, site visits, preliminary studies, existing reports and background information the key issues that are likely to require assessment have been identified:

- Marine Water Quality;
 - Marine Ecology;
 - Terrestrial Ecology, Landscaping and Biodiversity;
 - Water supply and wastewater;
 - Waste Management;
-

- Social and Cultural;
- Traffic and Infrastructure;
- Green Design and Carbon Footprint; and
- Landscape and Visual.

A summary of the social issues raised during the public meeting is listed below:

- Provision of local employment opportunities.
 - Possibility of providing training to allow Seychellois access to higher level employment opportunities.
 - Local access to Île Aurore Nouvelle facilities.
 - Developer to consider a contribution to social upliftment and community development initiatives.
 - An updated list of scoping comments is to be made available to the public.
 - Request for further public consultation to allow more detailed information on the project to be communicated.
-

4.4. FIELD ASSESSMENTS AND SURVEYS

This section presents the field work and assessments that were conducted in the proposed reclamation locations. To note, marine surveys and sediment modeling studies were conducted. The full reports for these assessments can be found in the annex documents to this report.

4.5. MARINE ASSESSMENTS

4.5.1 ZONE 30

To assess the benthic habitat composition and biodiversity within Zone 30, a photoquadrat survey was conducted along two designated transects (T1 and T2), covering key habitat zones. The total length of surveyed transects was 2 000 meters, with T1 extending 950 m and T2 reaching 1,050 m (Figure 4.5.1_1). Each transect was designed to capture variations in substrate composition, coral cover, and macroalgal distribution across the site.

Data collection was conducted using snorkeling-based transects, where a surveyor swam along each transect while towing a GPS device on a float to ensure accurate georeferencing of the collected imagery. Georeferenced photoquadrat images, each covering approximately 1 m² of the seafloor, were systematically captured every 2 to 4 meters along the transect path. Time synchronization between the camera and GPS ensured precise spatial positioning of the benthic images, allowing for high-resolution mapping of habitat features.

The captured photoquadrat images were analyzed using CoralNet, a web-based solution for coral reef monitoring and benthic habitat classification (Beijbom et al., 2015)¹. In each image, 50 random points were overlaid, and the benthic components under these points were classified into functional groups, including: Soft Substrate (e.g., Sand), Hard Substrate (e.g., Rock), Hard Coral (e.g., Porites), Macroalgae (e.g., Sargassum) and Seagrass.

Additionally, one team member recorded all observed taxa, with identification carried out to the lowest taxonomic level possible. A comprehensive species list and photo catalogue were compiled and are available in the annexes.

¹ Beijbom, O., Edmunds, P. J., Roelfsema, C., Smith, J., Kline, D. I., Neal, B. P., ... & Kriegman, D. (2015). Towards automated annotation of benthic survey images: Variability of human experts and operational modes of automation. *PLoS one*, 10(7), e0130312.

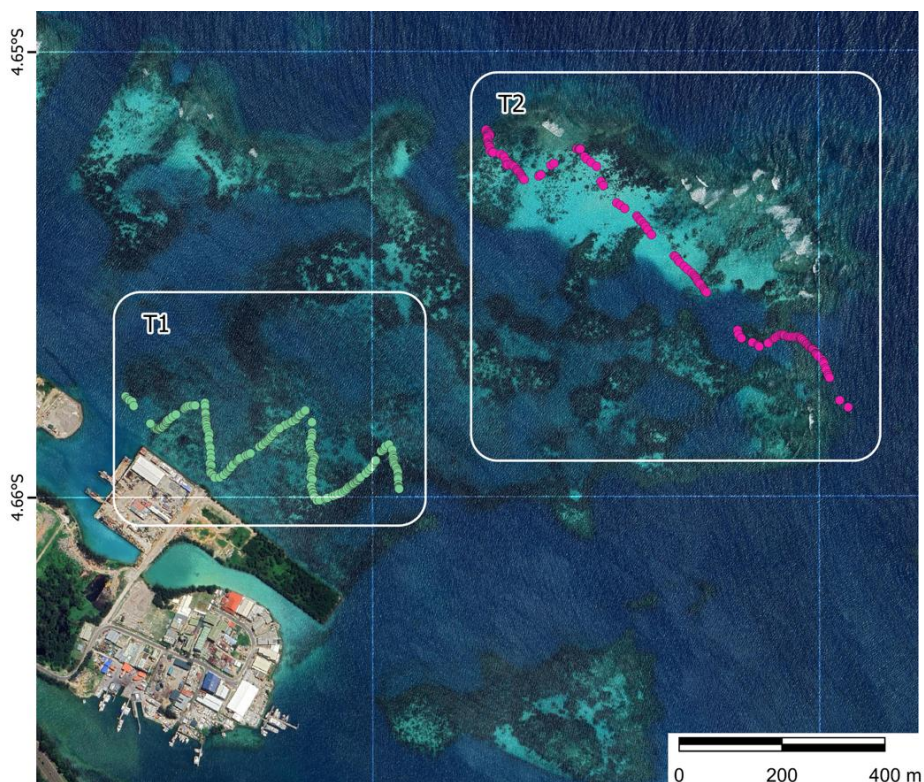


FIGURE 4.5.1_1: SPATIAL DISTRIBUTION OF SAMPLED TRANSECTS T1 AND T2.

4.5.2 BENTHIC, HABITAT COMPOSITION AND BIODIVERSITY

The habitat survey of Zone 30, conducted in January 2025, reveals a benthic environment primarily dominated by macroalgal meadows. Transect T1, located in the western portion of the study area and aligned with the proposed reclamation site, is characterized by extensive macroalgal dominance, with all dead and old coral boulders heavily overgrown by *Sargassum sp.* This indicates a significant ecological shift away from coral-dominated reef structures.

No seagrass meadows were observed in the area, suggesting that prevailing oceanographic conditions are unsuitable for seagrass establishment. The high sedimentation rates, substrate instability, and competitive exclusion by macroalgae are likely contributing factors to the absence of seagrass beds.

Benthic cover analysis results confirm that macroalgae cover is the dominant benthic component throughout the reclamation footprint in T1 (36.8%) and T2 (32.5) (Figure 4.5.1_2). The widespread proliferation of *Sargassum* species is indicative of an ecosystem shift, likely driven by sedimentation, nutrient enrichment, and reduced herbivore grazing pressure.

The dominance of macroalgae presents significant ecological risks, as it competes with corals for space and light, inhibiting coral recruitment and recovery. Transect T1, situated within the planned reclamation area, is almost entirely covered by macroalgal meadows, indicating that existing coral communities in this section are already severely reduced. Additionally, during field observations in T1, a considerable amount of marine debris, including discarded materials and marine cables, was found scattered throughout the area. The presence of such debris may further contribute to habitat

degradation, obstructing coral recruitment, and promoting macroalgal colonization on artificial substrates (Figure 4.5.1_3).

Mean Benthic Cover (%)

	Hard Coral	Macroalgae	Hard substrate	Rubble	Sand
T1	6.1	36.8	9.4	2.3	40.0
T2	13.1	32.5	13.8	7.8	27.3

Created with Datawrapper

FIGURE 4.5.1_2: MEAN COVER (%) OF THE MAIN BENTHIC CLASS OVER THE TRANSECTS.

Despite macroalgal dominance in the western transect (T1), higher hard coral cover is observed in the northeastern (T2) portion of the survey area. The presence of these remaining coral patches suggests potential refugia for reef-associated biodiversity and may serve as priority sites for conservation efforts (Figure 4.5.1_4).



FIGURE 4.5.1_3: PHOTOS OF CABLE AND DEBRIS FOUND IN T1.

The mean coral cover varies significantly across transects. T1 exhibits the lowest coral cover at only 6.1%, reflecting a severely degraded coral community with minimal reef development. T2 presents an intermediate coral cover of 13.1%, reflecting a transitional habitat with both coral and macroalgal influence. T2 coral cover shows high variability (16.90%), whereas T1 has the lowest coral standard deviation (8.89%), confirming that coral communities in this zone are consistently sparse.

Rubble cover is lowest in T1 (2.3%), but increases T2 (7.8%), suggesting localized coral degradation in certain sections of these transects. The higher standard deviation values for rubble cover in T2 (11.75%) indicate variable levels of substrate fragmentation, likely from past disturbances or natural reef dynamics.

The biodiversity survey conducted at Providence Laguna revealed a total of 40 species spanning four major groups: corals, other invertebrates, macroalgae, and fish.

A total of 7 Hard coral genera from 5 families namely Acroporidae, Euphylliidae, Fungiidae, Merulinidae and Poritidae was observed. The survey recorded a total of 7 other invertebrates was recorded from the following families Demospongiae, Cypraeidae, Diadematidae, Holothuriidae, Ostreidae, Stichopodidae and Strombidae. Six species of macroalgae was documented from 4 families namely Caulerpaceae, Cladophoraceae, Halimedaceae and Sargassaceae. The latter being the most abundant. Lastly, a total of 20 Teleostei was recorded from 15 families namely Acanthuridae,

Carangidae, Chaetodontidae, Epinephelidae, Holocentridae, Labridae, Lethrinidae, Nemipteridae, Pomacanthidae, Pomacentridae, Scaridae, Siganidae, Sphyraenidae, Syngnathidae and Zanclidae

4.5.3 SEDIMENTATION AND WATER COLUMN TURBIDITY

Field observations recorded high turbidity levels and elevated sediment concentrations in the water column, particularly in T1, within the planned reclamation area. These findings suggest that sediment resuspension and deposition are ongoing stressors in this region.

Excessive turbidity reduces light penetration, negatively affecting coral photosynthesis and the growth of other photosynthetic benthic organisms. Additionally, high sedimentation loads may further facilitate macroalgal proliferation while hindering coral settlement, exacerbating the observed ecosystem shift towards algal dominance.

4.5.4 ECOLOGICAL IMPLICATIONS

The results indicate that T1 is heavily dominated by macroalgae and sand, with minimal coral presence, suggesting that this area has experienced significant degradation, likely due to sedimentation and environmental stressors.

T2, while showing higher macroalgal presence, still retains moderate coral cover and substrate complexity, making it a transitional zone between degraded and healthier reef habitats.

Given these findings, sediment management strategies, coral transplantation efforts, and targeted conservation interventions should be prioritized to mitigate potential impacts from reclamation activities and promote reef resilience within Zone 30.

Sediment control strategies, such as turbidity barriers and controlled dredging techniques, to minimize further sediment deposition on nearby coral reefs.

Coral relocation programs, focused on transplanting viable coral colonies from impacted zones to stable reef structures in the northeastern and southeastern areas.

Monitoring programs to assess ongoing changes in water quality, coral health, and macroalgal expansion, ensuring that early warning indicators of ecosystem degradation are addressed proactively.

The findings highlight the urgent need for adaptive management interventions to mitigate the ecological consequences of reclamation activities, reduce macroalgal overgrowth, and support coral resilience in the surrounding marine ecosystem.

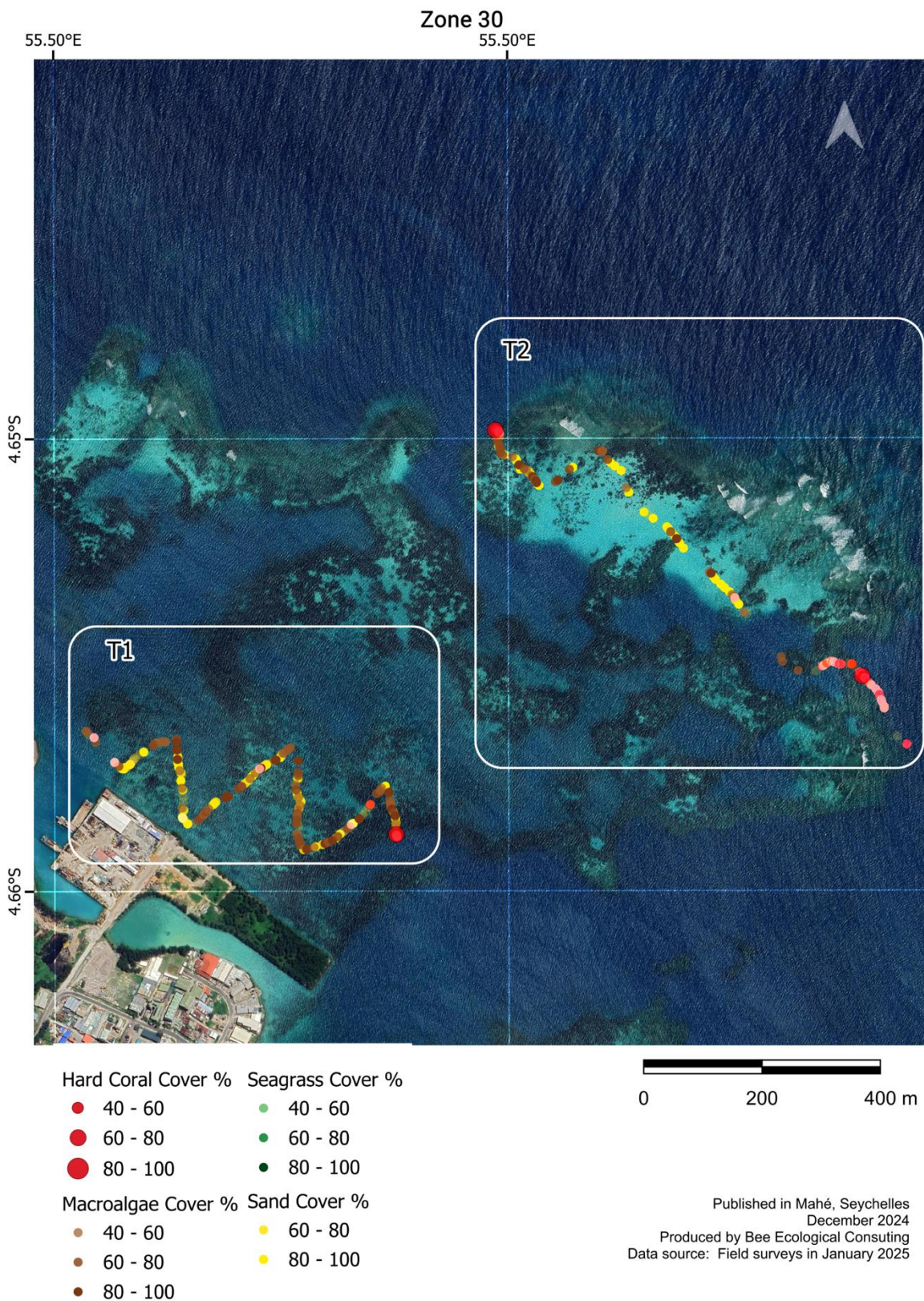


FIGURE 4.5.1_4: BENTHIC HABITAT COMPOSITION AND HARD CORAL COVER IN ZONE 30. EACH DOT REPRESENTS A PHOTOQUADRAT OF 1M².

See annex for Non-exhaustive list of species observed during the field survey at Zone 30

4.5.5 PROVIDENCE LAGUNA

To evaluate benthic habitat composition, georeferenced photoquadrats were utilized, representing approximately 1 m² of the seafloor per image. Data collection was conducted along snorkeling transects where a snorkeler or diver, towing a GPS device on a float, captured photoquadrat images every 2–4 m. Time synchronization between the camera and GPS allowed for precise geolocation of benthic images. This approach ensures high spatial accuracy, critical for detecting sensitive habitats like seagrass beds and coral patches.

The captured photoquadrat images were analyzed using CoralNet, a web-based solution designed for coral reef monitoring and analysis (Beijbom et al., 2015)². In each image, 50 random points were overlaid, and the benthic components under these points were classified into functional groups, including: Soft Substrate (e.g. Sand), Hard Substrate (e.g. Rock), Hard Coral (e.g. Porites), Macroalgae and Seagrass.

For biotic groups, identification was conducted at the genus level to determine the specific composition of the benthic community. A 100 meters buffer was applied to the provided reclamation Area to take into account the proximity of sensitive habitat

The methodology for benthic mapping involved the utilization of the NICFI Satellite Data Program's Basemaps for Tropical Forest Monitoring—Africa dataset. The NICFI basemaps, boasting a spatial resolution of 4.77 meters and comprising both RGB and infrared bands, served as the primary data source. Mapping activities were conducted on a single NICFI Basemap dated of August 2024. Pixel-based Analysis was performed using the Google Earth Engine (GEE) platform. Training dataset were derived from georeferenced photoquadrats to facilitate accurate classification. Mapping efforts focused on the shallow region spanning 0-10 meters.

4.5.6 BIODIVERSITY ASSESSMENT

During fieldwork, one team member recorded all observed taxa, with identification carried out to the lowest taxonomic level possible. A comprehensive species list and photo catalogue were compiled and are available in Annex 1 & 2.

² Beijbom, O., Edmunds, P. J., Roelfsema, C., Smith, J., Kline, D. I., Neal, B. P., ... & Kriegman, D. (2015). Towards automated annotation of benthic survey images: Variability of human experts and operational modes of automation. *PLoS one*, 10(7), e0130312.

4.5.7 RESULT

Semi Detailed Benthic Mapping

A total of 697 still images of the benthic area were analyzed. The structure of Providence Laguna corresponds to a shallow lagoon approximately 500 meters in length and 600 meters in width. At the lagoon's boundary, a fringing reef extends to depths of 12 to 15 meters (Figure below).

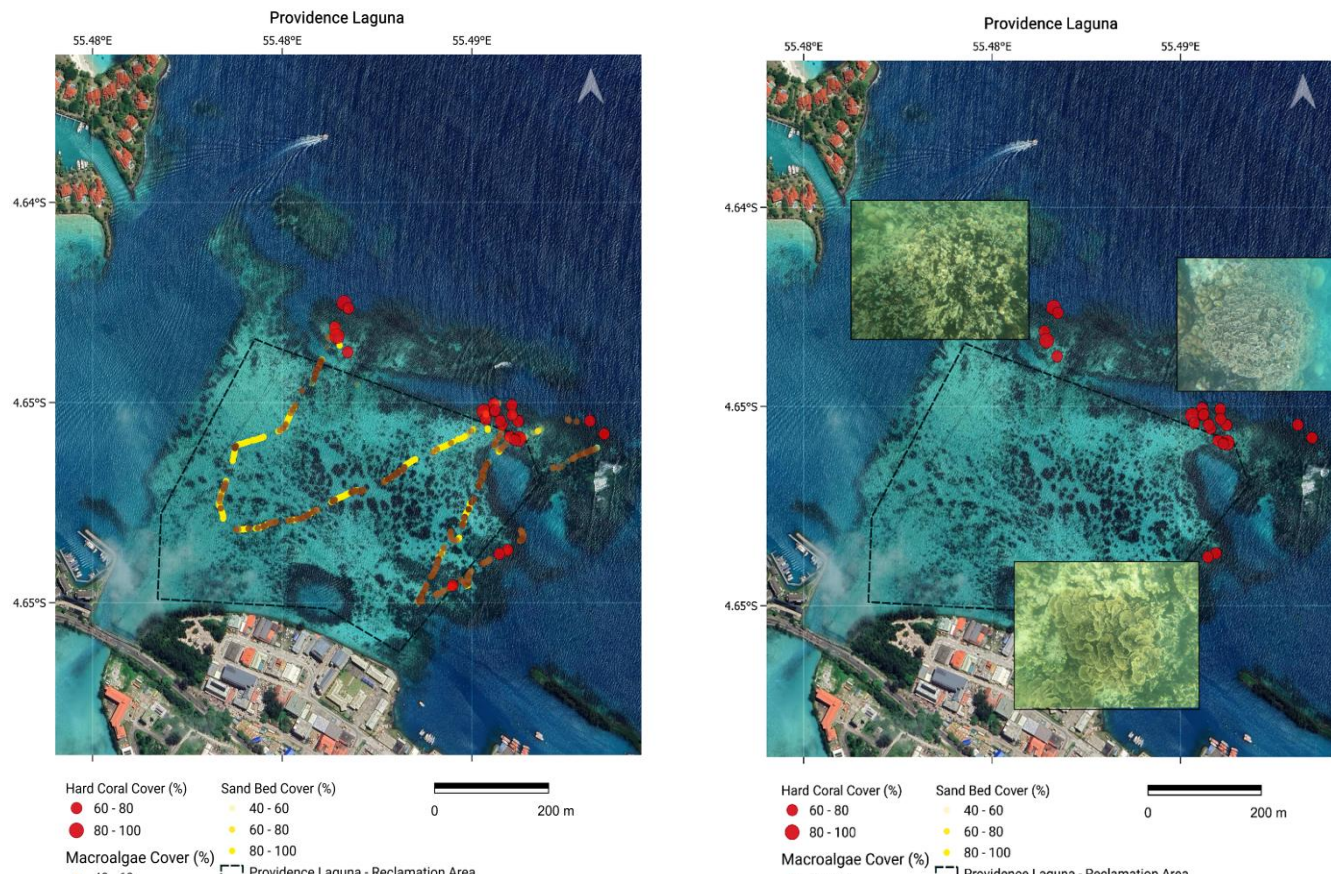


FIGURE 4.5.7_5: PERCENTAGE OF DOMINANT BENTHIC CLASS: HARD CORAL, MACROALGAE, OR SAND AT EACH SAMPLED IMAGE – EACH DOT REPRESENTS 1M² (LEFT); CORAL REEF HOTSPOT (RIGHT).

The marine survey and photoquadrat analysis indicate that the lagoon within the Providence Laguna Reclamation Area is dominated by a macroalgal meadow, with a significant proliferation of Macroalgae (*Sargassum sp.*). This species has overgrown nearly every coral boulder in the area, significantly reducing coral cover within the reclamation zone. The widespread dominance of *Sargassum* suggests an ecosystem shift toward algal overgrowth, likely driven by environmental factors such as nutrient enrichment, sedimentation, and reduced herbivory. The dense macroalgal cover outcompetes corals for space and light, inhibiting larval settlement and the recruitment of new coral colonies. Additionally, *Sargassum* meadows can alter local hydrodynamics by trapping sediments, further reducing light penetration and negatively impacting any remaining coral populations (Figure 4.5.7_6).

However, the fringing reef on the northern side of the area remains relatively healthy, featuring large and thriving colonies of branching corals (*Acropora sp.*). This reef is situated at the boundary of the reclamation activities and may require mitigation measures to minimize potential impacts. These include monitoring water quality, reducing sedimentation, and controlling macroalgal overgrowth through ecological restoration techniques.

The results of the marine survey reveal significant differences in benthic habitat composition between the proposed reclamation area and the surrounding 100-meter buffer zone. The estimated hard coral cover within the reclamation area is low, at only 6.1%, indicating degradation of coral communities). Macroalgae has become the dominant benthic component, covering 39.3% of the area, reflecting a possible ecological imbalance driven by increased sedimentation, nutrient influx, or reduced herbivory. The presence of hard substrate is significantly lower than in the buffer zone, at only 6.9%, limiting suitable attachment points for coral larvae and reef-associated species. Sand dominates the reclamation area, comprising 42.2% of the surveyed cover (Figure 4.5.7_7).

In contrast, the 100-meter buffer zone around the reclamation site show higher coral cover, recorded at 25.5%, indicating a relatively healthy presence of coral communities. However, a standard deviation of 19.94% suggests considerable variability across survey points, likely due to natural patchiness and micro-habitat differences. Macroalgae cover in this area stands at 26.1%, which is comparable to coral coverage and suggests competition between macroalgae and corals. Hard substrate accounts for 18.6% of the surveyed area, providing a stable surface for coral recruitment and other reef-associated organisms. Sand constitutes 9.8% of the cover, indicating that the area retains structural complexity, with reef structures being predominant over sediment-dominated environments (Figure 4.5.7_8).

While the reclamation process will not directly bury highly sensitive coral reef areas or other sensitive area, indirect impacts such as sediment plumes and increased turbidity could negatively affect the surrounding healthier reef ecosystems and adjacent MPA, Sainte Anne Marine National Park. These processes may lead to reduced light penetration, smothering of corals, and an overall decline in reef health beyond the immediate reclamation footprint. Given the encroaching impacts of reclamation activities, a coral relocation program could be implemented to preserve coral biodiversity and mitigate habitat loss. This would involve the careful removal of healthy coral colonies from impacted areas and

their transplantation to suitable recipient sites with stable substrates and optimal environmental conditions.

No seagrass meadows or individual seagrass plants were observed during sampling, indicating that macroalgae, rather than seagrasses, are the dominant benthic primary producers in the area. The absence of seagrass beds may be due to unsuitable substrate conditions, high sedimentation levels, or competition from macroalgae, which can prevent the establishment of seagrasses.

A band of mangrove forest exists behind Providence Bridge, approximately 200 meters from the reclamation activity (Figure 4.5.7_6).

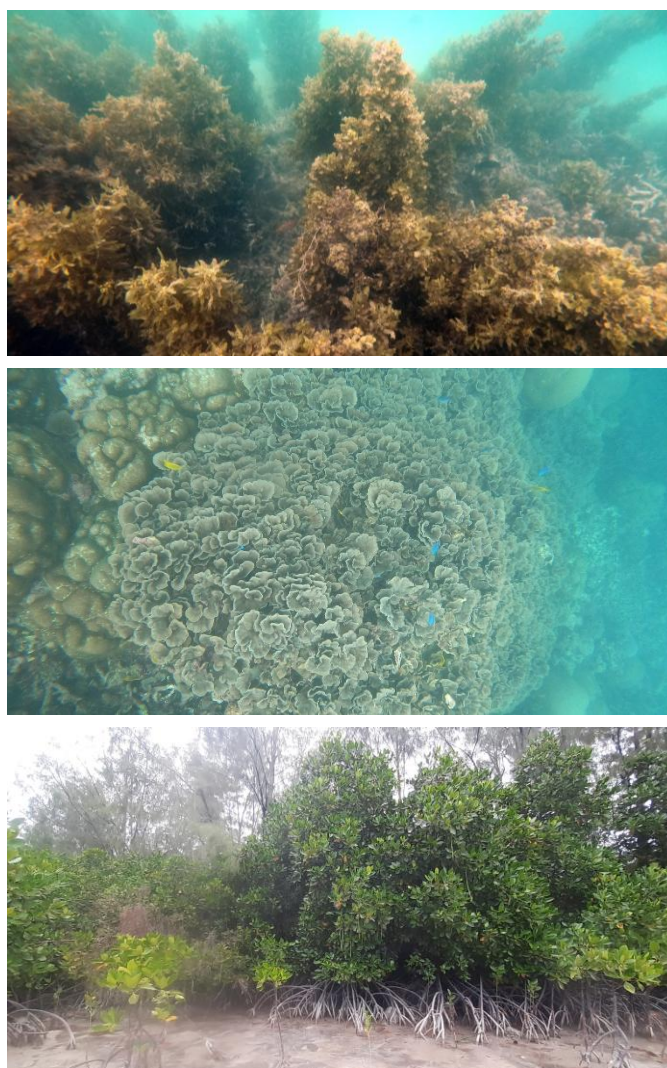


FIGURE 4.5.7_6: MACROALGAL MEADOWS DOMINATED BY SARGASSUM (TOP), HEALTHY *ECHINOPORA SP.* COLONIES IN THE CORAL REEF (MIDDLE), AND *RHIZOPHORA MUCRONATA* IN THE MANGROVE FOREST (BOTTOM) SURROUNDING THE PROVIDENCE LAGUNA RECLAMATION AREA.

Mean Benthic Cover (%)

	Hard Coral	Macroalgae	Hard substrate	Rubble	Sand
Reclamation area	6.1	39.3	6.9	2.8	42.2
100 m buffer - around reclamation	25.5	26.1	18.6	12.7	9.8

FIGURE 4.5.7_7: MEAN COVER (%) OF THE MAIN BENTHIC CLASS INSIDE AND OUTSIDE THE RECLAMATION AREA.

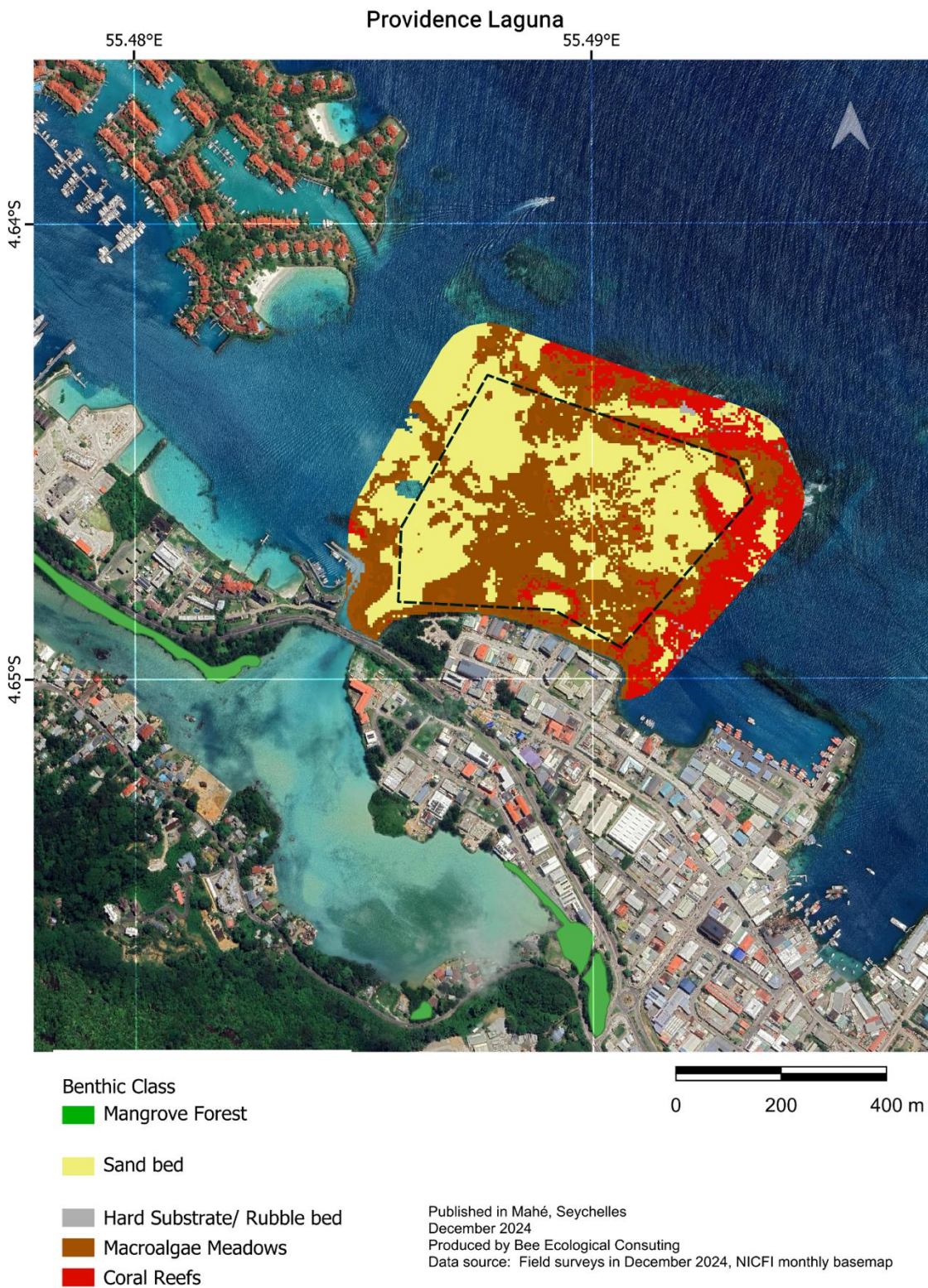


FIGURE 4.5.7_8: BENTHIC CLASS DISTRIBUTION AT THE PROPOSED PROVIDENCE LAGUNA RECLAMATION SITE (BLACK DASHED LINE) AND ITS SURROUNDING AREAS.

4.5.8 BIODIVERSITY ASSESSMENT

The biodiversity survey conducted at Providence Laguna revealed a total of 73 species spanning four major groups: corals, other invertebrates, macroalgae, and fish.

The coral community was diverse, with 14 genera identified across 9 families namely Acroporidae, Agariciidae, Euphylliidae, Faviidae, Fungiidae, Lobophylliidae, Merulinidae, Pocilloporidae, and Poritidae. Merulinidae was the most diverse family with 4 genera recorded namely Favites, Goniastrea, Platygyra and Echinopora. The latter composed of large beds spanning few meters across in certain area (Figure 19).

A total of 14 species of other invertebrates, from 9 class namely Asterozoa, Bivalvia, Demospongia, Echinozoa, Gastropoda, Hexacorallia, Holothurozoa, Polychaeta, and Thecostraca. The class Holothurozoa and Gastropoda was the most divers with 3 species observe for each. This consist of *Holothuria atra*, *Stichopus chloronotus*, *Stichopus sp.*, *Conus sp.*, *Cypraea tigris*, and *Littoraria sp.* (Figure 20).

Macroalgae were well-represented, with 6 species recorded from 3 families. This included Halimedaceae with 3 species namely *Chlorodesmis fastigia*, *Halimeda maculosa* and *Halimeda sp.* indet. 1. This is followed by Sargassaceae with two genera represent: *Sargassum sp.* and *Turbinaria sp.* and lastly Dictyotaceae represent by *Padina sp.* (Figure 21).

Lastly, the survey recorded a total of 38 species of Teleostei from 20 different families was recorded. Chaetodontidae (Butterflyfish) was the most divers family observed with 6 different species recorded. This was followed by Labridae (Wrass) with 4 different species. Other families represented with several species included Acanthuridae, Pomacentridae, Epinephelidae, Holocentridae, Siganidae and Lethrinidae. Families represented by only one species includes Scaridae, Zanclidae, Sphyrnidae, Carangidae, Haemulidae, Monacanthidae, Apogonidae, Mullidae, Synodontidae, Nemipteridae, Ehippididae, Pomacanthidae. Additionally, 1 species of Elasmobranchii namely Dasyatidae (Stingray; *Pastinachus sp.* was recorded.

Twenty-eight species recorded are listed in the IUCN Red list (Table 5). This includes one species of Butterflyfish (*Chaetodon trifascialis*) is classified as Near Threatened (NT), two species namely the Broad Cowtail Stingray (*Pastinachus ater*), the Harlequin filefish (*Oxymonacanthus longirostris*), are listed as Vulnerable (VU). Twenty-three Teleostei from the following families Acanthuridae, Chaetodontidae, Nemipteridae, Pomacanthidae, Siganidae, Zanclidae, Ehippididae, Sphyrnidae, Carangidae, Haemulidae, Labridae, Lethrinidae, Holocentridae, Apogonidae, Mullidae, Pomacentridae, Holothuriidae, Stichopodidae, and two sea cucumbers namely the lollyfish (*Holothuria atra*) and the greenfish sea cucumber (*Stichopus chloronotus*) are listed as Least Concern (LC). No species from the data deficient category has been recorded

(See annex for List of species observed at Providence Laguna)

4.5.9 RISK AND IMPACT ASSESSMENT

The reclamation project presents several environmental risks, primarily associated with habitat alteration, sediment deposition, and water quality degradation. While the direct burial of highly sensitive ecosystem including coral reef habitats or seagrass meadows is not anticipated, indirect impacts such as sediment plumes and increased turbidity pose significant risks to the surrounding marine ecosystem and MPA. Elevated sedimentation levels may lead to reduced light penetration, affecting primary production and coral photosynthesis. Prolonged exposure to sediment-laden waters could result in coral stress, bleaching, and eventual mortality, particularly in areas with high coral cover in the buffer zone. Furthermore, sediment resuspension caused by dredging and reclamation activities can have cascading effects, extending beyond the immediate project footprint and affecting adjacent reef systems.

4.5.10 MITIGATION MEASURES

To minimize environmental degradation and facilitate ecosystem recovery, several mitigation strategies are proposed including:

1. **Sediment Control and Turbidity Management:** Silt curtains and turbidity barriers should be deployed around the reclamation site to reduce sediment dispersion and limit the spread of plumes into nearby coral reefs. Regular turbidity monitoring should be conducted to ensure compliance with water quality thresholds. (See section 4.5.10.1 concerning revised scope to the reclamation)
2. **Coral Translocation and Artificial Reef Structures:** In areas where coral loss is inevitable, transplantation of viable coral colonies to nearby reefs should be undertaken to preserve genetic diversity and enhance reef resilience (Figure 4.5.7_9). Additionally, artificial reef structures can be introduced to provide new settlement areas for coral recruitment and associated marine species.
3. **Water Quality and Habitat Monitoring:** A long-term monitoring program should be established to track changes in water quality, coral health, and sediment deposition. This will allow for adaptive management responses if unexpected impacts occur.

By integrating these mitigation measures, the potential negative impacts of the reclamation project can be significantly reduced, ensuring the long-term sustainability of the surrounding marine ecosystem. Continuous environmental monitoring and adaptive management strategies will be essential in safeguarding biodiversity and supporting ecosystem resilience in the affected areas.



The Coral relocation/Restoration would prioritize species with high survival rates and adaptability, ensuring their continued ecological function.

**FIGURE 4.5.7_9:
ACROPORA COLONIES
IDENTIFIED ON THE
NORTHERN SIDE OF THE
RECLAMATION AREA FOR
POTENTIAL CORAL
RELOCATION EFFORTS.**

Prior to relocation, a detailed site assessment should be conducted to identify viable donor and recipient sites, considering factors such as water quality, depth, substrate stability, and hydrodynamic conditions. The relocation process should follow best practices, including:

- Pre-relocation monitoring to assess coral health and environmental conditions.
- Selection of recipient sites that provide favorable conditions for long-term coral survival (e.g. Sainte Anne Marine National Park)
- Use of artificial structures such as coral nurseries or stabilization frames to enhance survival and acclimatization.
- Implementation of monitoring programs to track survival rates, growth, and overall ecosystem integration.

By integrating coral relocation with broader conservation efforts, including sediment control measures and water quality management, the reclamation project can help minimize ecological degradation while supporting long-term reef resilience.

4.5.10.1 REVISION OF RECLAMATION SCOPE

Following the results of the semi-detailed benthic habitat mapping and associated environmental sensitivity analysis, the reclamation footprint for the Providence Laguna project was revised in 2025.

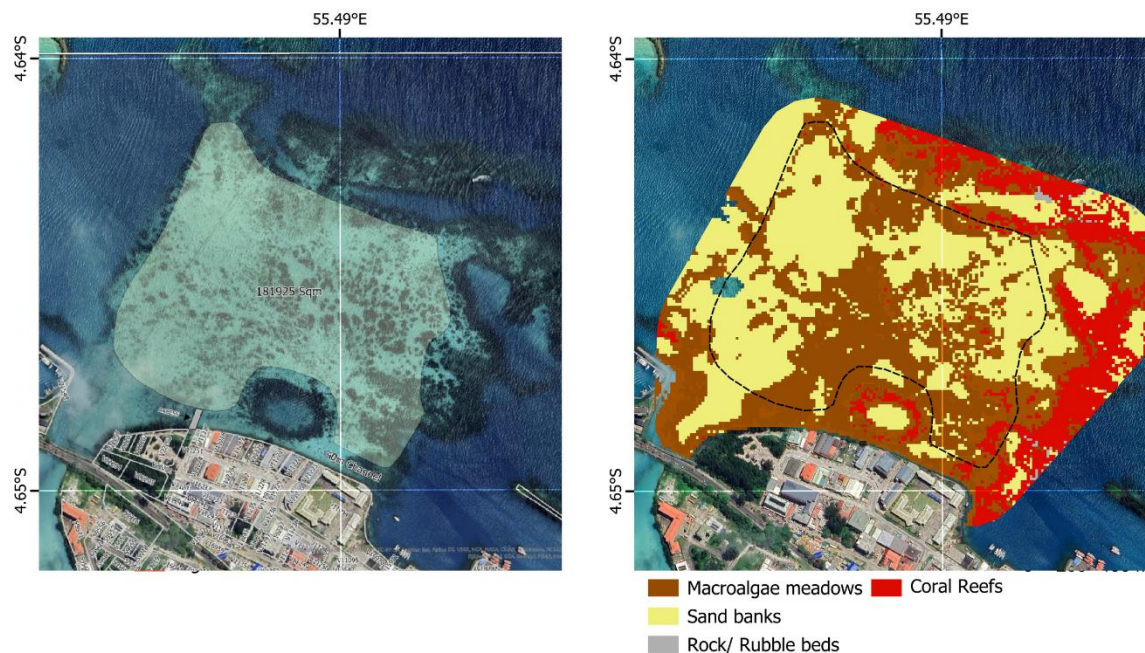


Figure 4.5.10.1_1: Comparison of the revised reclamation footprint and benthic habitat composition at Providence Lagoon. *Left panel:* Revised reclamation boundary (light green polygon) totaling approximately 181,925 m², showing exclusion of ecologically sensitive reef areas. *Right panel:* Benthic habitat classification map overlaid with the revised reclamation footprint (black dashed line), highlighting areas of coral reefs (red), macroalgal meadows (brown), sand banks (yellow), and rubble beds (grey). The revised footprint now avoids direct overlap with high-value coral habitats, aligning reclamation activities with less sensitive sand and macroalgal-dominated zones.

The updated boundary reflects a strategic reduction in spatial extent, particularly on the eastern and northeastern periphery, where coral reef habitats were previously at risk. The key modifications are outlined below:

1. **Avoidance of Coral Reef Areas:** The revised footprint now excludes most of the benthic zones classified as coral reefs (as indicated by the red polygons in previous habitat maps). These ecologically valuable areas have been preserved outside the active reclamation boundary.
2. **Concentration on Lower-Sensitivity Habitats:** The adjusted reclamation area now primarily overlaps with sandbanks and macroalgal-dominated rubble beds. These habitats are considered of lower conservation value compared to the previously included coral-rich areas.

Updated Risk Profile and Revised Mitigation Strategy

The table below provides a comparative overview of the key environmental risks before and after the revision of the reclamation footprint:

Impact Parameter	Original Assessment	Updated Assessment (Revised Scope)
Direct Coral Loss	Moderate–High (6.1% coral cover within footprint, including viable colonies)	Low – Coral habitats now excluded from direct reclamation activities
Macroalgal Dominance	High – indicative of ecological imbalance and reduced coral recovery potential	Moderate – Dominance remains, but fewer critical areas now impacted
Sediment Plume Impact	High – potential for downstream reef smothering, especially northeast of footprint	Moderate – Reduced footprint expected to lower plume dispersal potential
Seagrass Habitat	Absent	No Change
Mangrove Proximity	~200 m from reclamation site	No Change

Table 4.5.10.1_1

The existing mitigation framework remains largely valid and applicable but can now be refined and scaled based on the reduced environmental risk:

Sediment and Water Quality Management: Silt curtain deployment should now be concentrated along the northern and central bund edges, with less intensive control required in the east.

Coral Relocation: Coral translocation is no longer a core mitigation requirement within the revised reclamation footprint. However, coral buffer monitoring and optional relocation may still be warranted if sediment dispersal models or water quality exceedance indicates risk to reefs just outside the footprint (north and northeast edge).

4.5.11 ILE AURORE

4.5.12 BENTHIC MARINE MAPPING

To evaluate benthic habitat composition, georeferenced photoquadrats were utilized, representing approximately 1 m² of the seafloor per image. Data collection was conducted along snorkeling transects where a snorkeler or diver, towing a GPS device on a float, captured photoquadrat images every 2–4 m. Time synchronization between the camera and GPS allowed for precise geolocation of benthic images. This approach ensures high spatial accuracy, critical for detecting sensitive habitats like seagrass beds and coral patches.

The captured photoquadrat images were analyzed using CoralNet, a web-based solution designed for coral reef monitoring and analysis (Beijbom et al., 2015³). In each image, 50 random points were overlaid, and the benthic components under these points were classified into functional groups, including: Soft Substrate (e.g. Sand), Hard Substrate (e.g. Rock), Hard Coral (e.g. Porites), Macroalgae and Seagrass.

For biotic groups, identification was conducted at the genus level to determine the specific composition of the benthic community.

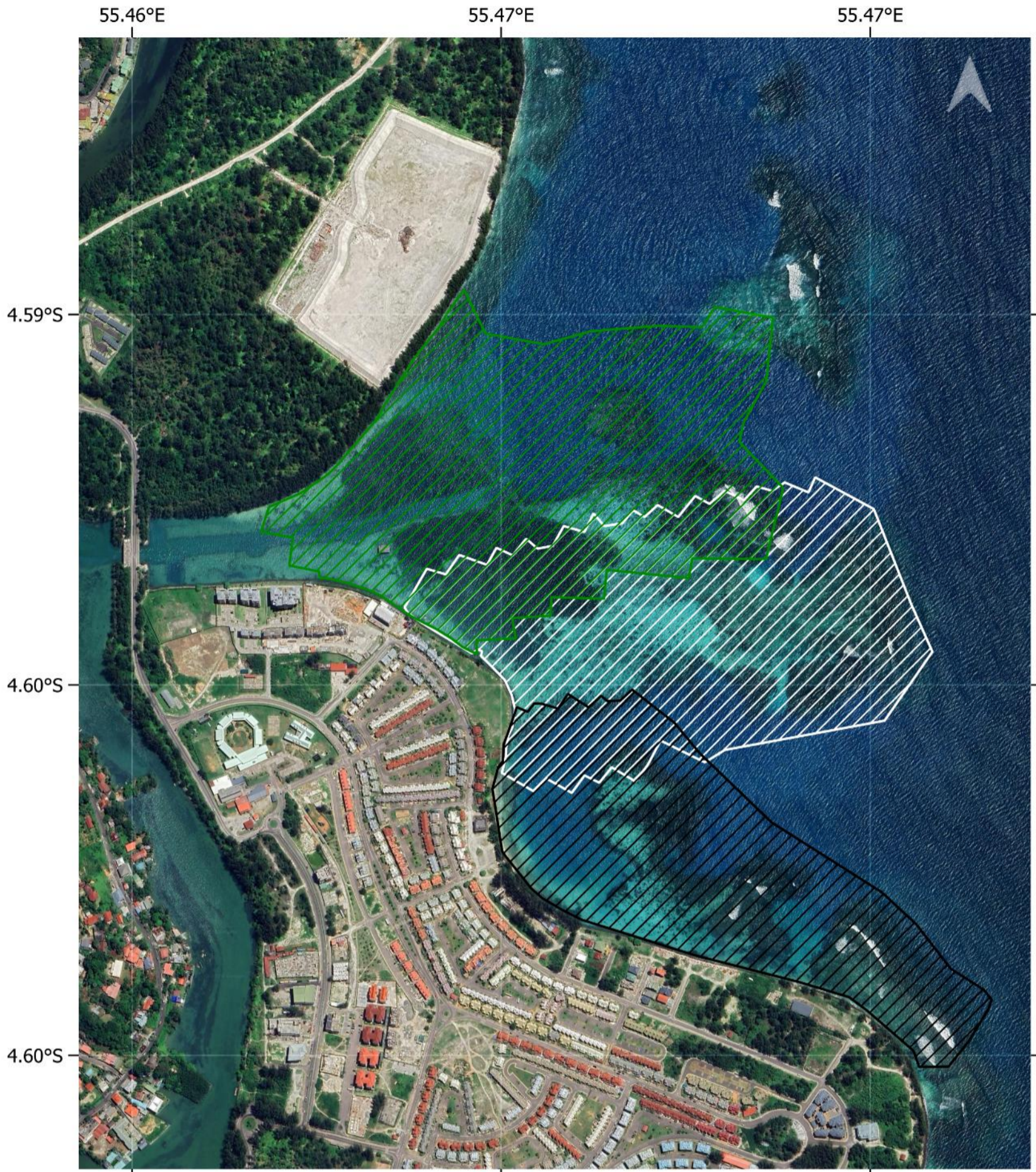
4.5.13 AERIAL IMAGERY

Aerial imagery was collected using an Unmanned Aerial Vehicle (UAV) to complement in-water assessments by providing extensive spatial coverage of the reclamation area. The DJI Mavic 2 Pro drone was deployed, operating at a flight altitude of 90 m above the water surface. High-resolution (2.34 cm per pixel) true-color (RGB) imagery was captured with 80% sidelap and frontlap to ensure seamless image stitching. The drone's flight speed was set at a maximum of 15 m/s to optimize data quality. The study covered a total area of 67.05 hectares across three predefined grids (Table 4.5.13_1; Figure 4.5.13_10)

TABLE 4.5.13_1: GRID-BASED AREA COVERAGE (HECTARES) FOR THE DRONE MAPPING OF THE AUREORE RECLAMATION AREA.

Grid	Area (Ha)
1	23.51
2	25.47
3	18.07
Total	67.05

³ Beijbom, O., Edmunds, P. J., Roelfsema, C., Smith, J., Kline, D. I., Neal, B. P., ... & Kriegman, D. (2015). Towards automated annotation of benthic survey images: Variability of human experts and operational modes of automation. *PloS one*, 10(7), e0130312.



- Grid 1
-  Grid 2
-  Grid 3



Published in Mahé, Seychelles
December 2024
Produced by Bee Ecological Consulting
Data source: Field surveys in December 2024, NICFI monthly basemap



FIGURE 4.5.13_10: UAV FLIGHT GRID FOR AURORE RECLAMATION MAPPING AND SPATIAL ANALYSIS.

A total of 999 aerial images were captured. After pre-processing, these images were uploaded into Google Earth Engine following methods described by Bennett et al. (2020)⁴. Benthic classification was performed using six benthic categories: Seagrass meadow, Rock/dead coral bed, Sand bed, Photic coral reefs and Macroalgae meadows (Figure 4.5.13_11). A specific distinction was made for *Enhalus Acoroides* seagrass due to its ecological and socio-cultural significance. The rock/dead coral bed class also included epilithic algae matrix and rubble bed. This classification modified from IUCN (Keith et al. 2022)⁵, provided critical spatial insights into substrate distribution and habitat composition, essential for identifying ecologically sensitive zones within the reclamation area.

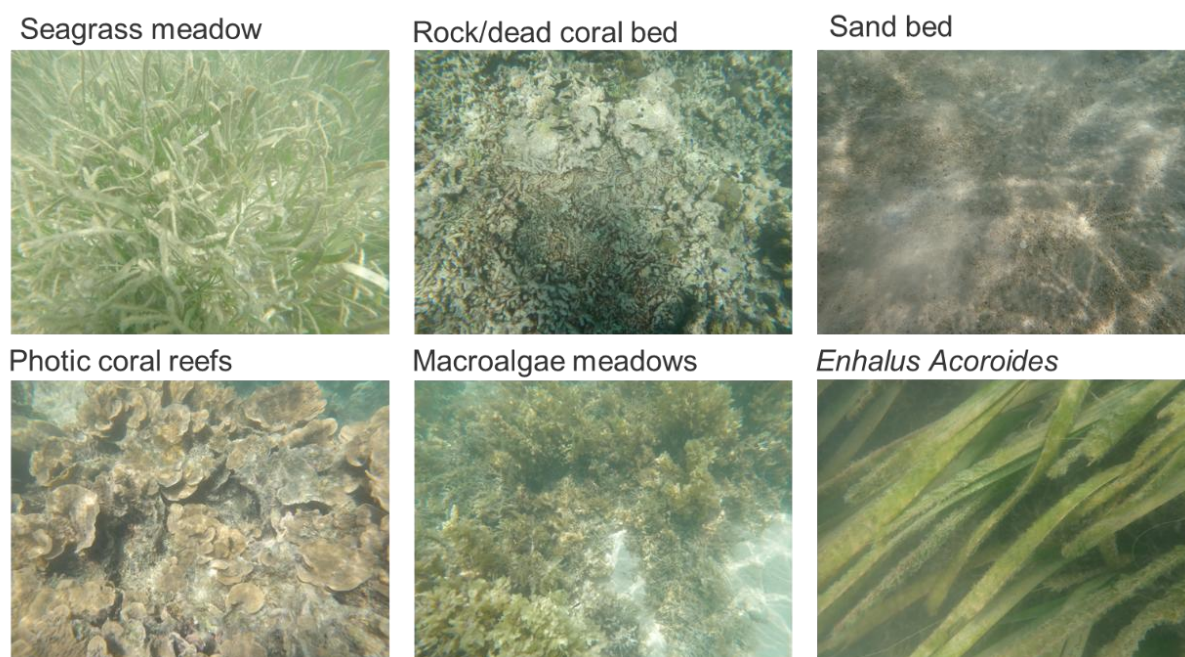


FIGURE 4.5.13_11: BIOTIC AND ABIOTIC FUNCTIONAL GROUP

4.5.14 BUFFER ZONE ANALYSIS

To evaluate the potential impacts of reclamation activities on the surrounding sensitive benthic habitats, a series of buffer zones were created around the reclamation polygon provided. The analysis began with the delineation of the reclamation footprint based on project plans. Using GIS software, incremental buffer zones were established at distances of 25 m, 50 m, and 250 m from the polygon representing the reclamation footprint. These zones were designed to capture the spatial extent of potential effects such as sediment dispersal, habitat alteration, or hydrodynamic changes.

The benthic habitat mapping data, generated through photoquadrat analysis and UAV imagery, was then integrated with the buffer zones. Within each buffer, the coverage of key sensitive habitats was

⁴ Bennett, M. K., Younes, N., & Joyce, K. (2020). Automating drone image processing to map coral reef substrates using google earth engine. *Drones*, 4(3), 50

⁵ Keith, D. A., Ferrer-Paris, J. R., Nicholson, E., Bishop, M. J., Polidoro, B. A., Ramirez-Llodra, E., ... & Kingsford, R. T. (2022). A function-based typology for Earth's ecosystems. *Nature*, 610(7932), 513-518.

quantified. Spatial analysis tools were employed to calculate the total area occupied by each habitat type within the buffers.

The incremental distances of the buffers allowed for a tiered assessment, with the 25 m and 50 m zones focusing on immediate and localized impacts, while the 250 m zone provided insights into broader ecological influences. This approach ensured a comprehensive understanding of how reclamation activities might interact with sensitive marine environments at varying scales. The results of this analysis serve as a foundation for impact assessment and mitigation planning, directly supporting the objectives of the EIA.

4.5.15 ECOLOGICAL SENSITIVITY ANALYSIS

This analysis evaluates the ecological sensitivity of the Region of Interest (ROI) by integrating habitat classifications and the spatial extent of Marine Protected Areas (MPAs). A binary mask of MPAs was generated to delineate protected regions and ensure precise spatial integration of habitat classifications with conservation boundaries.

Sensitivity levels were determined based on ecological significance and conservation status, as outlined below:

- Extreme Sensitivity (Red): Coral Reef and Seagrass habitats located within MPAs, due to their critical biodiversity and ecosystem services under existing protection measures.
- High Sensitivity (Orange): Coral Reef and Seagrass habitats located outside MPAs, reflecting high ecological value without formal protection
- Medium Sensitivity (Yellow-Orange): Other Habitat and ecosystem within an MPA
- Low Sensitivity: Lower ecological importance within the ROI.

4.5.16 BIODIVERSITY ASSESSMENT

During fieldwork, one team member recorded all observed taxa, with identification carried out to the lowest taxonomic level possible. A comprehensive species list and photo catalogue were compiled and are available in Annex 1 & 2.

Fish Community

The belt transect method was employed to record fish within a 250 m² transect area. A 50 m transect line was deployed, and the observer visually counted all fish within a 5 m wide belt along the transect (Samoilys and Carlos, 2000). All observed species were identified to the family level or lower to document fish biodiversity and size class were estimated in 10 cm class intervals. Transect were laid in the Seagrass meadow and Coral Reefs habitat. A total area of 2000 m² was surveyed.

4.5.17 INVERTEBRATE COMMUNITY

The abundance of key invertebrates was estimated using belt transects (Hill and Wilkinson, 2004)⁶. Eight 50 m transect was laid within the study zone of which four were randomly placed in the inner seagrass zone and four in the outer reef area. The observer used a systematic 'S' bend swimming patterns and recorded all macro and cryptic invertebrate species observed within 1 m either side of the transects.

4.5.18 ENVIRONMENTAL DESCRIPTION

4.5.19 MARINE ECOSYSTEM STRUCTURE

The 18 Ha reclamation area is dominated by rock and dead coral reefs following by a Seagrass meadow. High sensitive area represent 5.73 Ha or 32% of the total reclamation (Table 4.5.19_2; Figure 4.5.19_12).

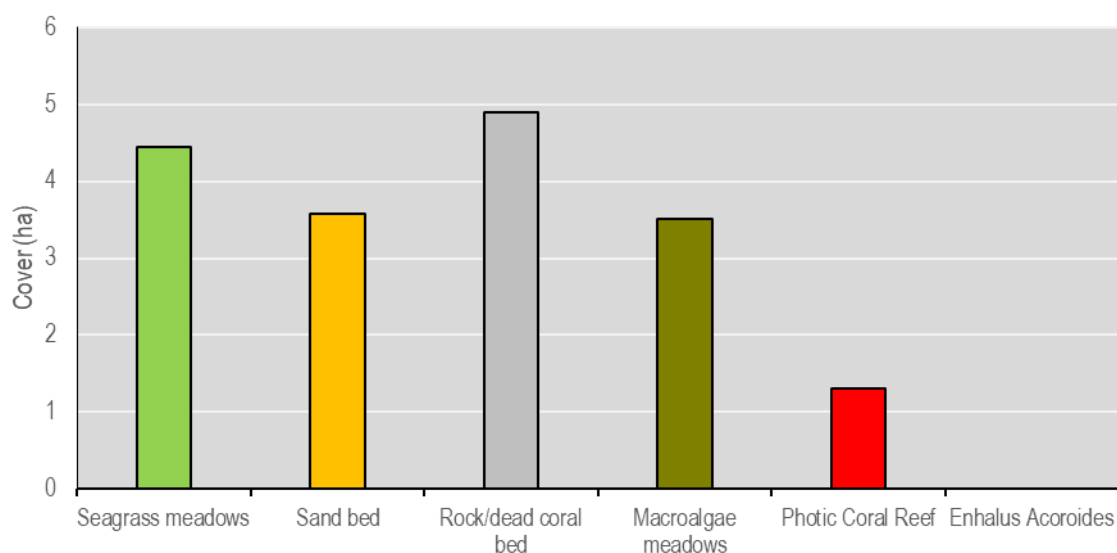


FIGURE 4.5.19_12: ECOSYSTEM DISTRIBUTION IN HECTARES WITHIN THE RECLAMATION AREA

The buffer zone analysis revealed a gradient of habitat coverage across the reclamation polygon and the surrounding buffer zones at 25 m, 50 m, and 250 m. The results provide critical insights into the distribution and extent of sensitive benthic habitats relative to the reclamation activities.

TABLE 4.5.19_2: SPATIAL DISTRIBUTION OF BENTHIC HABITAT TYPES WITHIN THE RECLAMATION ZONE AND SURROUNDING BUFFER AREAS

Habitat type	Reclamation (Ha)	Buffer 25 m (Ha)	Buffer 50 m (Ha)	Buffer 250 m (Ha)
Seagrass meadows	4.443	5.344	6.071	6.705
Sand bed	3.579	5.149	7.520	20.883

⁶ Hill, J., & Wilkinson, C. (2004). Methods for ecological monitoring of coral reefs. Australian Institute of Marine Science, Townsville, 117.

Rock/dead coral bed	4.898	5.367	5.835	7.714
Macroalgae meadows	3.512	4.034	4.386	6.168
Photic Coral Reef	1.309	2.655	3.620	7.556
<i>Enhalus Acoroides</i>	0.000	0.000	0.008	0.081
Grand Total	17.741	22.549	27.440	49.107

4.5.20 SEAGRASS MEADOWS

Seagrass meadows were most concentrated within the reclamation polygon, occupying 4.4 hectares. This coverage increased progressively in the 25 m buffer (5.3 ha), 50 m buffer (6.0 ha), and peaked at 6.7 hectares within the 250 m buffer. The gradual increase in coverage with buffer distance suggests that seagrass habitats extend beyond the direct reclamation site, but remain highly vulnerable to sedimentation and hydrodynamic changes resulting from reclamation activities. The mean seagrass cover is 77% (Figure 5.5.20_13) in the area. A total of four seagrass species were identified in the survey:

1. *Syringodium isoetifolium*
2. *Thalassia hemprichii*
3. *Halophila sp.* (newly recorded)
4. Patchy distributions of *Enhalus acoroides*

This represents a shift in species composition from the 2010 ESAI, which recorded only two dominant species (*Thalassia hemprichii* and *Syringodium isoetifolium*), along with scarce and localized presence of *Enhalus acoroides*. Our survey documents the first observation of *Halophila sp.*, expanding the recorded species richness.

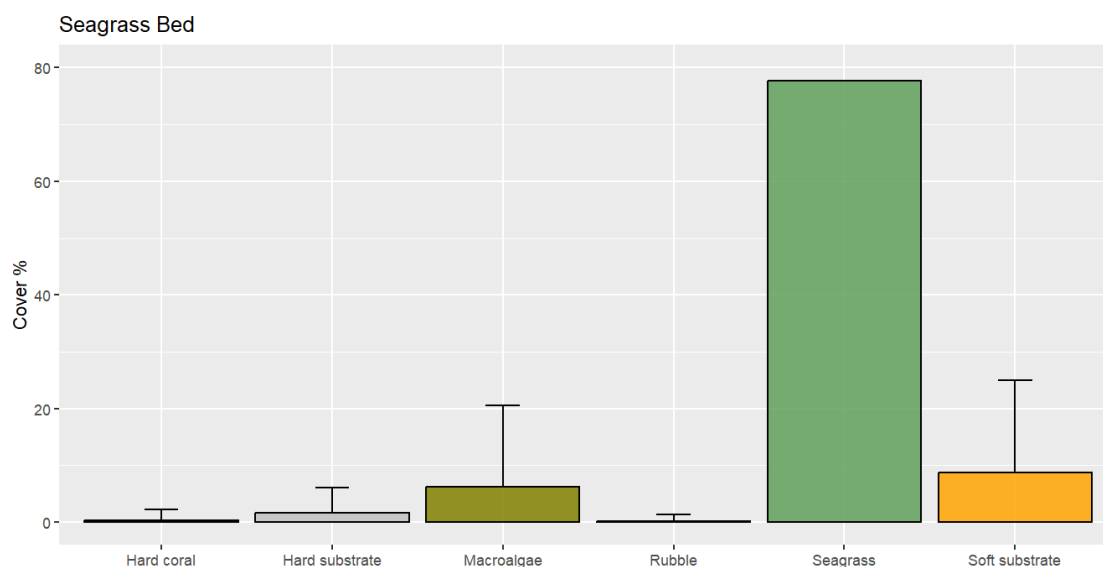


FIGURE 5.5.20_13: MEAN COVER (+ SD) OF SUBSTRATE IN SEAGRASS BED

ENHALUS ACOROIDES

Tape seagrass (*Enhalus acoroides*) was absent within the reclamation site and the 25 m buffer but appeared in trace amounts (0.008 ha) within the 50 m buffer and increased slightly to 0.081 hectares in the 250 m buffer. Although small in coverage, the presence of this species underscores the need for careful impact assessments, given its ecological significance as a primary producer.

Enhalus acoroides remains highly vulnerable due to its restricted distribution. The species was recorded only in localized patches, primarily in the western section of the reclamation area, particularly near the northern section of the fisherman's channel (**Error! Reference source not found.**; Figure 14.). Given its low abundance and limited coverage (0.081 ha in the 250m buffer), *Enhalus acoroides* requires careful monitoring to assess potential impacts from sediment deposition and altered water dynamics.

4.5.21 SAND BEDS

Sand beds dominate the broader area surrounding the reclamation site, indicating extensive sediment distribution in the vicinity. A progressive increase in sand bed coverage is observed with buffer distance, expanding from 3.6 hectares within the reclamation polygon to 5.1 hectares in the 25 m buffer, 7.5 hectares in the 50 m buffer, and reaching 20.9 hectares in the 250 m buffer.

The significant increase in sand coverage at greater buffer distances suggests active sediment mobilization, likely influenced by reclamation activities, hydrodynamic forces, and natural transport processes. This pattern raises concerns about potential sediment redistribution beyond the immediate project area, which could impact adjacent seagrass meadows, coral reef habitats, and overall benthic stability.

4.5.22 ROCK/DEAD CORALS

Rock and dead coral beds were relatively evenly distributed across the reclamation area and its surrounding buffers, covering 4.898 hectares within the reclamation polygon. Their coverage gradually increased with buffer distance, expanding to 5.367 hectares in the 25 m buffer, 5.835 hectares in the 50 m buffer, and reaching 7.714 hectares in the 250 m buffer.

4.5.23 MACROALGAE MEADOWS

Macroalgae meadows covered 3.5 hectares within the reclamation site, with a gradual increase in coverage across buffer zones, expanding to 4.0 hectares in the 25 m buffer, 4.4 hectares in the 50 m buffer, and reaching 6.2 hectares in the 250 m buffer. This trend suggests a widespread and dispersed distribution of macroalgal habitats in the surrounding marine environment.

It is important to note that macroalgae coverage has expanded significantly since 2010, a change that is notably associated with the shift from shallow-water coral reefs observed over the past decade. The

increase in macroalgae may be linked to coral reef degradation, sedimentation effects, and changes in water quality, which favor algal growth over coral recruitment.

4.5.24 PHOTIC CORAL REEFS

Within the reclamation area, coral reefs occupied 1.3 hectares, with coverage gradually increasing in the surrounding buffers to 2.7 hectares in the 25 m buffer, 3.6 hectares in the 50 m buffer, and reaching 7.6 hectares in the 250 m buffer. This distribution highlights the importance of coral habitats in the broader marine landscape and suggests that coral ecosystems are more extensive beyond the immediate reclamation site.

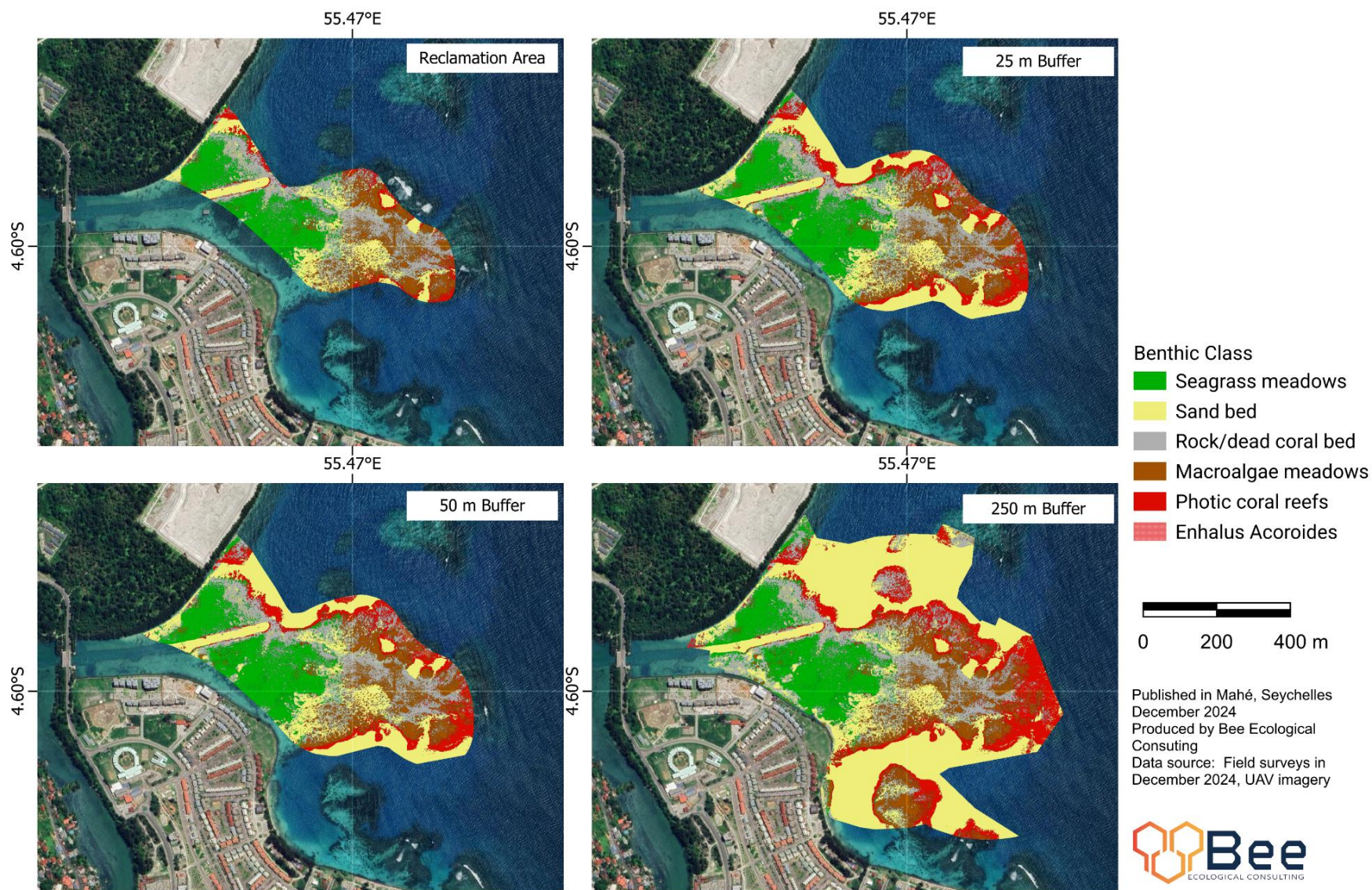
The mean live coral cover is 19% (Figure 15,) with dominance by *Porites* sp., a stress-tolerant genus that is often resilient to environmental fluctuations. However, branching corals, particularly *Acropora* sp., exhibited high cover and healthy colonies in the northern part of the reclamation area. This coral assemblage composition and live cover values are consistent with the findings from the 2010 ESAI and the 2023 Rapid Marine Survey, indicating relative stability in coral community structure despite environmental stressors.

Although some coral colonies remain healthy and thriving, the site has undergone significant ecological changes, characterized by increased coral rubble and macroalgal proliferation (e.g., *Turbinaria* sp.). This observation suggests a potential regime shift, likely influenced by the cumulative impact of the last two mass bleaching events and local reef stressor. The dominance of macroalgae and dead coral substrates may indicate declining reef resilience and reduced coral recruitment, a trend that has been observed in other reefs affected by repeated thermal stress events in Seychelles.

4.5.25 MANGROVE FOREST

The closest mangrove forests to the reclamation area are located near Anse Etoile Primary School in the north and near the Paradis de enfant to the south. Both sites are sheltered by the existing reclaimed islands namely Aurore and Perseverance.

Buffer Zone Analysis



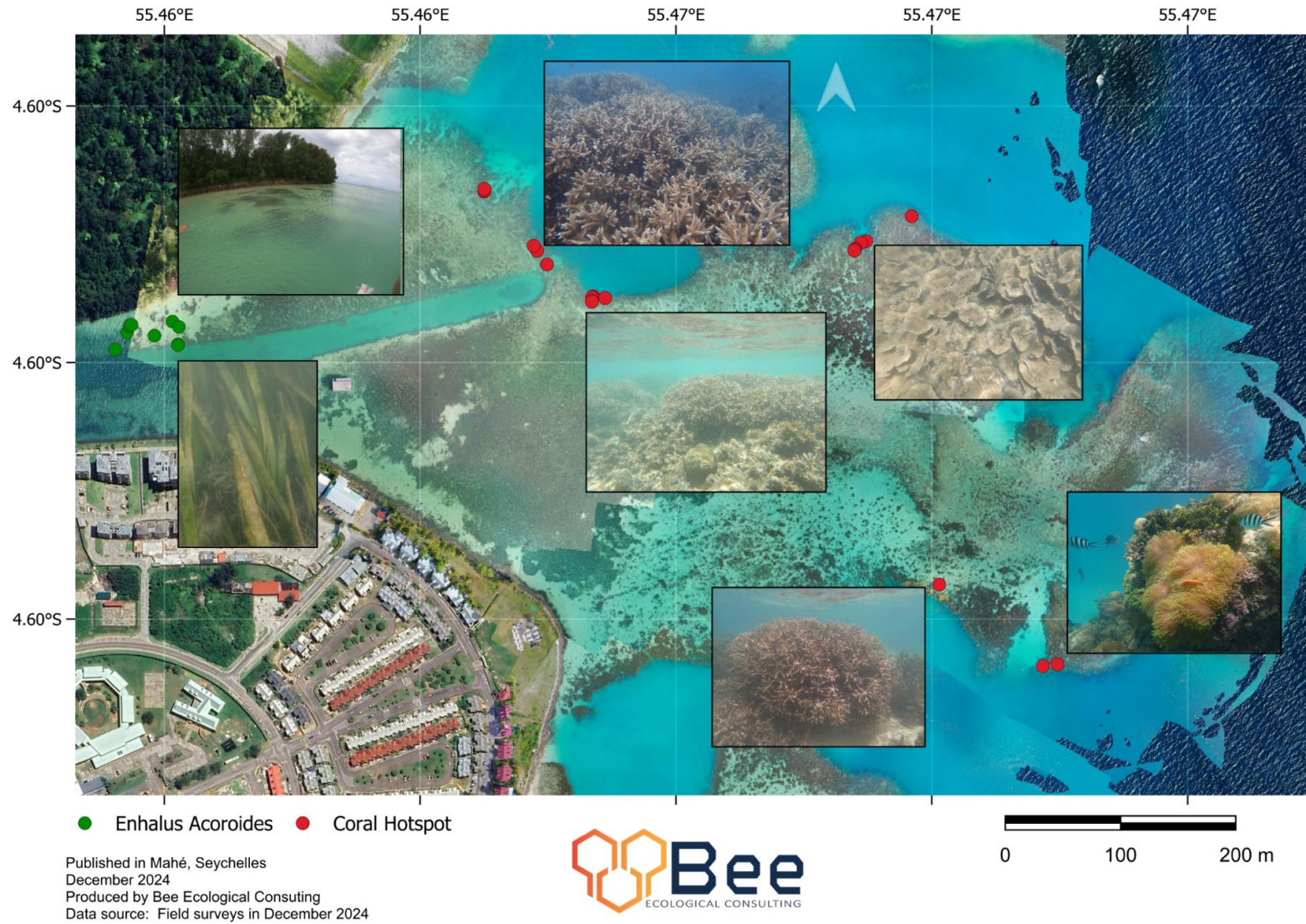


FIGURE 14: GEOLOCALISATION OF CORAL HOTSPOT AND ENHALUS ACOROIDES PATCHES

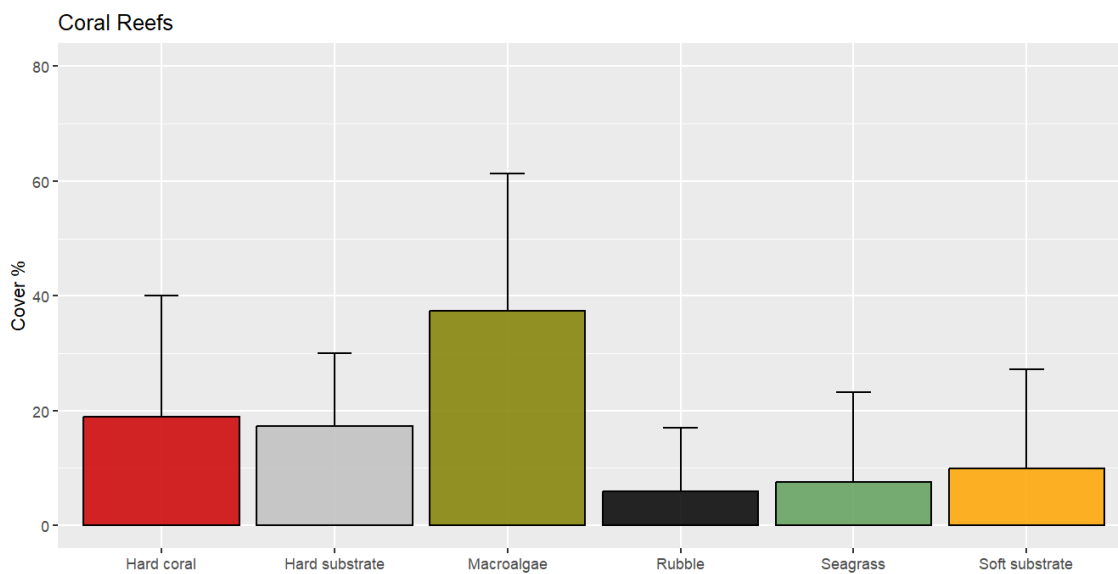


FIGURE 15: MEAN COVER (+SD) OF SUBSTRATE IN CORAL REEFS

4.5.26 SENSITIVITY ANALYSIS

As part of the environmental impact assessment for the proposed 18-hectare reclamation near Ile Aurore, a sensitivity analysis was conducted to identify and evaluate the ecological significance of surrounding marine habitats. This analysis reveals critical distinctions between habitats in terms of their ecological importance and conservation needs, categorized into four levels of sensitivity: extreme, high, medium, and low (4.5.26_1). The findings are summarized below, along with an assessment of potential impacts and recommendations for mitigation.

Extreme Sensitivity Areas (Red)

Coral reefs and seagrass beds within Marine Protected Areas (MPAs) are concentrated to the east of Ile Aurore and around nearby offshore islands at a distance of 2600 meters from reclamation activities. These habitats are biodiversity hotspots, hosting a high diversity of marine life and serving as essential nurseries for juvenile fish and invertebrates. In addition to supporting fisheries productivity, they provide critical ecosystem services, such as coastal protection against wave energy and carbon sequestration. Their ecological importance and legal protection under MPAs make them highly sensitive to environmental disturbances, such as sedimentation and water quality degradation.

High Sensitivity Areas (Orange)

Coral reefs and seagrass beds outside MPAs are located in the nearshore zones adjacent to the proposed reclamation site. 14.2 hectares of sensitive habitat are in the 250 m buffer zone of the reclamation areas. These habitats are ecologically significant, contributing to fisheries productivity, marine biodiversity, and essential ecosystem services. Activities such as dredging and runoff from reclamation could result in sedimentation and reduced water quality, posing significant threats to these habitats.

Medium Sensitivity Areas (Yellow-Orange)

Sandy bottoms and other non-coral habitats within MPAs are present near the project site. While less complex than coral reefs or seagrass beds, these habitats play an important role in maintaining sediment stability and supporting benthic organisms. Their sensitivity stems from their location within MPAs, though their biodiversity and ecological functions are comparatively lower.

Low Sensitivity Areas (Yellow)

Sandy and macroalgae-dominated zones are primarily found outside MPAs and further from the immediate vicinity of the reclamation site. These areas have lower ecological significance, offering basic ecosystem functions such as sediment dynamics and nutrient cycling. While they are less sensitive to disturbances, their loss could still indirectly affect nearby sensitive habitats through altered hydrodynamics and sediment transport.

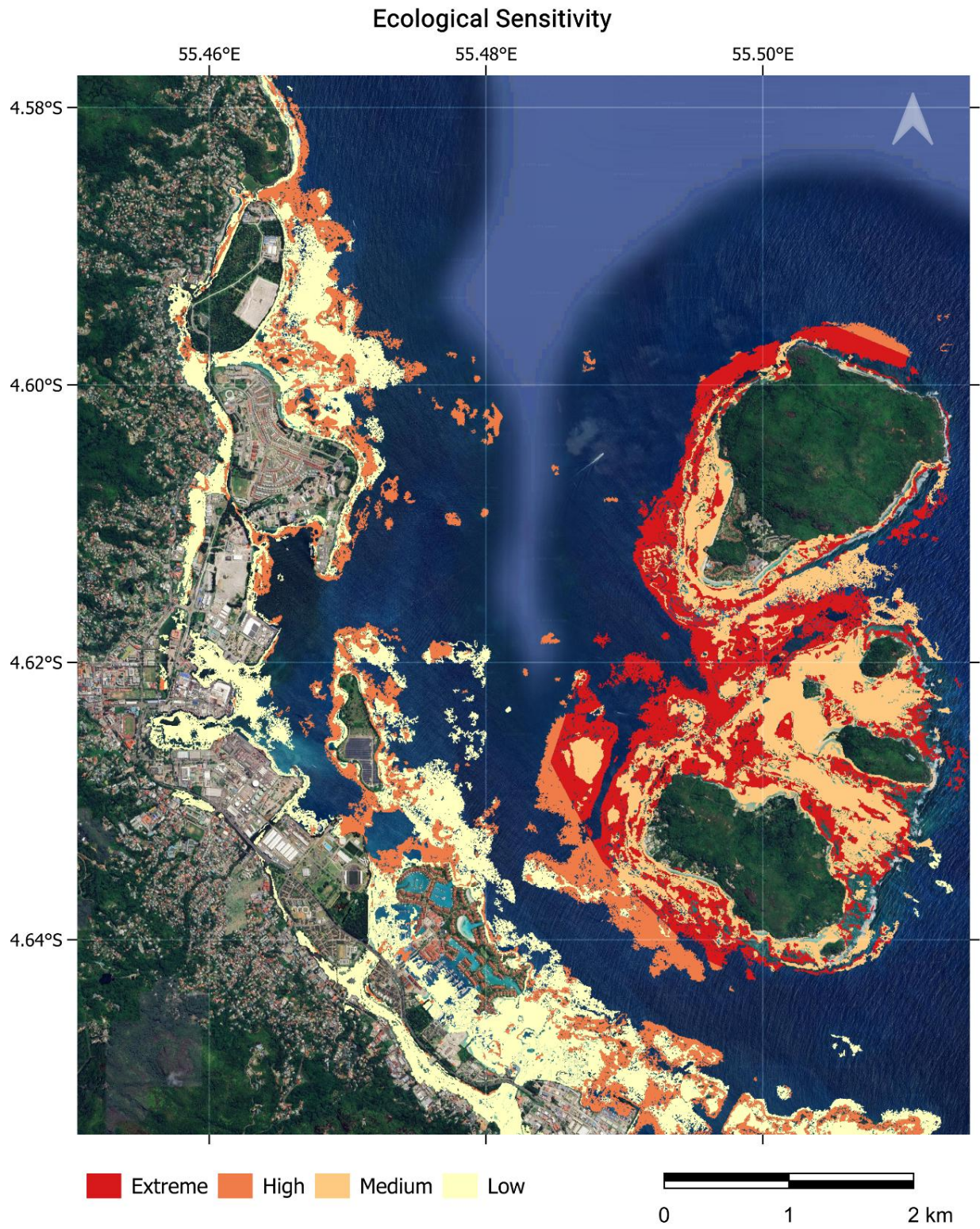


FIGURE 4.5.26_1: MARINE ECOSYSTEM SENSITIVITY IN THE NORTH-EAST OF MAHÉ, SEYCHELLES

4.5.27 BIODIVERSITY ASSESSMENT

The biodiversity survey conducted at Aurore South revealed a total of 101 species spanning six major groups: birds (Aves), corals, other invertebrates, macroalgae, seagrass and fish. Among the birds, three species were recorded, including the Striated Heron (*Butorides striatus*), the Whimbrel (*Numenius phaeopus*), and a Tern (*Sterna sp.*), highlighting the ecological link between coastal and marine environments.

The coral community was diverse, with 12 genera identified across eight families namely Acroporidae, Dendrophylliidae, Euphylliidae, Fungiidae, Merulinidae, Plerogyridae, Pocilloporidae, and Poritidae. Amongst those the most abundant included key reef-builders like *Acropora sp.*, and *Porites sp.*, essential for creating habitat and supporting marine biodiversity. Several large colonies of Pearl bubble coral (*Physogyra lichtensteini*), an Evolutionary Distinct and Globally Endangered (EDGE) species was observed along the reef slopes (Figure 23).

The survey also documented 19 species of other invertebrates, from 8 class which includes Holothuroidea (seacucumber) being the most divers class with 5 different species observed. The lollyfish (*Holothuria atra*) was the most abundant species in this class. This was followed by (2) Echinoidea (sea urchin) with 4 different species from 2 families namely Diadematidae and Stomopneustidae. Most of the individuals was observed on the plateau to the north of the proposed reclaimed area. Four species of Gastropoda (seashell) was recorded with Tiger Cowrie (*Cypraea tigris*) being the most common despite only a few individuals spotted. In the class Demospongia 2 sponges were observed. Only one species was recorded in the class Rhabditophora, Hexacorallia, Anthozoa and Bivalvia namely a Polycladida (Flatworm), Corallimorphes, Sea Anemone (*Radianthus magnifica*), Pen shell (*Pinna muricata*) respectively. The latter was abundant in the seagrass beds identified for reclamation (Figure 24).

Macroalgae were well-represented, with 16 species recorded from eight families. This included several species from the same genus such as *Caulerpa sp.*, and *Halimeda sp.* The most abundant species were *Sargassum sp.*, followed by *Turbinaria sp.* both of which contributes to primary production and sediment stability in the area (Figure 25).

Four species of seagrass, including *Enhalus Acoroides*, *Halophila sp.*, *Syringodium isoetifolium*, and *Thalassia hemprichii* was recorded. The two latter was most abundant and covered most of the proposed reef flat to be reclaimed. A significant presence of juvenile fish was observed within these seagrass beds which supports the fact that this area provides vital nursery habitats for marine life (Figure 26).

Lastly, the survey identified 2 species of Elasmobranchii from 2 families namely Dasyatidae (Stingray; *Pastinachus sp.*) and Carcharhinidae (Shark; *Carcharhinus sp.*) (Figure 27). Additionally, a total of 44 species of Teleostei from 25 different families was recorded. Acanthuridae (Surgeonfish) was the most divers family observed with 6 different species recorded. This was followed by Chaetodontidae (Butterflyfish) with 5 different species. These two families comprise of key functional guilds namely

herbivores and corallivores. The common presence of the coralivorous Butterflyfish supports the observation that there are relatively healthy coral patches in the area.

The abundant presents of commercially important fish species such as Acanthuridae, Lethrinidae, Siganidae, Scaridae, Lutjanidae which are targeted by trap fisherman shows the importance of this area for trap fisheries. During the field survey several fish traps were spotted and on one occasion the fishers collecting their catch (Figure 29)

See annex for photo gallery and fish species list

Fish Communities at Aurore South

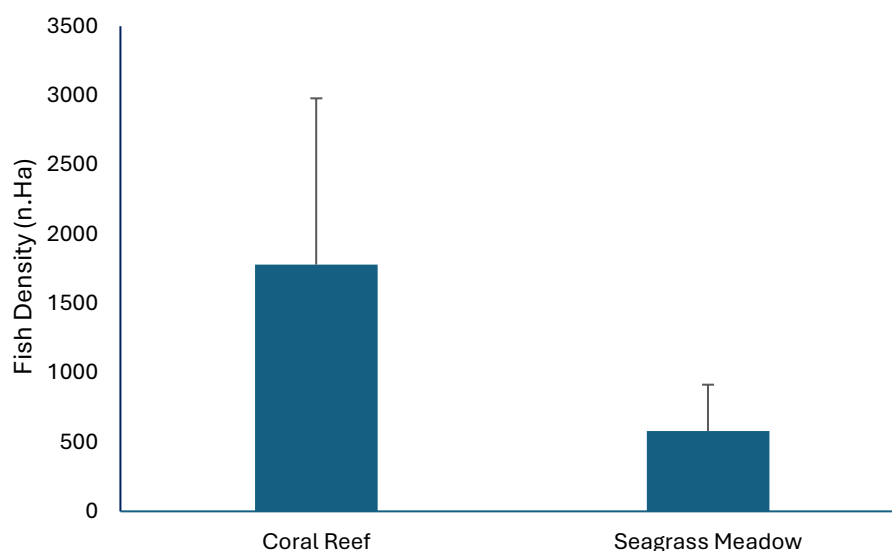


FIGURE 16: FISH DENSITY (N.HA) IN CORAL REEF AND SEAGRASS MEADOW IN AURORE SOUTH RECLAMATION PROJECT

The seagrass beds at Aurore South supported a relatively low diversity and abundance of fish compared to the coral reef habitat (Figure 16). A total of 96 fish, representing 12 genera, were recorded across the four transects surveyed in this habitat. The most abundant species in the seagrass habitat was the Permit Fish (*Trachinotus sp.*), with up to six individuals observed in a single transect. Other frequently observed species included the Parrotfish (*Scarus sp.*) and the Goatfish (*Parupeneus sp.*), which were recorded in moderate abundance across the transects. The largest individuals recorded in this habitat were the Jack Fish (*Caranx sp.*), measuring up to 40 cm in length. Despite these observations, certain species, such as the Needlefish (*Ablennes sp.*), were observed but had no individuals recorded within the transects, suggesting that they may be transient or rare species in this area.

A total of 178 individuals, representing 21 genera were recorded across the four transects conducted in the coral reef habitat at Aurore South. The coral reef habitat supported a far more diverse and abundant fish community compared to the seagrass beds, with size classes ranging from small juveniles (2.5 cm) to large predators exceeding 100 cm. This diversity highlights the complex ecological roles of coral reefs, which provide essential shelter, feeding opportunities, and nursery grounds for a variety of marine species.

The most abundant species observed in the coral reef habitat was the Parrotfish (*Scarus sp.*), with 33 individuals recorded in a single transect. This species was consistently present across all transects, underscoring its ecological dominance in the coral reef environment.

Other notable species included the Surgeonfish (*Acanthurus sp.*), with up to 15 individuals observed, and the Butterflyfish (*Chaetodon sp.*), which occurred at moderate densities of up to six individuals. Shark (*Carcharhinus sp.*) and the Batfish (*Platax sp.*) were recorded in low numbers. Notably, the Shark (*Carcharhinus sp.*) was the largest individual recorded in the entire survey, measuring an estimated 150 cm in length (Figure 27).

The area functions as a vital nursery for bull sharks, offering essential resources such as seagrass meadows and coral reefs that provide food and shelter. This habitat supports juvenile bull sharks' growth and contributes to the marine ecosystem's biodiversity and health.

Macrobenthic epifauna

A total of 9 major taxonomic groups were recorded during belt transects across seagrass and reef habitats. The seagrass habitat supported a higher density and diversity of invertebrates, with sea cucumbers (*Holothuria sp.*) being the most dominant taxa, recorded at 64.5 individuals per 100m². Other notable species included bivalves (*Pinna muricata*; 26 per 100m²), sponges (Demospongiae; 1.25 per 100m²), and low densities of sea urchins (*Echinothrix sp.*; 0.25 per 100m²).

In the reef habitat, species diversity was low, with only two recorded taxa: sea urchins (Echinoidea, 1 per 100m²) and polychaete worms (Polychaeta, 1 per 100m²) (Figure 17).

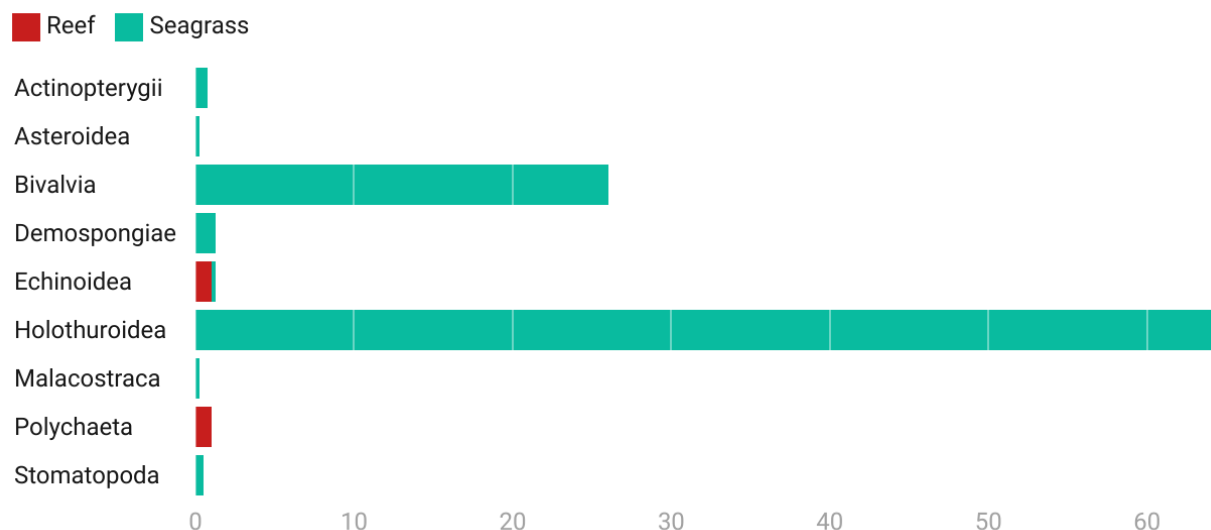


FIGURE 17: DENSITY OF MACROBENTHIC EPIFAUNA (N/100M²) IN CORAL REEF AND SEAGRASS MEADOW HABITATS.

4.5.28 RISK, IMPACT AND MITIGATION

The planned reclamation project near Ile Aurore presents three major ecological risks, particularly for sensitive marine habitats in and around the Sainte Anne Marine Protected Area (MPA). Reef flat excavation will: 1) generate turbidity and sediment plumes, 2) Bury marine ecosystems and sensitive habitats, and 3) degrade water quality.

These risks are supported by findings from previous EIA reports, marine survey evidence, and expert analysis from the consultant team. Each identified risk is associated with specific ecological impacts. For example, the project will result in the permanent loss of 1.3 ha of coral reefs and 4.4 ha of seagrass meadows, with potential indirect impacts extending to 7.5 ha of coral reefs and 6.7 ha of seagrass meadows within a 250m buffer zone. This destruction of critical habitats threatens sessile and benthic organisms, including commercially and ecologically important marine species that rely on these environments for spawning, feeding, and shelter.

For each impact a Matrix has been developed using a scoring system based on the following criteria:

Criteria	1	2	3
Magnitude Measure of the importance of the condition in relation to spatial boundaries	Change/effect within project site only	Change/effect to local conditions and/or areas immediately outside	Regional/national/international change/effect
Permanence To define whether the impact is temporary or permanent	No change/not applicable	Temporary	Permanent
Reversibility Measure of the control over the effect of the applied impact	No change/not applicable	Reversible	Irreversible
Cumulative Measure of whether the impact will be a single effect or a cumulative effect over time or a synergistic effect with other conditions	No change/not applicable	Non-cumulative/single effect	Cumulative effect over time or synergistic effect with other condition

Table 4.5.28

RISK 1 – Sediment Plumes generation and dispersal

The generation of sediment plumes during dredging and reclamation is a major risk identified, affecting water quality, primary productivity, and sensitive marine habitats.

Risk	Impact	Magnitude	Permanence	Reversibility	Cumulative
Sediment plumes generation and dispersal	Temporary reduction in light penetration and primary productivity.	2	2	2	3
	Deposition of fine sediment on adjacent extreme sensitive marine habitats in MPA (See Sensitivity analysis).	2	2	2	3
	Smothering of coral reefs and seagrass beds, reducing biological performance and biodiversity.	2	2	2	3

Dispersal Model

Sediment dispersion resulting from dredging activities was modelled based on the hydrodynamic simulations produced by ORCA (2025). The modelling predicts the formation of a plume of suspended sediments generated by dredging operations, which is transported by prevailing ambient currents. According to the study, the sediment is primarily composed of silt, as the dredged substrate contains negligible clay and the coarser sand fractions are predicted to settle rapidly in proximity to the dredging apparatus.

Two distinct monsoonal scenarios were assessed to capture seasonal variability in hydrodynamics: the Northwest (NW) Monsoon and the Southeast (SE) Monsoon. Figure 4.5.28_18 presents the modelled Total Suspended Sediment (TSS) dispersal under both seasonal conditions. The simulation indicates that sediment plumes extend further south under NW Monsoon conditions, whereas a northward dispersion pattern is observed during the SE Monsoon.

Importantly, as dredging is largely planned to occur behind a progressively constructed containment bund, the majority of suspended sediments remain confined within the bunded area. Even under high percentile exceedance scenarios (e.g, 99th percentile, >1 mg/L TSS), the plume remains spatially restricted to the immediate vicinity of the reclamation site, including areas surrounding Perseverance Island and Ile Aurore.

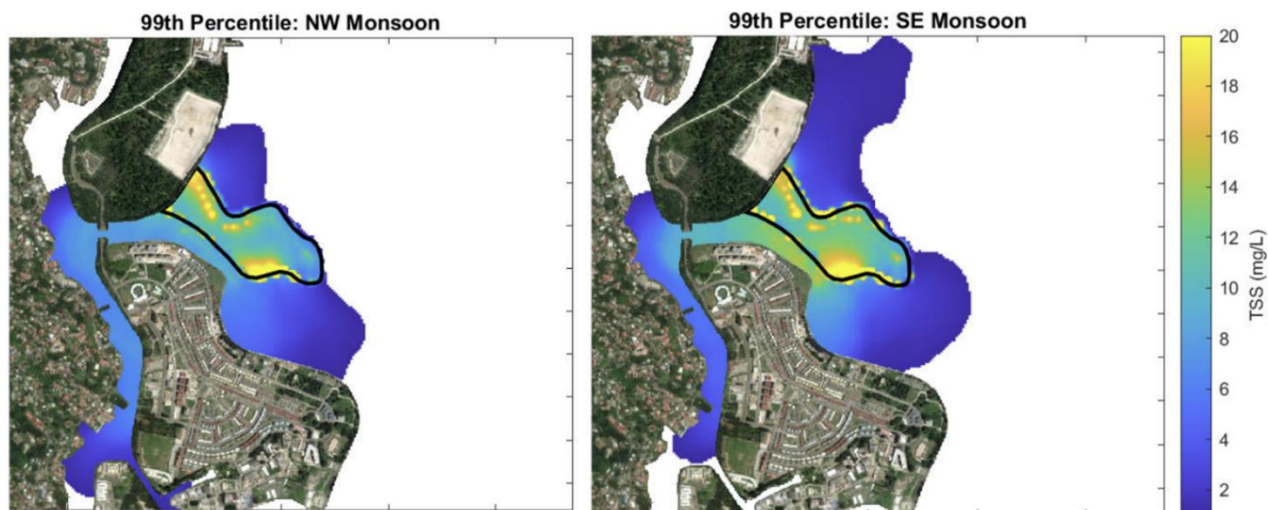


Figure 4.5.28_18. Modelled Total Suspended Sediment (TSS) dispersal under prevailing monsoonal conditions, illustrating NW (left) and SE (right) Monsoon simulations. Modified from ORCA (2025).

Sensitivity Analysis

A sensitivity analysis was conducted using modelled TSS outputs to assess the potential extent and ecological impact of plume dispersal under both monsoonal conditions. During the Southeast Monsoon, approximately 18.7 hectares of highly sensitive marine habitats are predicted to be exposed to elevated TSS concentrations. In comparison, 14.5 hectares are affected during the Northwest Monsoon scenario. In both cases, the impacted sensitive receptors include fringing coral reef communities located on the eastern slope adjacent to the reclamation site.

Additional vulnerable ecosystems include nearby seagrass meadows, with particular concern for isolated patches of *E. acoroides* (Tape Seagrass). These represent the only known occurrences of this species in the northeastern Mahé region, underscoring their ecological significance. As such, mitigation measures should be prioritised to avoid adverse impacts on these meadows. Notably, multispecific seagrass assemblages were observed only in areas where sediment silt content remained below 15%. *E. acoroides*, however, demonstrates a higher tolerance for turbid conditions, persisting in silt-rich sediments up to 15% content due to its morphological adaptation, specifically, long leaves that facilitate light capture in turbid waters. Nevertheless, once silt content exceeds 20%, seagrass cover is entirely absent (Terrados et al., 1998), indicating a threshold beyond which habitat degradation becomes irreversible.

Modelling results suggest that sediment plumes from the proposed dredging operations are not expected to reach or impact the extremely sensitive areas within the Sainte-Anne Marine National Park.

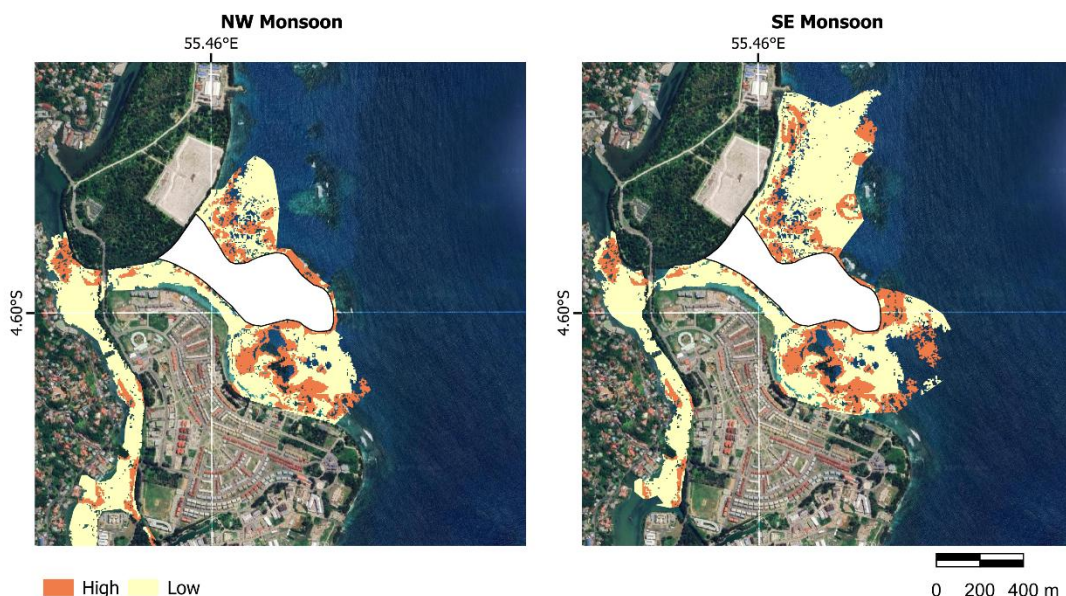


Figure 4.5.28_2: Sediment plume impact risk classification under NW and SE Monsoon conditions. The maps illustrate areas of high (orange) and low (yellow) potential ecological sensitivity to dredging-related sediment dispersal, based on hydrodynamic modelling outputs.

	Dispersal Model	
	SE Monsoon	NW Monsoon
Sensitivity Area (Ha)		
Low	52.3	38.6
High	18.8	14.5

Table One: *Estimated extent of sensitive habitat areas affected by sediment dispersal under SE and NW Monsoon conditions.* The table presents the modelled area (in hectares) of low and high ecological sensitivity exposed to suspended sediment plumes during dredging operations.

1.1 Impact- Temporary reduction in light penetration and primary productivity.

Increased turbidity from suspended sediments during dredging and reclamation activities significantly reduces light penetration, impacting photosynthesis in seagrass, corals, and phytoplankton communities (Erftemeijer & Lewis, 2006)⁷. Studies indicate coral growth and recruitment are significantly reduce in areas experiencing high turbidity levels (Erftemeijer *et al.*, 2012)⁸.

- The magnitude is moderate (2) as turbidity effects are localized but sediment plumes can extend beyond the project footprint to extreme sensitive area in the Sainte-Anne Marine National Park depending on sediment grain size and hydrodynamic conditions.
- The permanence is temporary (2) because suspended sediments eventually settle, especially in low-energy environments.

⁷ Erftemeijer, P. L., & Lewis III, R. R. R. (2006). Environmental impacts of dredging on seagrasses: a review. *Marine pollution bulletin*, 52(12), 1553-1572.

⁸ Erftemeijer, P. L., Riegl, B., Hoeksema, B. W., & Todd, P. A. (2012). Environmental impacts of dredging and other sediment disturbances on corals: a review. *Marine pollution bulletin*, 64(9), 1737-1765.

- Reversibility is also moderate (2), as primary productivity can recover once sediment plumes dissipate, though prolonged exposure can cause permanent ecosystem shifts.
- The cumulative impact is high (3) because repeated dredging and coastal development projects have contributed to chronic light reduction in coral reef and seagrass in the North-East of Mahé. The East Coast Coral Reef and seagrass meadows are already stressed by past sedimentation and climate change impacts.

1.2 Impact - Deposition of fine sediment on adjacent extreme sensitive marine habitats in Sainte Anne Marine National Park

Fine sediment deposition smothers benthic organisms, disrupts filter-feeding invertebrates, and degrades seagrass and coral reef ecosystems (Jones et al., 2016)⁹. In the Sainte-Anne Marine Park this impact is double sided, first many species rely on oligotrophic conditions to thrive and second the tourism industry rely on a pristine environment.

- The magnitude is moderate (2) as sedimentation is primarily localized but can extend into the adjacent MPA, depending on current strength and sediment characteristics.
- The permanence is temporary (2) since sediment can be resuspended and transported elsewhere, although accumulated layers may persist for months or years in low-energy environments.
- The reversibility is moderate (2) as some habitats may recover if sediment input ceases, but long-term burial of benthic communities can lead to irreversible habitat loss.
- Cumulative effects are high (3) due to historical and ongoing sedimentation events linked to coastal infrastructure projects, dredging, and land-based runoff

1.3 Impact - Smothering of coral reefs and seagrass beds, reducing biological performance and biodiversity.

Excess sedimentation physically buries coral reefs and seagrass meadows, blocking light penetration and causing hypoxia in benthic communities (Erftemeijer et al., 2012). Coral reefs are particularly vulnerable, as sediment can clog their feeding structures, reduce photosynthetic efficiency (via symbiotic zooxanthellae), and increase disease susceptibility. Seagrasses also require high water clarity, and prolonged sediment accumulation can result in dieback and reduced productivity.

- The magnitude is moderate (2) as sedimentation effects are localized but extend to adjacent ecosystems.
- The permanence is temporary (2), as wave and current action can clear sediments, but prolonged exposure can lead to irreversible degradation.
- The reversibility is moderate (2) because if sedimentation ceases, corals and seagrasses can recover, though chronic burial can lead to permanent loss.
- The cumulative impact is high (3) due to past dredging projects, increasing coastal development, and global climate-related stressors (e.g., coral bleaching and rising sea temperatures). The interaction of sedimentation with other stressors reduces ecosystem resilience, making recovery increasingly difficult.

⁹ Jones, R., Ricardo, G. F., & Negri, A. P. (2015). Effects of sediments on the reproductive cycle of corals. *Marine Pollution Bulletin*, 100(1), 13-33.

RISK 2 - Marine Ecosystem and Habitat burial

The permanent loss and degradation of marine habitats due to dredging and land reclamation near Ile Aurore is identified severe to biodiversity and ecosystem functionality

Risk	Impact	Magnitude	Permanence	Reversibility	Cumulative
Marine Ecosystem and Habitat burial	Direct permanent loss of 1.3 ha of coral reefs	1	3	3	3
	Direct permanent loss of 4.4 ha of seagrass meadows	1	3	3	3
	Loss of sessile and benthic organisms.	2	3	3	3
	Disruption of feeding and breeding grounds for fish and invertebrates	2	3	3	3

2.1 Impact - Direct Permanent Loss of 1.3 ha of Coral Reefs

The burial of 1.3 ha of coral reefs due to reclamation results in immediate and irreversible habitat destruction. Coral reefs support 25% of marine biodiversity, serving as critical nursery grounds for fish, invertebrates, and keystone species. Coral loss leads to ecosystem collapse, fisheries decline and reduced coastal protection from wave energy.

- The magnitude is assessed as 1 because this is a localized impact
- The permanence (3) and irreversibility (3) are high, as buried corals cannot recover naturally.
- The Cumulative impacts (3) are severe, as the northeast coast of Mahé has already experienced significant coral loss due to past reclamation projects, coral bleaching events (1998, 2016, 2020), and climate change (Graham et al., 2008)¹⁰.

2.2 Impact - Direct Permanent Loss of 4.4 ha of Seagrass Meadows

Seagrass meadows are one of the most valuable marine ecosystems, providing carbon sequestration, habitat for juvenile fish, and sediment stabilization (Duarte et al., 2008)¹¹. The 4.4 ha of seagrass meadows lost due to burial represents a significant ecological disruption, particularly for fisheries and benthic invertebrates due to high density of sea cucumber.

- The magnitude is local (1).
- The permanence (3) and irreversibility (3) are high, as seagrass restoration is challenging and often unsuccessful.
- Cumulative impacts (3) are severe, as seagrass loss has accelerated due to coastal development, and pollution in Seychelles.

2.3 Impact - Loss of sessile and benthic organisms.

The burial of 18 Ha of ecosystem including coral reefs and seagrass meadows leads to the loss of sessile organisms, including sponges, bivalves, anemones, and crustaceans, which form the foundation of benthic food webs.

¹⁰ Graham, N. A., McClanahan, T. R., MacNeil, M. A., Wilson, S. K., Polunin, N. V., Jennings, S., ... & Sheppard, C. R. (2008). Climate warming, marine protected areas and the ocean-scale integrity of coral reef ecosystems. *PLoS one*, 3(8), e3039.

¹¹ Duarte, C. M., Borum, J., Short, F. T., & Walker, D. I. (2008). Seagrass ecosystems: their global status and prospects. In *Aquatic ecosystems: trends and global prospects* (pp. 281-294). Cambridge University Press.

- The magnitude is moderate (2) as this impact extends beyond the immediate footprint of the reclamation. Permanence (3) and irreversibility (3) are high, as many sessile organisms are slow-growing and cannot migrate.
- Cumulative impacts (3) are also severe, as past coastal developments, and pollution have already degraded benthic habitats in Seychelles.

2.4 Impact - Disruption of feeding and breeding grounds for fish and invertebrates

Key fish breeding grounds in seagrass meadows and coral reefs support commercially and ecologically important species. The burial of these habitats disrupts fish spawning, juvenile recruitment, and trophic interactions, affecting biodiversity and local fisheries. The loss of spawning and foraging grounds directly threatens species that depend on these ecosystems for reproduction and survival.

The reclamation site and surrounding area is a traditionally known nursery ground for Bull Sharks (*Carcharhinus leucas*). Bull sharks utilize shallow seagrass meadows and coral reef fringes as safe breeding and nursery areas, offering shelter for juveniles before they migrate to deeper waters (Heupel et al., 2010)¹². Multiple sharks have been observed during the marine survey and the loss of these habitats will directly impact juvenile shark populations, which may increase vulnerability to predation and disrupt recruitment success.

- The magnitude is moderate (2)
- Permanence (3) and irreversibility (3) are high, as some species may not recolonize impacted areas.
- The cumulative impact (3) is severe, as Seychelles' fisheries are already under pressure from overfishing and climate change

¹² Heupel, M. R., Simpfendorfer, C. A., & Hueter, R. E. (2004). Estimation of shark home ranges using passive monitoring techniques. *Environmental Biology of Fishes*, 71(2), 135-142.

RISK 3 – Water quality degradation

Risk	Impact	Magnitude	Permanence	Reversibility	Cumulative
Water quality degradation	Increased nutrient levels leading to potential algal blooms and eutrophication	2	2	2	3

3.1 Impact - Increased nutrient levels leading to potential algal blooms and eutrophication

Excessive nutrient input from dredging and reclamation activities can lead to harmful algal blooms (HABs). The resulting conditions can suffocate marine life, including fish and reduce biodiversity.

- The magnitude is moderate (2) because nutrient loads and resulting algal blooms are often localised but can extend to adjacent habitats.
- The permanence is temporary (2) since nutrient levels may stabilize over time,
- the reversibility is reversible (2) as ecosystems can recover when nutrient inputs cease.
- Cumulative impacts (3) are severe, as nutrient pollution from past coastal development, runoff, and climate change-related ocean warming has already contributed to coastal eutrophication and periodic algal blooms in Seychelles¹³.

¹³ Poisonous algal bloom on the move around Seychelles' islands - 4 december 2020 / URL: <http://www.seychellesnewsagency.com/articles/13987/Poisonous+algal+bloom+on+the+move+around+Seychelles%27+islands>

4.5.29 MITIGATION RECOMMENDATIONS

An adaptive management strategy should be implemented to respond to environmental impacts during the construction and post-reclamation phases. This approach ensures flexibility in mitigation measures based on real-time monitoring results, particularly for water quality, sediment dispersion, and habitat impacts. SOPs should outline thresholds for intervention, corrective actions, and contingency plans to minimize ecological disturbances. Proposed mitigation measures are available in Table 4.5.29_3 and recommendation are made below.

Protection of High and Extreme Sensitivity Areas

- Deploy sediment control measures such as silt curtains to limit sediment dispersal and protect coral reefs and seagrass meadows from excessive turbidity.
- Schedule construction activities to avoid peak hydrodynamic conditions (e.g., periods of strong currents and storms) to reduce sediment plume dispersal.

Habitat Restoration and Compensation

- Conduct coral transplantation or establish artificial reefs to compensate for habitat loss, ensuring that displaced marine species have alternative structures for recolonization.
- Restore degraded seagrass beds in adjacent areas to enhance ecosystem resilience and maintain critical ecosystem services such as carbon sequestration, shoreline stabilization, and nursery habitat functions.

Given the presence of healthy coral colonies in the northern reef section, coral relocation should be considered to minimize the direct impact of reclamation activities. Successful coral translocation has been demonstrated as a dredging mitigation tool in Jamaica (Kenny et al., 2012)¹⁴, where managed coral relocation programs have preserved biodiversity and enhanced post-reclamation reef recovery.

- To optimize coral relocation effectiveness, the following measures should be taken:
- Prioritize coral species with high survival potential, particularly stress-tolerant species like *Porites* and resilient branching corals such as *Acropora* (See Figure 14).
- Select suitable receptor sites with similar environmental conditions (e.g., Marine Protected Areas) to maximize post-transplantation survival rates.
- Implement a structured long-term monitoring plan to assess coral health, survival rates, and ecosystem recovery post-relocation.

4.5.30 WATER QUALITY MANAGEMENT

- Establish a real-time water quality monitoring program to track turbidity, nutrient concentrations, and pollutant levels throughout the construction and post-reclamation phases.
- Develop and enforce a runoff management plan to prevent contaminant introduction into adjacent marine habitats, ensuring compliance with water quality thresholds and environmental regulations.

¹⁴ Kenny, I., Kramer, A., Kelly, P. W., & Burbury, T. (2012). Coral Relocation: A mitigation tool for dredging works in Jamaica. *Cairns, Australia*, 20A.

TABLE 4.5.29_3: KEY ENVIRONMENTAL RISKS, ASSOCIATED IMPACTS, AND PROPOSED MITIGATION MEASURES FOR THE ILE AURORE RECLAMATION PROJECT

Risk	Impact	Mitigation
Turbidity and sediment plumes	<p>Temporary reduction in light penetration and primary productivity</p> <p>Deposition of fine sediment on adjacent extreme sensitive marine habitats in MPA (See Sensitivity analysis).</p> <p>Smothering of coral reefs and seagrass beds, reducing biological performance and biodiversity.</p>	<p>Use modern trailing suction hopper dredgers with real-time monitoring and control to limit plume spread.</p> <p>Conduct reclamation during periods of lower hydrodynamic activity to reduce plume dispersion.</p> <p>Employ silt curtains around dredging and reclamation sites to minimize sediment dispersal</p> <p>Implement Standard Operation Procedure to conduct regular inspections and maintenance of silt curtains to ensure effectiveness</p>
Marine Ecosystem and Habitat burial	<p>Direct permanent loss of 1.3 ha of coral reefs</p> <p>Direct permanent loss of 4.4 ha of seagrass meadows</p> <p>Loss of sessile and benthic organisms.</p> <p>Disruption of feeding and breeding grounds for fish and invertebrates</p>	<p>Restoration or Compensation</p> <p>Restoration or Compensation</p> <p>Design and artificial reefs to mimic natural reef habitats and promote recolonization.</p> <p>Establish artificial reef structures to provide alternative habitats</p>
Water quality degradation	<p>Increased nutrient levels leading to potential algal blooms and eutrophication</p>	<p>Implement SOP and protocol for regular water quality monitoring (e.g. turbidity) during and after construction at increasing distance from construction activities</p>

4.5.31 CONCLUSION

This section has primarily focused on ecological risks, impacts, and mitigation measures associated with the reclamation activities at Ile Aurore extension, emphasizing habitat loss, biodiversity decline, sedimentation, and water quality degradation. These environmental risks are critical, particularly in extreme sensitive areas such as MPAs that include coral reefs, seagrass meadows, and shark nurseries. However, it is important to acknowledge that other significant impacts exist beyond ecological concerns, including physical, atmospheric, cumulative, and socio-economic risks that must also be addressed.

Among these additional risks, increased coastal erosion potential due to altered wave patterns and sediment transport can threaten neighbouring shorelines. Air emissions from dredging operations contribute to CO₂ and NO_x pollution, impacting air quality and contributing to climate change, which can be mitigated by using fuel-efficient, modern dredging equipment and optimizing operational schedules.

Visual impacts from construction can degrade the aesthetic appeal of coastal areas, affecting local communities and tourism-dependent economies. Cumulative effects from past and present reclamations further compound environmental degradation, requiring an adaptive management approach to monitor and mitigate unforeseen consequences over time.

Beyond environmental risks, socioeconomic impacts are also significant. Noise pollution from construction activities may disturb residential areas and tourism operations, while heavy machinery and site access restrictions pose safety concerns. Moreover, fishing communities face disruptions due to reduced access to traditional fishing grounds and habitat degradation, leading to potential declines in fish stocks and recruitment rates. Engaging local fishers and implementing artificial reef projects could help mitigate these effects.

While this section provides a detailed ecological risk assessment, the broader physical, atmospheric, and socio-economic risks require integrated mitigation strategies to ensure the long-term sustainability of the project and its surrounding environment. A holistic environmental management approach that incorporates ecological, hydrodynamic, atmospheric, and human dimensions is essential to minimize long-term impacts and enhance ecosystem resilience.

4.6. DREDGE MODELLING STUDY ILE AURORE

The study relates specifically to the proposed 180,000m² reclamation off Ile Aurore (the Ile Aurore Extension). As part of this, a >4m high coral bunding wall will be created around the perimeter of the proposed reclamation. The material for this bund will be taken from the seabed using a backhoe dredger. The dredging process will generate a plume as material is transferred from the seabed to the surface. The site is 'moderately sensitive' and consequently, a modelling investigation is required to establish the likely fate of dredged material resultant from the dredging works and effects of the reclamation on local hydrodynamics. This section provides the details of this modelling study and the full report is attached to this ESIA.

4.6.1 METHODOLOGY

The scope of this study can be considered in two parts:

1. Examination of the fate of sediment released as part of the dredging activities
2. Quantification of changes in hydrodynamics due to the presence of the reclamation.

These are to be considered in the context of the two monsoon seasons.

This was undertaken by developing a coupled hydrodynamic and wave model which formed the basis of a subsequent sediment transport model. The dredging activity was schematized in this model and the fate of sediments were tracked throughout the simulations. The hydrodynamic model was used to explore changes in current patterns with and without the reclamation in place

4.6.2 LOCAL SURVEY

A single beam survey was undertaken of the waters surrounding Ile Aurore covering the area where the reclamation to be built. The survey lines and associated depths are shown in Figure 4.6.2_2.1.

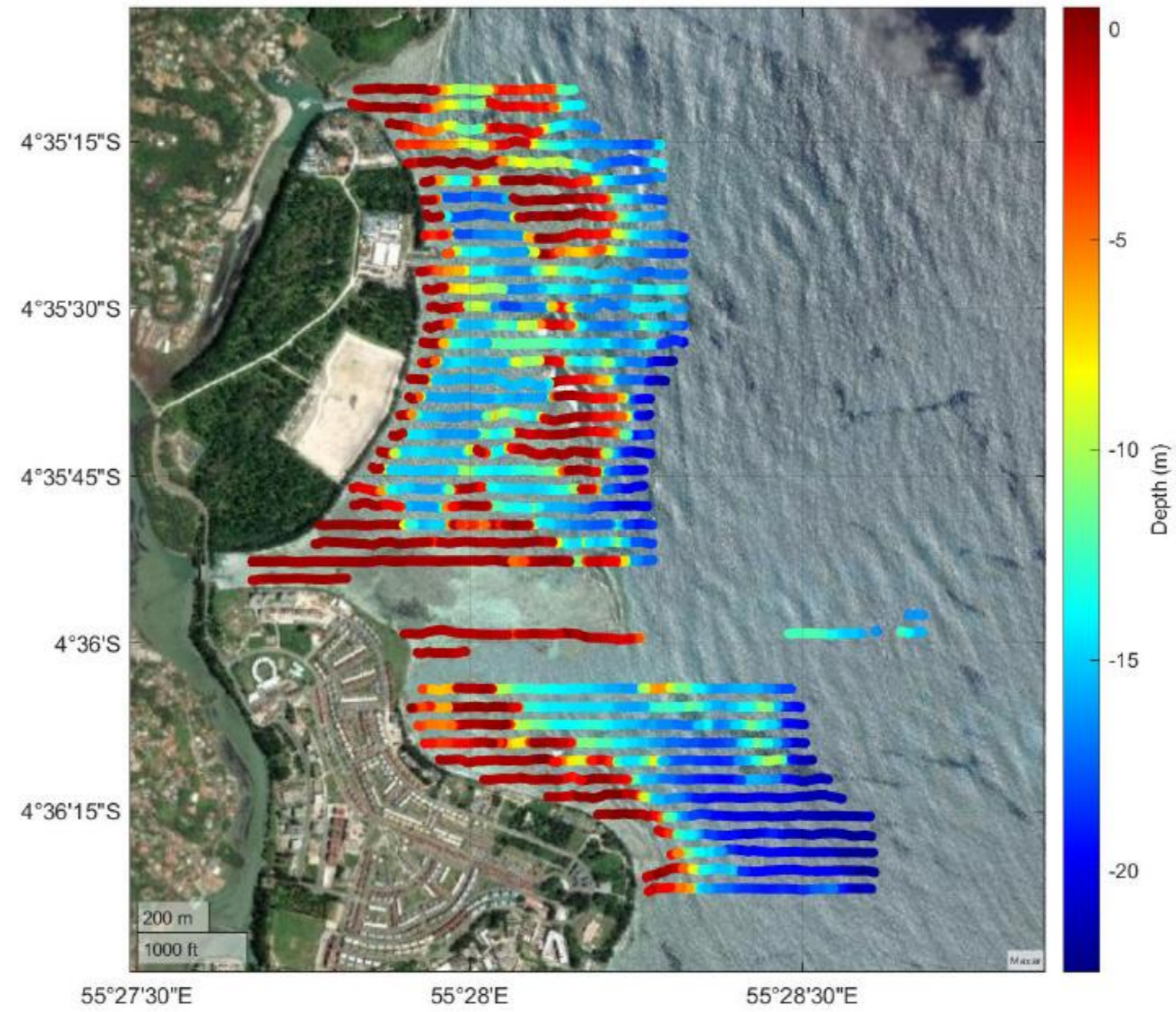


Figure 2.1: Bathymetric survey of the waters surrounding Ile Aurore.

Figure 4.6.2_2.1

GEBCO

The GEBCO (GEBCO, 2020) dataset is produced as part of the Seabed 2030 project, which is a collaborative project between the Nippon Foundation of Japan and GEBCO. The GEBCO grid is a continuous, global terrain model for ocean and land with a spatial resolution of 15 arc seconds. This dataset was used to define the broadscale bathymetry around the Gilbert Islands.

4.6.3 CHART DATA

Relevant admiralty charts were identified and digitised contours and spot depths were included in the model bathymetry.

2.1.1.4 Open Street Map Coastline data

Open Street Map1 (OSM) provides a detailed shoreline that approximately coincides with Mean High Water Spring (MHWS). This contour was extracted from the OSM covering the entire Gilbert Island group and was used as a land polygon throughout the modelling. At locations of interest, the polygon was checked thoroughly and modified where needed.

2.1.1.5 LiDAR

LiDAR surveys of Mahé and Praslin were undertaken by The Government of The Seychelles and have been incorporated into the DEM. The LiDAR surveys have a resolution of 1 m.

2.1.1.6 Combining Bathymetric Datasets

Datasets were combined preferentially in the following order:

- LiDAR
- OSM coastline
- Local survey data
- Chart Data
- GEBCO

Datasets were merged by removing points based on search radius and order of preference. Where discontinuities occurred, less preferential depth values were adjusted using a gaussian weighting based on nearest neighbour proximity to more preferential data.

2.1.2 Tidal Boundary Data

Tidal boundary conditions on the open ocean boundaries of the model were extracted from the FES2022 (Finite Element Solution) Ocean Tide model (AVISO, 2024). The FES2022 model mesh is comprised of approximately

11 million elements, with varying spatial resolution around the globe. Extra refinement was applied to a number of coastal zones.

2.1.3 Wind Data and Spectral Wave Data

Spatially and temporally varying spectral wave data were sourced from the European Centre for Medium-Range Weather Forecasts' (ECMWF) ERA5 hindcast. The data are 2-dimensional wave spectra from the ERA5 0.25°x0.25° (approximately 27.5 km by 27.5 km) resolution database C3S (2017). These were used as boundary conditions in the broadscale wave modelling.

2.1.3.1 Wind Data

Spatially and temporally varying model wind data were derived from the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) dataset. This provided hourly wind data on a grid with a resolution of 0.312 by 0.312 degrees from 1979 until 2011 (Saha et al., 2010) and 0.205 by 0.204 from 2011(Saha et al., 2014) onwards until present day.

4.6.4 HYDRODYNAMIC AND SEDIMENT TRANSPORT MODELLING

2.2.1 Delft3D

The Delft3D Model Suite was used for the coupled wave, current and sediment transport. A major advantage of Delft3D is that, although it started as licensed software, it is now open source meaning that improvements in the software come from a large-scale collaborative effort including internal developers as well as from a broad base of users worldwide.

The modelling framework is composed of three interconnected modules:

- **Delft3D-WAVE:** A nearshore wave propagation model that simulates the transformation of incoming wave fields.
- **Delft3D-FLOW:** A multi-dimensional (2D or 3D) hydrodynamic model designed to compute non-steady flows and transport processes driven by tidal forces, meteorological conditions, and wave interactions.
- **Delft3D-MOR:** A module that calculates sediment transport fluxes and the resulting changes in seabed morphology based on the combined effects of waves and currents.

These modules are fully integrated to capture morphodynamic feedback mechanisms. At each coupling time step, the hydrodynamic module provides updated flow conditions (depth averaged currents and water levels) to the wave module. The wave module then propagates waves throughout the domain while accounting for ambient hydrodynamic conditions. It also generates radiation stress fields and key wave parameters, which subsequently influence the hydrodynamic calculations. Delft3D-MOR then determines sediment transport based on wave-current interactions and updates seabed morphology, which in turn influences subsequent wave and flow computations.

An option is available to disable seabed morphology updates, allowing sediment transport calculations without altering the bathymetry. This approach is particularly useful for analysing sediment transport pathways while avoiding potential inaccuracies caused by uncorrected non-linear interactions between waves, currents, and seabed changes.

The hydrodynamic model was 2 Dimensional and driven by spatially and temporally variable wind, pressure, tides and wave effects. The modelling setup used a system of nested rectilinear model grids using a nesting process known as Domain Decomposition (DD). Standard nesting procedures use a coarse model run over a large model domain, and nested boundary conditions are extracted from this to run higher resolution models covering a smaller area contained within the domain of the coarse grid. DD is a dynamically coupled nesting system whereby the coarser and finer grids are run simultaneously and information is passed between the domains (Deltares, 2018). This means that trace substances can pass seamlessly between the two grids in a way that is not possible using standard nesting.

Furthermore, information pertaining to other hydrodynamic processes is not lost between domains in the nesting process as it is using standard nesting. The model used 4 nested domains which are shown in Figure 4.6.4 _2.2 overleaf. The wave model was driven by spectral wave boundary conditions on the open boundary and wind.

The wave and hydrodynamic model have been calibrated on multiple occasions using a range of measured datasets (Atkin, et al., 2013 and Borrero et al., 2016). The sediment transport model was driven by the hydrodynamic model and wave model and included 3 sediment fractions (clay, silt and fine sand). The model included settling and resuspension.

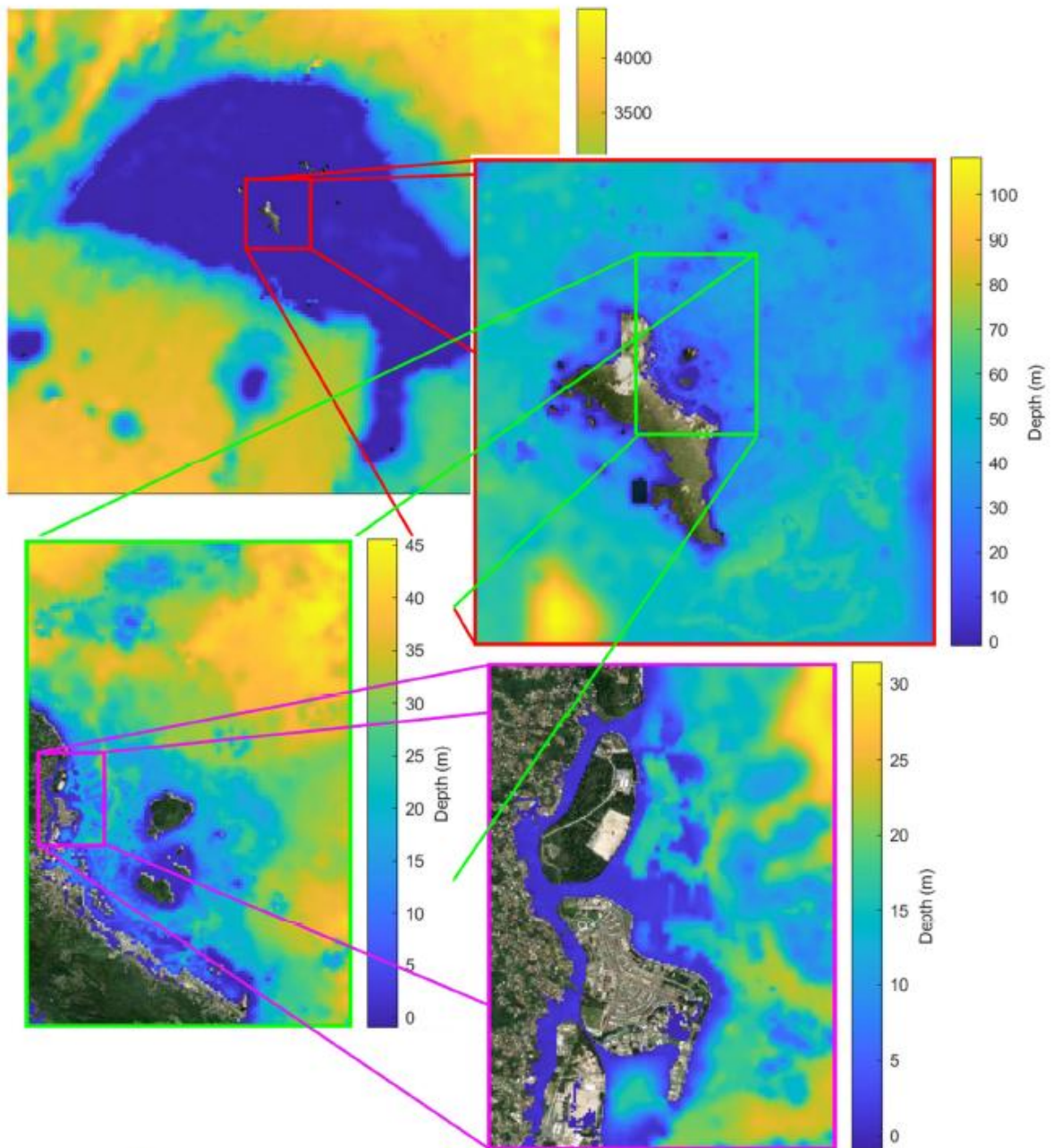


Figure 2.2: The bathymetric grids used in the Delft3D hydrodynamic model.

Figure 4.6.4_2.2

Dredging Source Term

The dredging work will be undertaken using a backhoe dredger with an assumed bucket size of 7 m³. Dredging will be undertaken 24 hour a day for a 20-day period with a dredging rate of 4,000 m³ per day (165m³/hour). Sediment grain size analysis of the study site indicated that the benthic substrate around the reclamation contain no clay, 7% silt and 19.8% fine sand (Figure 2.3).

The loss of sediment while dredging is quantified by an 'S' Factor which specifies the amount of material lost per cubic meter of sediment dredged. This can vary substantially due to the particle size distribution of the sediment being dredged, operator experience, and the size of the dredge bucket being used, though some general estimates are available for backhoe dredgers. CIRIA (2000) estimate that typical 'S' factors range between 12 and 30 kg/m³ of dredging for backhoe dredges.

Van Rijn (2018) estimate between 5 and 50 kg/m³ (see Table 2.1). Kirby and Land (1991) estimate losses of between 12 and 25 kg/m³ for a 6 m³ backhoe dredge bucket. We use the conservative S Factor of 25 kg/m³ from Kirby and Land (1991) since the bucket size used in their estimation is similar to the one proposed for this study. This leads to a total spill rate of 1.146 kg/s (165 x 25 / 3600) with 0.080 kg/s for silt and 0.227 kg/s for fine sand.

The bulk of the dredging will be undertaken from the inner side of the bund as it is built. The aim of this is to ensure that any sediment release will be into a more quiescent areas to encourage more rapid settling of fine material. On the southern perimeter, dredging will be undertaken on the seaward side of the bund to excavate a new channel for artisanal fishing boats. In the model the bund was created as per the schematisation in the scooping presentation (Figure 2.4) with bund creation starting on the offshore edge of the reef and progressing anti-clockwise until it is completed.

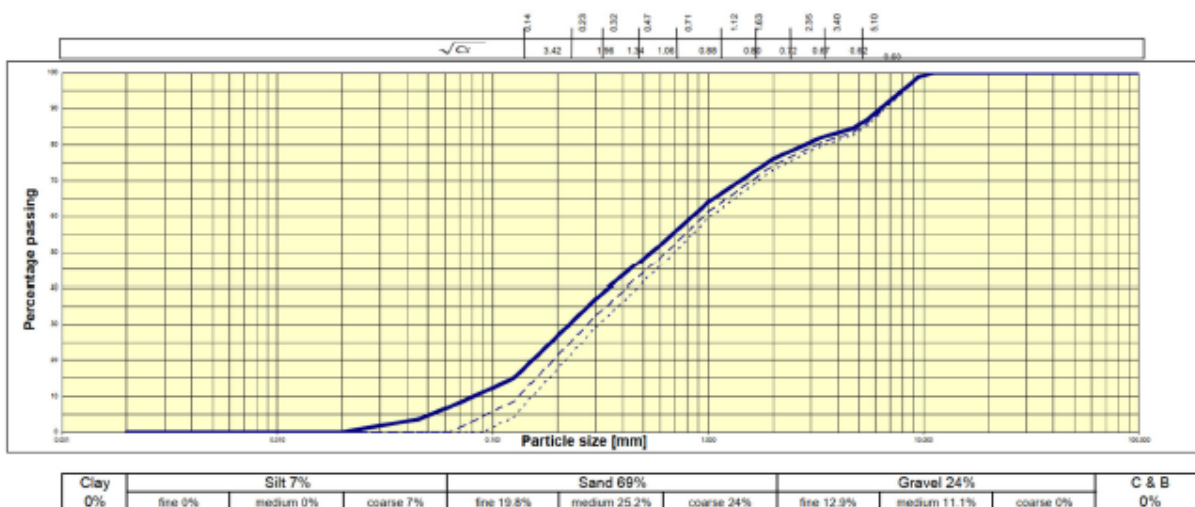


Figure 2.3: Particle Size Distribution (PSD) for the bathymetric substrate at the site of the proposed Ile Aurore reclamation.

4.6.5 SCENARIOS

The Seychelles experience two distinct Monsoon seasons which feature different wind conditions. The seasons are the NW monsoon season (November - April) the SE monsoon (May – October) with transition seasons in between (Figure 4.6.5_2.5). For this study we undertook modelling for the two monsoon seasons using January for the NW Monsoon and July for the SE Monsoon.

The model scenarios were as follows:

- Dredging and bund creation during the NW Monsoon.
 - Dredging and bund creation during the SE Monsoon.
 - Current patterns with and without the reclamation in place for the NW Monsoon.
 - Current patterns with and without the reclamation in place for the SE Monsoon.
-

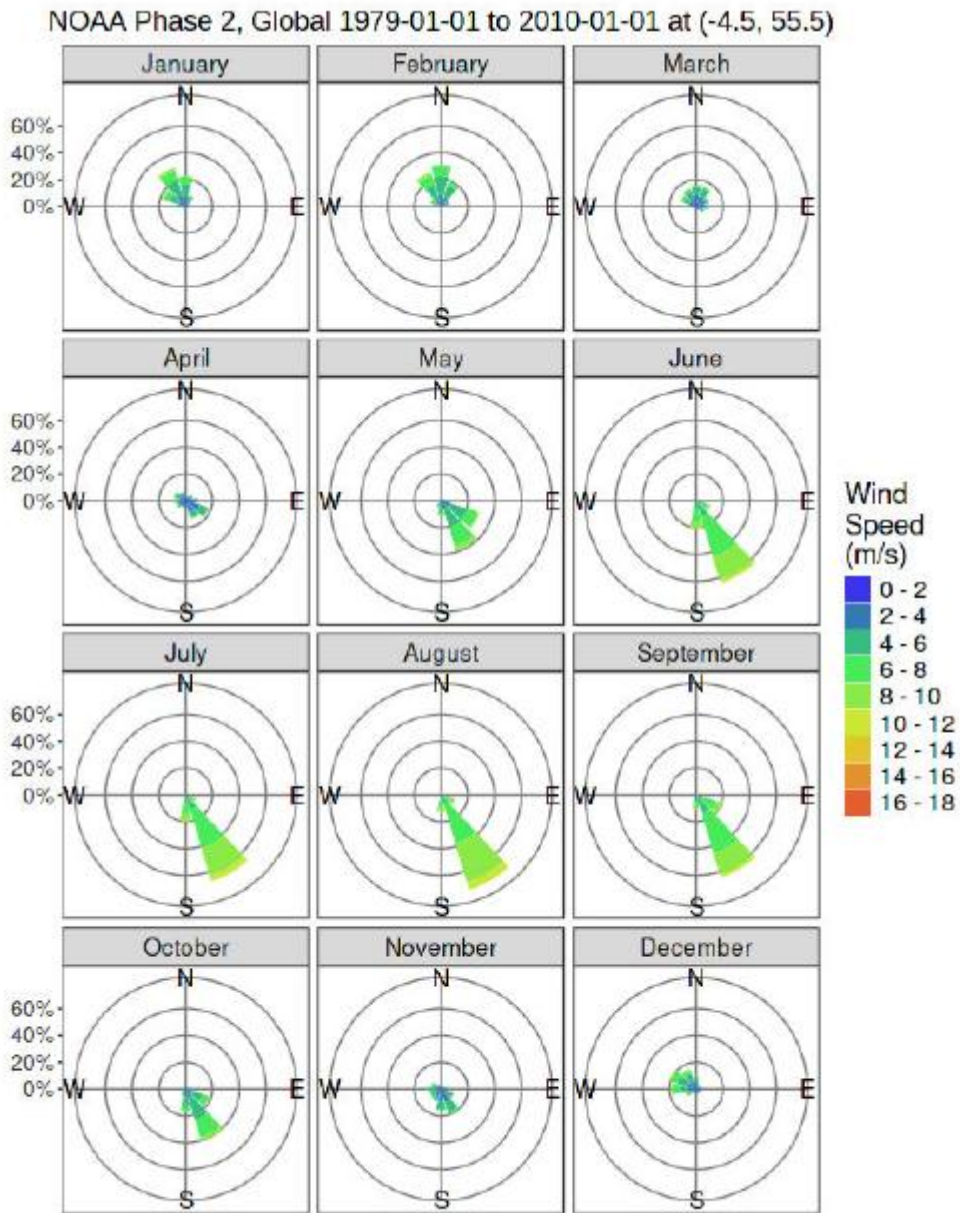


Figure 2.5: Monthly wind rose for The Seychelles illustrating the seasonal variability in wind strength and direction.

Figure 4.6.5_2.5

4.6.6 RESULTS

3.1 Effect of Reclamation on Currents

To consider the effect of the reclamation on ambient currents, it is useful to consider residual currents both before and after the construction of the reclamation. Residual currents are long-term vector averaged water movements and they represent the net flow over time. The residual currents are shown in Figure 4.6.6_3.2 and Figure 4.6.6_3.1 for the NW and SE Monsoons respectively. The figures show residual currents before and after construction and also the difference between the two current fields. In both monsoon seasons, the differences in residual current speeds before and after construction are greatest near the reclamation but do not exceed 0.1 m/s. In the midfield vicinity around the reclamation, differences are in the range of 0.03 m/s.

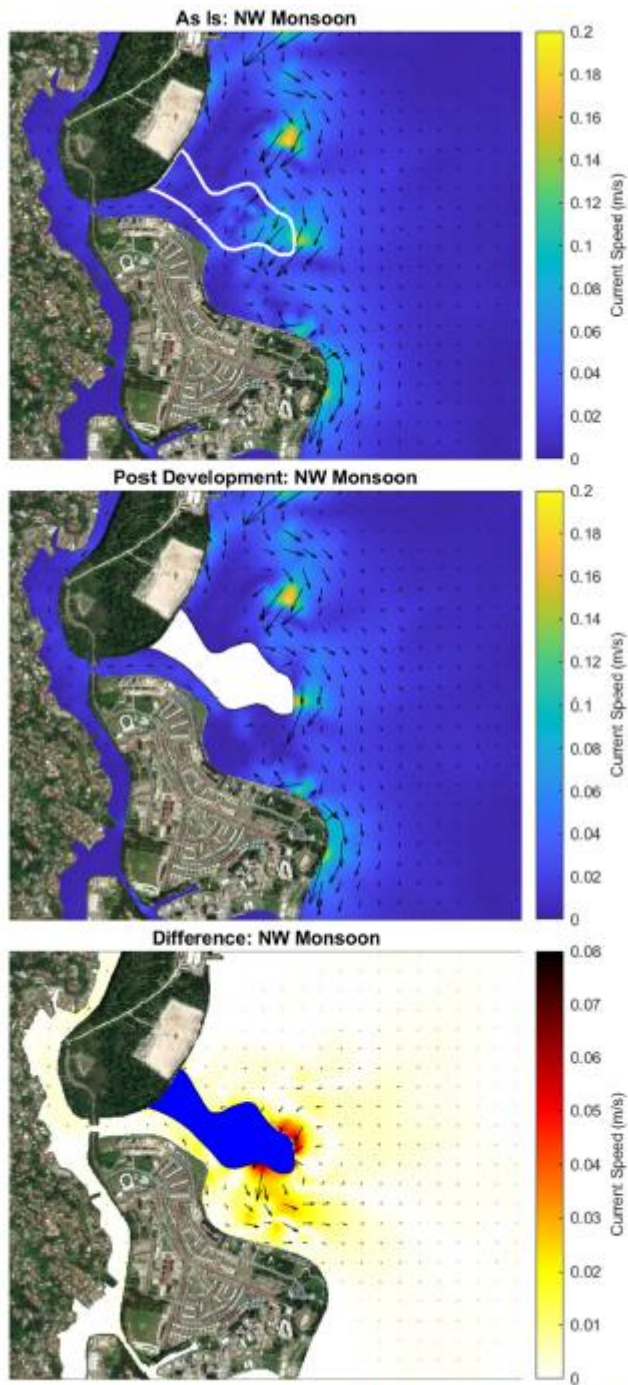


Figure 3.1: Residual currents during the NW Monsoon Season before construction (top panel), after construction (middle panel) and the difference between the two (lower panel).

Figure 4.6.6_3.2

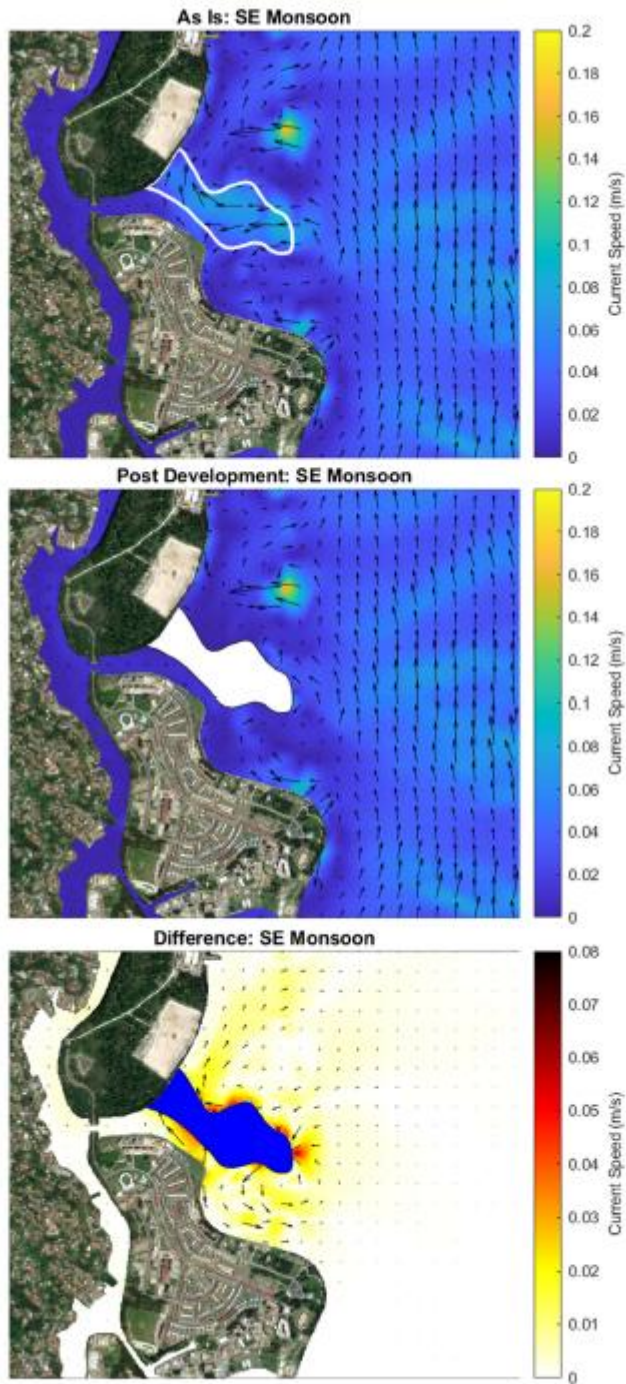


Figure 3.2: Residual currents during the SE Monsoon Season before construction (top panel), after construction (middle panel) and the difference between the two (lower panel).

Figure 4.6.6_3.1

4.6.7 SUSPENDED SEDIMENT

As outlined in Section 2.2.2, sediment will be released over 20 days during bund construction, creating a plume of suspended sediments around the dredger that will be transported by ambient currents. Fine sands will settle quickly near the dredger, and since the dredged substrate contains no clay, the plume will primarily consist of silt.

The dredging spill was modelled under two scenarios simulating waves and hydrodynamics during the NW and SE Monsoon seasons. Additional animations of the plume movement accompany this report. Figure 3.3 and Figure 3.4 provide summary plots of median, 95th percentile, and 99th percentile sediment concentrations for the NW and SE Monsoons respectively. As expected, the plume extends further south during the NW monsoon and further north during the SE monsoon. Since dredging is to largely take place behind the bund as it is constructed, much of the suspended material remains confined within the bund area. Even in the 99th percentile maps, the plume (>1 mg/L) is restricted to the surrounding waters of Perseverance Island and Ile Aurore.

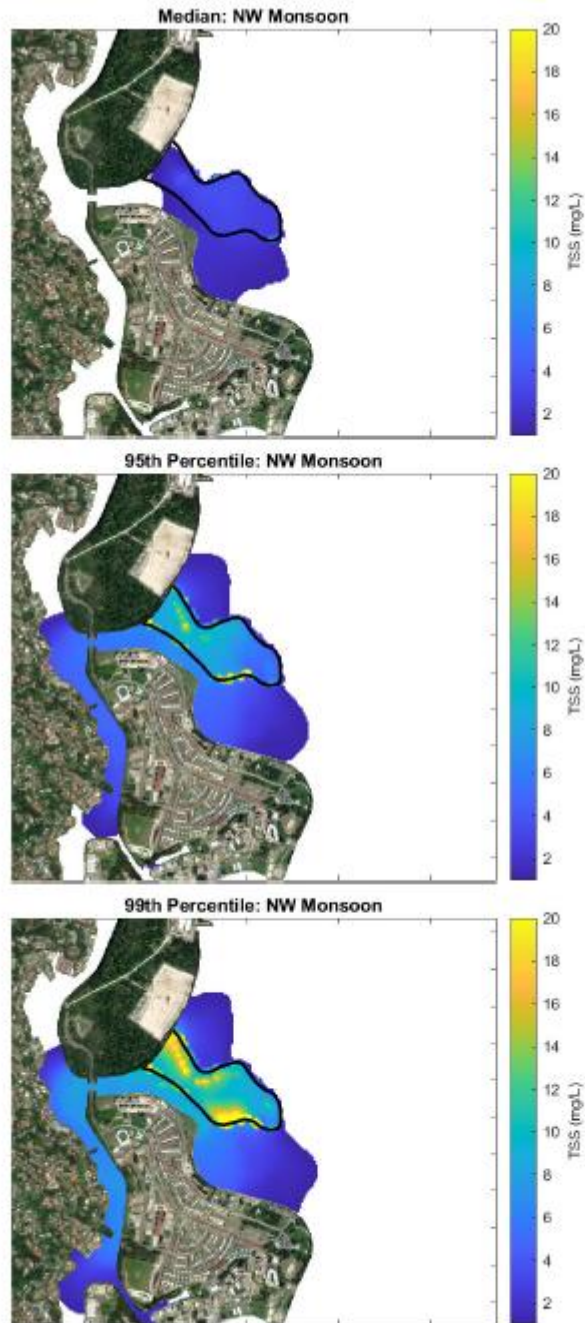


Figure 3.3: The plume of TSS (Silt) resultant from the dredging undertaken to construct the bund around the proposed reclamation assuming construction were to take place during the NW Monsoon. The plot only shows TSS concentrations above 1mg/L.

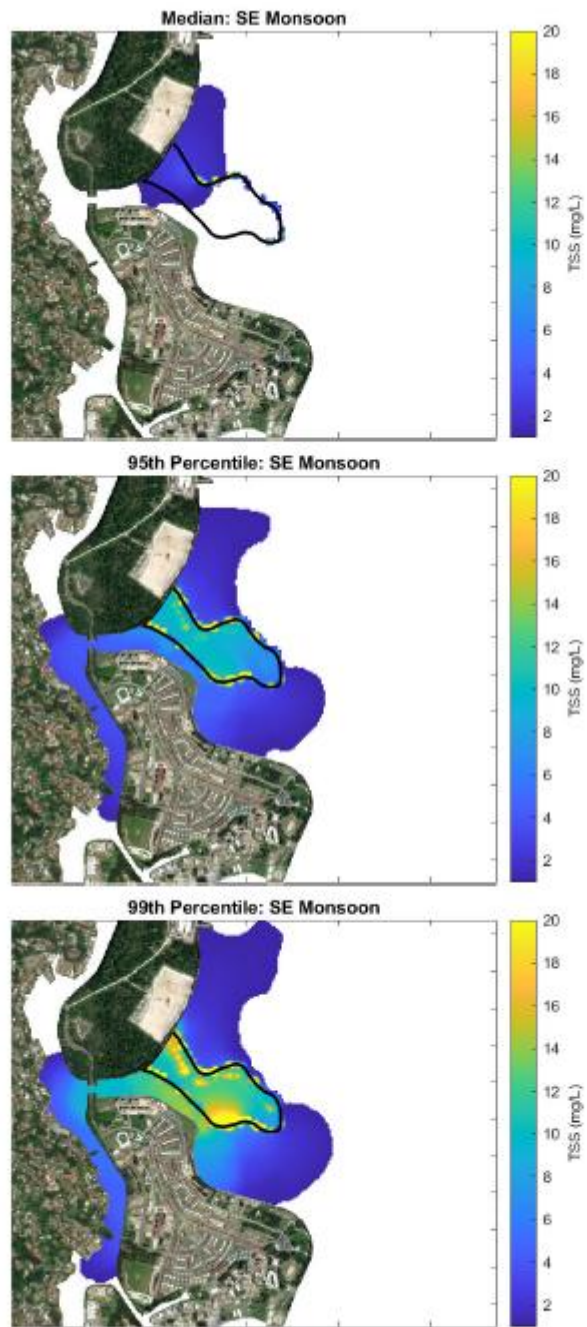


Figure 3.4: The plume of TSS (Silt) resultant from the dredging undertaken to construct the bund around the proposed reclamation assuming construction were to take place during the SE Monsoon. The plot only shows TSS concentrations above 1mg/L.

4.6.8 SEDIMENTATION

The sediment transport accounts for settling and resuspension of sediment. For the two Monsoon seasons, sediment thickness resultant from the dredging activity was tracked throughout the model runs. The final sediment thickness is shown in Figure 4.6.83.5 for the NW and SE Monsoon periods. In both scenarios, the thickness of the layer of settled sediment is very small and except for very close to the dredging activity, it is less than 1 mm in thickness.

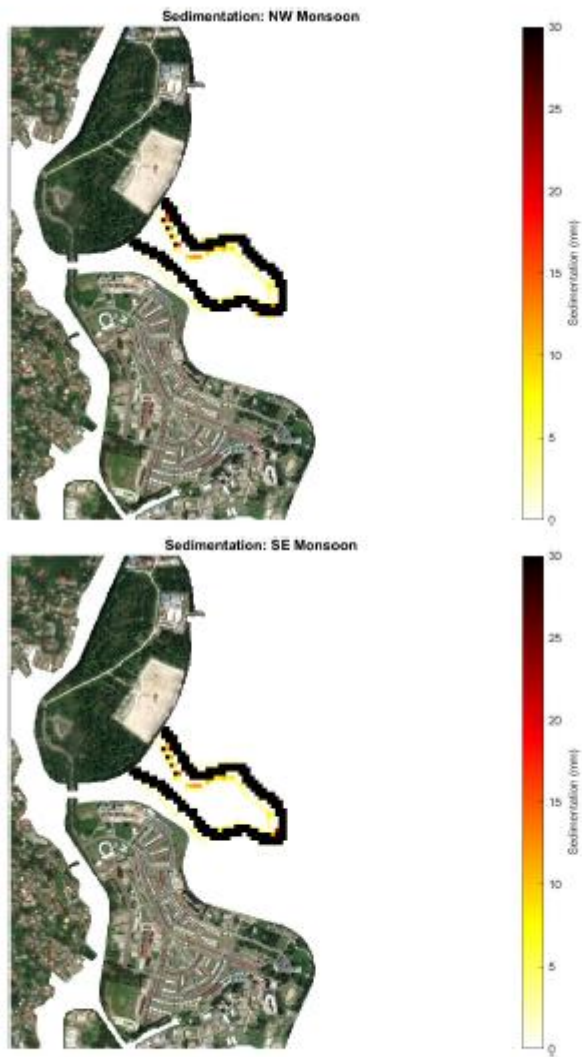


Figure 3.5: The thickness of the layer of settled sediment due to dredging activities carried out in the NW Monsoon season (upper panel) and in the SE Monsoon season (lower panel).

Figure 4.6.8_3.5

4.6.9 CONCLUSION

A coupled wave and hydrodynamic model were developed to drive a subsequent sediment transport model to simulate the dynamics of the suspended sediment plume resultant from dredging activity the associated with the Ile Aurore reclamation.

The model was used to simulate:

- The hydrodynamics before and after construction of the reclamation and
- The suspended sediment and sediment accretion associated with the dredging activity.

The modelling was undertaken for both the NW and SE Monsoon seasons. In both monsoon seasons, the differences in residual current speeds are greatest near the reclamation but do not exceed 0.1 m/s. In the midfield vicinity around the reclamation, differences are in the range of 0.03 m/s.

The suspended sediment plume extends further south during the NW monsoon and further north during the SE monsoon. Since dredging is to largely take place behind the bund as it is constructed, much of the material remains confined within the bund area. Even in the 99th percentile maps, the plume (>1 mg/L) is restricted to the surrounding waters of Perseverance Island and Ile Aurore. In both seasons, the thickness of the layer of settled sediment associated with the dredge plume is very small and except for very close to the dredging activity, it is less than 1 mm.

5. CONSULTATIONS AND PARTICIPATION

The sections below describe the methodology and scope of the consultation process indicating the approach that was used to identify, evaluate and recommend mitigation measures for social impacts.

Consultations with key stakeholders is a continuous process that was carried out throughout the ESIA process. During the study, stakeholder analysis was undertaken to identify Interested and Affected Parties (I&APs) to the project. Consultation was critical in enabling the understanding of the local conditions and socio-economic impacts and feasible mitigation measures. Consultations were carried out through;

- Government Scoping Meetings
- Focus group meetings
- Community level consultations (see focus group outcomes)

The three project sites for this Environmental and Social Impact Assessment (ESIA) are all located on Mahé with community, commercial and residential components. However, no stand-alone socio-economic data for these regions are available. Therefore, the section below will provide only an overview of the country in general with statistics pertaining to the area of influence.

5.1 GENERAL CENSUS INFORMATION

5.1.2 POPULATION, EMPLOYMENT AND HOUSEHOLD SIZE

As per the 2022 census count, the population of Seychelles has passed the 100,000 mark and stands at 102,612, with 56,266 males and 46,386 females. The majority of the population lives on Mahe.

The country's labour force, which comprises both employed and unemployed persons, is made up of 58,660 individuals, of whom 97.2 per cent were employed and 2.8 per cent were unemployed. The Seychellois population accounted for 69 per cent and the non-Seychellois population accounted for 31 per cent. Among the employed Seychellois, the contribution of men and women towards the economy was almost equal: 49 per cent were male and 51 per cent were female.

At the national level, the average household size recorded in the 2022 census was 3.0 persons. The overall census results show that there are more female-headed (53.3 per cent) than male-headed households in Seychelles.

99 per cent of households use electricity for lighting, with 98.9 per cent using electricity from the Public Utilities Corporation and the remaining 0.1 per cent using electricity from generators. Most households (96 per cent) use LPG (gas) as the main source, followed by electricity (3.1 per cent).

5.1.3 LAND OWNERSHIP

The project sites are located on government or state-owned land.

5.1.4 RESETTLEMENT

The assessment has not identified any stakeholders who will require resettlement as a result of the project. However, it was assessed that the reclamation at Providence Laguna would require the Seychelles Aquaculture Department to relocate their water intake pumps further out to sea once the project began.

5.2 STAKEHOLDERS' CONSULTATIONS OUTCOMES

5.2.1 SCOPING MEETING

The scoping meeting for this project was held with government stakeholders. The representatives included government authorities and the environmental consultants Eco Sol who are appointed for the project. Meeting participants were provided with a comprehensive presentation of the project concept and components by government and SIA representatives. The environmental consultant Mr Nimhan Senaratne also presented the environmental and social aspects of the project including the environmental surveys and stakeholders' consultations that were to be undertaken. A Q&A session followed thereafter, and the meeting concluded at 11.30 am.

Thematic Area	Stakeholders concerned	Key Concerns Raised	Action Required
Oceanography modelling, sediment dispersal, current changes	MACCE (CCED)	Methods to mitigate sediment washout during reclamation required Concerns raised on sand extraction impacting the marine environment through use of dredging Further dredging will alter the physical characteristics of the environment Ecologically sensitive habitats will be affected by the changes, such as seagrass beds, which might possibly have an effect on the food web What are the proposals to compensate for the environmental loss?	Have these comments been clarified with the CEO for PetroSeychelles?
	MACCE (BCM)	Ensuring water circulation in and out of the lagoon is key to prevent accumulation of seaweed and marine litter Construction of bunds might lead to a high generation of sediment plume Appropriate measures to release mega fauna such as sea turtles who may be trapped in the bunds must be proposed	
	Planning Authority	A pre assessment and simulation of sand current and sea movement to be conducted Modelling of wave propagation and wave velocities to be conducted Proposed reclamation to state seagrass losses and timeframe for restoration Ensuring water circulation in and out of the lagoon was also noted here	
	PetroSeychelles	Northern sand extraction zone to be further away from Mahe to prevent severe erosion to BV bay The extension proposed at Ile Aurore should be parallel rather than perpendicular to prevent groyne effect Providence Laguna should be shifted southwards to prevent further erosion to Cerf Island	
Artisanal fisheries, communities, residences, private sector	Tourism Department SEYCATT	Requested a high value low impact approach to the project with emphasis on sustainability Further, a balance between the environmental needs and the advancement of industry to be considered	Have these comments been
	MACCE (BCM, EAPS)	Channel is heavily used by fishermen and boat owners who will require consultation There may be a reduction in the daily catch forcing fishers to go out further or double their efforts, thereby spending more fuel	

		<p>One on one scoping is recommended, especially for communities closest to the project</p> <p>To what extent will public be able to participate in the process?</p> <p>Proposed land use for Ile Aurore includes tourism so have the effects of reclamation on this been considered?</p> <p>What are the permitted working hours given the proximity of the reclamation to communities?</p>	clarified with the CEO for PA?
	Planning Authority	<p>Social impact assessment required</p> <p>How many return land schemes to GOS have been successful and how can this address the need for more reclamation for business?</p>	
Ecology, footprint, benthic and losses	MACCE (CCED, BCM)	<p>Bathymetry and benthic survey with mapping</p> <p>Developer to present a zonation impact scheme</p> <p>Provide a site waste management plan</p>	
Monitoring, administrative and permit needs	MACCE (CCED)	<p>Ongoing monitoring and evaluation reports</p> <p>Why has developer not proposed alternate sites given the Government's declaration to protect 100% of the seagrass meadows?</p>	Have these comments been clarified with the CEO for PA?
	SMSA	<p>Coordinates and notification of dredging activity to be communicated to SMSA prior to operations</p>	
	PUC	<p>Developer to liaise with PUC to maintain utility connections at Providence Zone 5</p> <p>Developer needs to make provisions for adequate utility corridors in the design</p> <p>Developer needs to contribute towards the cost of reinforcing existing networks</p>	
	SFRSA	<p>A second route to the island in case of emergencies and fire hydrants installation</p>	
	Planning Authority	<p>An audit assessment of previous land reclamation to be done</p> <p>Masterplan status of Ile Aurore requested Responsible Ministry to provide demand for light Industry and Industry and show how proposed project is addressing space to be delivered in the SSLPUD per district</p> <p>SCCA lights to be integrated in Zone 30 means there will be height restrictions, so how will reclamation be economically viable when there are development constraints for future development?</p> <p>Is Victoria Waterfront reclamation being considered?</p>	
No Comments	DA Mont Fleuri		

Table 5.2.1_1

5.2.2 FOCUS GROUP MEETINGS

Following the government scoping meeting, MACCE instructed the Client and EIA consultant to conduct a set of focus group consultations with residents, businesses and stakeholders. This section outlines the feedback received from these consultations.

Stakeholder	Mode of Consultation	Feedback
SLTA/DOT	Focus Group	These stakeholders attended the meeting and queried about the impact on the roads that were to be used on the East coast for the North west and Western burrow zones. It was explained by the EIA consultant that the distances are too far to have an impact. It was noted the bridges connectivity to these islands need to be properly discussed with LTD. There was also a discussion on the breakwaters' offshore protection for roads overall on Mahe.
IEA	Invited for consultation	Requested Scoping form via email, no further response
DICT	Meeting	The main concern for this stakeholder involved the buried (Internet) cable that goes near Ile Aurore and how the reclamation would impact their linkages. The stakeholder pointed out that it was not a simple cable that can be cut and re-tied, noting that major costs were involved if the cable was ever to go out of service, with the need to mobilize the cable laying ship if that happens. The stakeholder further queried whether the reclamation project was in danger of not meeting the ICPC set back requirements. The participants also provided the KMZ files associated with the PEACE cable (see Annex)
Eden Island VMA	Invited for consultation	No Response
National Sports Council	Invited for consultation	It was communicated to the EIA consultant that the CEO was out of the country at the time of the consultation
SIB	Focus Group	SIB noted they were in favour of the development, and further remarked that the risk the project carried vis-à-vis the Internet cable was one that can be easily adopted by Government and safeguards can be applied to deal with it. SIB stated that investors have asked for the shape of the reclamation as well as deep water pockets around it to consider potentially Marinas in the future. It was noted that was no Master Plan Yet to confirm design of Tourism on Island. It was further noted that there was no LUP yet but Government had considerations for the potential of the reclaimed bit.
SCAA	Focus Group	No Response to a reschedule request, but an independent meeting was held to discuss the SCAA component of this reclamation project given that it was considered to be a no-go component under this ESIA
SPGA	Focus Group	The stakeholders indicated they had no major issues with respect to the overall project. However, with respect to the reclamation proposed for Ile Aurore, they noted have a pilot study ongoing for seagrass propagation and would welcome a biodiversity offset in terms of a monetary contribution to their current existing coral plantations, reef restoration and seagrass promulgation pilot project. They requested information about the coral reef programmes be provided within the ESIA. Queried the sediment trajectory from Ile Aurore and risks to St Anne Marine Park given its importance as an MPA. <ul style="list-style-type: none"> It must be noted that SPGA recently planted around 200 corals in the St Anne Marine Park
Local Government and DA's	Focus Group	The Following persons attended this meeting: <p>DA Roche Caiman – Mrs. Maria Thomas DA Cascade – Ms. Begitta Melanie DA English River – Ms. Jancy Volcere DA Anse Etoile – Ms. Shirley Mussard DA Bel Air – Mr. Christophe Madeleine Office Manager Perseverance 02 – Ms. Chantal Mahoune Office Manager Perseverance 01 – Ms. Fraxidis Francoise</p> <p>The rationale for Reclamation for industrial usage when housing is still a more important issue was discussed by the participants. It was also queried whether there would be public meetings in each district for this or just a public inspection/review of the EIA documents.</p> <p>Stakeholders also discussed the project in relation to the loss of seagrass that would occur, given the Government's commitment that all seagrass meadows would be protected by 2025.</p> <p>The stakeholders also queried whether the local contractors would get opportunities for wealth generation during reclamation construction. To that end, they asked whether a reclamation Contractor had been appointed. The EIA consultant then explained that the project was still in planning stage.</p> <p>The DA for Anse Etoile noted apprehensiveness about the backlash the project might receive from the fishermen community there, as artisanal fisheries was often the only livelihood for many that own small boats.</p> <p>After the Ile Aurore Reclamation, stakeholders queried where the fishermen would pass in order to get to the North and whether they would have to go all the way round. The EIA consultant explained that this would not be the case as the channel will be done on both sides of island for navigation.</p>

National Assembly MNAs	All MNAs on the stakeholder consultation list were invited for this focus group meeting (See Gallery)	<p>Focus Group meeting was conducted with the Members of the National Assembly with the presence of the CEO for SIA and the EIA consultant.</p> <p>CEO Shah thanked the participants for their attendance and noted the need for reclamation, which would bring with it the diversification of the economic portfolio, with only Ile Aurore earmarked to have high end tourism therein.</p> <p>Participants discussed the methodology of the proposed project whereby the EIA consultant confirmed the offshore sand extraction EIA was approved by Government. Stakeholders mostly noted that they understood the economic rationale for piggy backing off the latter project as a means to reduce the cost on Government.</p> <p>Hon. Larue asked about the cables distances and the setback required for the project. The EIA consultant noted that the Ile Aurore reclamation barely made the distance required by the setback and risk mitigated by the government. This was to be considered during the EIA, especially in the dredging plan.</p> <p>MNAs from Pointe Larue and Cascade respectively noted their districts had rocks and queried whether the project could break these rocks. The EIA consultant noted that the project required much larger volumes that would necessitate the use of quarries to provide these large supplies. Therein, the CCCL situation was also discussed as it provided concerns for the economy of scales and availability of such resources for the project.</p> <p>Members commented on the impact on the aesthetic and visuals from the reclamation between Pangea and Eden Island. It was noted that the land use plan would need to be specific to mitigate these impacts, and the circumference of the reclamation would not have any intrusive smoke stacks or large noise emitting workshops. Thus it was concluded that the views from Pangea and Eden Island would not be impacted by the proposed project.</p> <p>MNAs further queried the Jan de Nul proposed timelines, arrival of barge/dredger and how long it will work in the Seychelles to do these reclamation projects as well. This would be provided by SIA in due course which would showcase the finite timeline for only the sand extraction, and the reclamation plus the sand component as well.</p> <p>Concerns were raised around the nearby Marine Park and Cerf Island especially with respect to the reclamation targeted around Pangea. Here, the MNAs wanted to know what was being done to scope the Cerf Island residents. It was noted the Cerf island residents had not featured on the EAPs stakeholder list but could always be consulted at a later stage.</p> <p>MNAs noted the government's desire to decentralize the Industrial Estate and have mini estates in larger districts. While that could form part of the national development plan, the CEO for SIA noted that it was presently challenging to create these estates given the strict Land Use plan in the districts. Small estates of this nature would prevent tourism, farming and place other constraints on land use planning to put decentralized estates around Mahe. From an economic viewpoint, new reclaimed islands hugging in and around the existing reclamation zones targeting the continuity of the industrial land use plan might be a better option than to find available and limited land for industrial use in the districts.</p>
SEPEC	Invited for consultation	No Response
CEPS	Invited for consultation	No response
Ile Aurore Management Condominium Board of Directors SFA + Aquaculture + Social Affairs + SIA + Public Health+ Pat Lablache + DRMD	Focus Group	<p>This combined focus group was to attempt to get the final set of government agencies for consultation. The meeting was attended by the CEO of SIA and the EIA consultant.</p> <p>Four stakeholders from the Ile Aurore Management Condominium Board of Directors and one stakeholder who lives in the complex submitted a scoping form (see annex). This stakeholder queried the water in and outflow between the sea and Laguna. She further noted the area sometimes experienced overflow during the monsoon season. Further clarity was requested on the sewage aspects following the reclamation.</p> <p>CEO Shah thanked the participants for their attendance and noted the need for reclamation, which would bring with it the diversification of the economic portfolio, with only Ile Aurore earmarked to have high end tourism therein.</p> <p>Method of reclamation was also outlined by Mr Pat Lablache. As a reminder it is repeated below:</p> <p>Aurore: partial extension of 24 hectares of land is proposed to be reclaimed in a shallow area. The site featured a water pipe feeding Ile Aux Cerf and other islands of the marine park and the electricity cable which would require close consultation with PUC on these two infrastructures. Mr Lablache also went on to detail the methodologies and equipment to be used for the reclamation, as well as expected timeframe for the project.</p> <p>Zone 20: Eden Island and Vijay undertook a reclamation under a PPP with government, which culminated in government gaining 30,000 sq m of land to offer to Class II contractors and other industries. This is a continuation of the prior reclamation and 10-11 hectares is proposed to be reclaimed there. Again, it is in shallow water and cost-effective to reclaim as a result.</p> <p>Providence Laguna will consist of a reclamation of 240,000 sq m and will extend adjacent to Eden and Pangea. This site is also in shallow water and will have a 40m buffer between the previously reclaimed area in Providence, adjacent to the highway.</p>

	<p>The proposed timeframe would be less than 5 months and would use 1/6th of the amount of sand that was required from the previous reclamation project. The project does not require cutter dredger and instead, opts for a less intrusive Trailing Suction Hopper Dredge (TSHD). As a result, already reduced the environmental impact of the project. To that end, Mr Lablache also apprised participants of the offshore sand extraction project being undertaken by IDC which would serve to replenish the sand required by the construction sector. The backhoe dredger would be used for creating the outer bunds of the reclamation and will work closely with contractors working on the rock armouring in a harmonised manner to quickly and efficiently rock armour the bundings and prevent leachate of sediments into the marine environment.</p> <p>SFA and Aquaculture representatives noted that the area close by to Providence Reclamation zone is their actual intake water zone by sea pipe. They noted that they did not go as far as the recommended distance and only placed the pipeline at the edge of the proposed reclamation extension. Thus, their concern was that any movement there will ruin water quality for the aquaculture intake ponds and recirculating water through the system. They were also concerned about the expected Plume spread for the intake pipe location and whether this will affect water quality for aquaculture intake as per above.</p> <p>SFA also has a small port expansion plan and Mr Lesperance was requested to provide the EIA consultant with the details about this plan such that it could be assessed against the reclamation project and whether the reclamation will cause any adverse impacts to happen. Such concerns raised were whether the port depths would suddenly get shallower by siltration, whether changes to the current pattern would cause SFA to require continuous dredging needs etc. Mr Lablache explained that even after the tsunami, Government had conducted a bathymetry survey and NO CHANGES were expected whatsoever.</p> <p>Social Affairs also commented on the social impacts of the reclamation, which focused on queries relating to the social impacts to housing and residences by the reclamations, the social impacts to Eden Island and tourism sector based on the providence reclamation and proximity, and whether Cerf Island residents would be scoped for their input. Further, it was noted that public meetings should be the norm for such large projects, however the EIA consultant noted that MACCE had mandated these focus groups and smaller consultations to elicit better information from the participants.</p> <p>One of the stakeholders from the Ile Aurore Management Condominium Board of Directors, namely charged with oversight of Block Garden 9, queried around the noise and vibrations, dust and disturbances the project would bring. It was noted that the view impairments for her block would be minimal as it faces the channels so no impacts to view.</p> <p>The impact from the reclamation on the Channel and its usage by local fisherman and artisanal fishermen as means of travel was also queried.</p> <p>The stakeholder also wanted to know how access to Reclaimed land would be done whether via bridge or road.</p> <p>The Land Use Plan for Ile Aurore was also questioned and its synergy with the reclamation project was also discussed. Here, stakeholders remarked on the currently mixed use type which was not viewed as a well ordered plan and no input from Government was forthcoming as to expected development plan of this island. Therefore, more insight was requested into proposed LUP on the newly reclaimed Extension to Ile Aurore now, whether it will be G or G + 1,+ 2 and how high will buildings be on that reclamation, also in relation to the residential components.</p> <p>Based on Reclamation shape and protrusions, the stakeholders also discussed the water regime circulation and impact to the water evacuation process of water from the Lagoon behind Ile Aurore, given the current smell, anoxic condition as well as how long the water remains red from earth wash done during heavy rains. Stakeholders also raised the concern around the presence of 'LANMOUS,' a particular kind of seaweed used by fisherman for their traps, and asked whether these be impacted from sedimentation and plumes.</p> <p>Another stakeholder from the Ile Aurore Management Condominium Board of Directors Carl Mills (Apartment Lot 3), voiced his concern that an owner having paid a few million rupees for a prime view would now lose same due to the reclamation. He queried around the price to pay for loss of sunrise views on the East coast for the Condominium owners now that Reclamation will be having certain impacts on the building heights.</p> <p>Mr Mills further noted that project would bring a loss of Seychelles' natural resources such as ecological niches, namely seagrass, fish and coral reefs.</p> <p>Ile Aurore, it was noted, was advertised by SIB and this project was seen as a 'fait accompli' with the ESIA just being viewed as a procedural requirement that did not provide a real chance to look at pros and cons to make viable decisions.</p> <p>Mr Mills was also concerned about the waste water and effluent flow from the High end development that would come on the reclamation versus the existing marine systems round Ile Aurore.</p> <p>Another stakeholder from the Ile Aurore Management Condominium Board of Directors Mr Guy also voiced his concern that the scenic views out to the horizon from his current condominium block would not be lost. He queried whether Ile Aurore reclamation was set in stone with respect to the shape, direction, size and indeed positioning, as a result. It was noted the obstruction of view is a major revenue loss for current owners who may decide to leave their homes for other locations and lease it out instead.</p> <p>It was noted that there will be an overall reduction in the available space for the lagoon to flush out now that reclamation will come into play. Stakeholders queried how does that impact the flooding and other related issues of red earth wash down etc from Dam la Gogue works as a result.</p> <p>It was also queried whether the reclamation was being fully financed by government. If not, what are these payment financing modalities? What is the direct benefit to Seychellois from the Aurore Reclamation Project?</p> <p>Stakeholders also queried whether the Ile Aurore reclamation development plan could be provided on a map. Here, the CEO for SIA noted it was still at tender no awards yet and no design, and this would be the basis of another ESIA.</p> <p>Stakeholders then discussed the existing reclaimed land. Ile Romainville, it was noted, was a waste of space, time and money for a renewable power island that contributed practically nothing to the national grid.</p>
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Dr Mortimer	Invited	Indicated would not be able to attend
Fishermen's and Sea Cucumber Associations:	Invited (see below)	
Sea Cucumbers	All Fishermen's and Sea Cucumber Associations on the stakeholder list were invited to attend the Focus Group meeting (See Gallery)	<p>The discussions for this session revolved around the artisanal fisherman's involvement in the coral restoration projects as a means to further their livelihood generation during and after the reclamation projects. Here, stakeholders mentioned they were working with SFA on several projects that involved the preservation of ecological niches. It was noted that budgetary considerations of SEYCCAT grants could be orientated for such projects which would alleviate some concerns the stakeholders felt around the reclamation project impacting their core livelihood. These projects were targeting mainly the zones in front of Eden and Ile Aurore, given the local fishermen's livelihoods in this area would be mainly impacted during construction.</p> <p>One participant commented on the noise and water pollution that would affect the area. It was noted by the EIA consultant that the methodology for reclamation had changed to mitigate this. The methodology now involved having offshore sand pumped in, creating of bunding and rock armouring to prevent leachate. Stakeholders also queried whether boat yards and boat repair zones would be possible under the project. Further, the order or protocol that would be in place for the purchase or tender of new plots was also queried. It was noted the current ESIA would not focus on the objects, leasing or providing of such infrastructure for people</p> <p>It was noted that Ile Aurore was where most fishers drop their traps. Once the corals are impacted, the stakeholders voiced concerns about the subsequent impact on their livelihoods. It was suggested that other nearby zones would be made available but most stakeholders noted they were territorial about their fishing locations.</p> <p>To counter that, it was suggested that similar to the Eden Island development experience, a built environment would also attract ecological species to come to the rock armouring which might alleviate the concerns stakeholders felt around the impact of the reclamation on their livelihoods.</p>
Roche Caiman Fishers		
Anse Etoile Fishers		
La Retraite Fishers		
Cascade Fishers		
Second meeting with Fishers and SFA	Fishermen Associations and SFA	The second meeting was held upon the request of some fisherman who had queried the project at SFA level. This meeting took place on 24th September at SFA offices, where the project was presented to the stakeholders. The participants re-iterated their need for compensation mechanisms and requested an allocated fishing ground during and after the project implementation. It was agreed that the MSP Initiative would need to be contacted with regard to the zoning requirement.
Pangia Beach Meeting	Focus Group Meeting	The group expressed strong opposition to the proposed reclamation for industrial purposes near their properties, citing concerns about noise, visual pollution, and potential devaluation. They stated that their investment was made with the understanding that adjacent development would be residential and more compatible. They also expressed disappointment about losing their ocean and Cerf Island views. Although zoning adjustments were suggested to limit industrial activity on the side facing them, they indicated a lack of trust in the Government's ability to enforce such measures. Additionally, they feared that the project could prompt many Pangia Beach owners to sell their units. Overall, their feedback was entirely negative, with no positive comments or suggestions offered.
Meeting with Land Applicants	Focus Group Meeting	Minister Devika and the Industrial Estates Authority (IEA) held two meetings in August and October 2024 to discuss the issue of land scarcity for industrial purposes and the Government's plans to address it, with a primary focus on reclamation projects. The minutes of meeting in the Annex outlines the key points discussed during these meetings.

Table 5.2.2

GALLERY OF SCOPING CONSULTATIONS



5.2.3 MINISTERIAL MEETING

On March 24, 2025, a Ministerial meeting was held to discuss the findings of the environmental studies. The attendees included the Minister for Lands and Housing Billy Rangasamy, PS for Environment Mr Denis Matatiken, CEO of SIA Mr Jitesh Shah, CEO of SIB Ms Anne Rosette, DG for MACCE Mrs Nanette Laure, BCM Director Mr Rodney Quatre, and EIA Consultancy Mr Nimhan Senaratne. This section provides an overview of the meeting discussion.

Agenda

The ORCAS team from New Zealand provided an assessment of sediment migration in relation to the marine park, concluding that the movement of sediments is minimal. Due to the strong southeast monsoon currents, the impact on recreational fishing is also expected to be negligible. Specifically, ORCAS estimated that the change in fishing conditions for the fishermen will be minimal and insignificant when compared to factors such as boat speed and tidal currents.

Regarding sedimentation concerns, it was noted that only small levels of silt and clay are present, posing a negligible risk to the underwater submarine cable situated outside Perseverance. However, the team was requested to look at the location of the cable in relation to the plume.

Concerns were raised about potential stagnation in the lagoon due to blocked channels, which could lead to reduced water quality if not properly managed. Addressing this issue will be crucial to maintaining the ecological balance and preventing long-term degradation of water conditions.

The marine team provided an overview of all three areas. They reported that seagrass and coral reefs in the Aurore area are affected by ongoing developments. To mitigate the impact, a proposal was made to translocate affected marine habitats to the marine park.

The participants discussed how Romainville indicated successful coral regrowth after past reclamation, suggesting that similar restoration efforts could be implemented in Aurore. The majority of sediment is expected to remain within the lagoon, minimizing dispersion beyond the immediate area. At Providence Laguna, it was noted that the proximity of SFA's aquaculture intake pumps to the proposed relocation meant they would have to relocate these pumps in future.

To address sedimentation risks, proposed mitigation strategies include the deployment of sediment curtains, real-time environmental monitoring, and storm surge management measures. These efforts aim to ensure that sedimentation remains controlled and does not adversely affect marine biodiversity.

Social and Economic Considerations

The meeting highlighted concerns over the potential loss of breeding grounds for marine species as a result of the development activities. However, current observations indicate that fishing activity in Aurore is relatively minimal compared to Pangea, which may reduce the social impact on local fishing communities.

To minimize ecological and social disruptions, there may be a need to adjust project plans to better protect coral reefs and address community concerns. As part of the offsetting strategy, it was proposed to increase the dredging scope at Zone 30 and reduce the scope at Providence Lagina. This proposal was put forward to compensate for potential environmental impacts.

With no further matters, the meeting concluded at 12.50pm.

5.3 POSITIVE SOCIO-ECONOMIC IMPACTS

The ECP4 government-funded reclamation projects can have transformative socio-economic impacts, serving as vital catalysts for economic growth and revitalization of the country's economy. These projects generate new land into valuable real estate, serving to increase the overall land supply and enable the development of new commercial and residential areas. This will in turn stimulate demand for local businesses, including construction, real estate, retail, and service industries, which can thrive on the new consumer bases created by the reclaimed areas. The ripple effect of such development tends to spread throughout the economy, boosting local economic activity and increasing tax revenues for governments, which can then be reinvested in other public services.

Employment is another critical area that can be positively impacted by reclamation projects. From the planning and construction phases to the long-term operation of the newly developed areas, these projects generate significant job opportunities across various sectors. Initially, they will create construction jobs, directly benefiting workers in engineering, architecture, and related industries. Once the development is completed, new businesses in the reclaimed areas, such as retail shops, offices, and restaurants, will create permanent employment opportunities. Additionally, these new jobs tend to offer a diverse range of roles, accommodating workers with varying skill levels, from low-skilled to highly specialized professionals. This influx of employment reduces unemployment rates, raises household incomes, and can lift communities economically, thus serving to enhance their overall quality of life.

Future development prospects are also enhanced through reclamation projects. These projects can set the foundation for long-term sustainable growth by expanding a country's current infrastructure capacity and increasing its capacity to accommodate future population growth. The creation of new spaces provides an opportunity for implementing modern, eco-friendly technologies and sustainable urban planning practices. Additionally, such projects enhance a country's ability to attract international investors looking for modern, well-planned spaces, further fueling future economic growth. This blend of socio-economic benefits, from immediate job creation to long-term development opportunities, makes government-funded reclamation projects a strategic investment with lasting positive impacts.

5.4 NEGATIVE SOCIO-ECONOMIC IMPACTS

However, government-funded reclamation projects, while potentially beneficial, can also have significant negative socio-economic impacts.

One of the primary concerns of the reclamation project was raised by the fishermen who were consulted during the scoping phase. According to them, the project might cause economic disruption as they depend on coastal and marine resources for livelihood generation. Reclamation often involves large-scale alteration of coastal ecosystems, leading to the destruction of fish habitats, coral reefs, and mangroves. This could directly affect the livelihoods of fishermen, who rely on these ecosystems for their income and sustenance. To that end, stakeholders have already made compensation requests. As fish stocks decline due to habitat loss and pollution from reclamation activities, fishing communities may face long-term unemployment and financial instability, which can trigger wider social and economic issues. The displacement of these communities and their economic activities would also reduce the cultural heritage tied to traditional fishing, further marginalizing small-scale industries. To counter that, it was suggested that similar to the Eden Island development experience, a built environment would also attract ecological species to come to the rock armouring which might alleviate the concerns stakeholders felt around the impact of the reclamation on their livelihoods.

Another issue that arises from large reclamation projects is the employment of foreign workers, which can undermine local employment opportunities. Construction companies often make use of foreign labor from abroad to reduce costs and meet labour needs, especially for low-skilled jobs. This practice can lead to reduced job opportunities for local workers. The influx of foreign labor can also strain social services and infrastructure, such as housing and healthcare as these workers increase the demand for such services in areas where resources may already be stretched thin. In some cases, social tensions between local communities and foreign workers may emerge, exacerbating issues of inequality and community resentment, potentially leading to social unrest. Where foreign workers are required, government should ensure that the contractors provide proper housing, healthcare, and social services, reducing the strain on local infrastructure and minimizing social tensions.

Additionally, while reclamation projects can promote future development, they also pose long-term risks if not carefully managed. The creation of new land in coastal areas may cause unforeseen or unpredicted environmental degradation, such as coastal erosion, flooding, and loss of biodiversity, which would undermine intended future economic growth and stability. Moreover, rapid urbanization following reclamation projects can lead to overburdened social infrastructure, such as transportation networks, hospitals, and schools, if not properly planned. These challenges can hinder the region's sustainable development goals, as the pressure to accommodate growing populations may outpace the capacity to provide essential services and infrastructure.

Without proper planning and regulation, government-funded reclamation projects can generate unintended consequences that overshadow their initial economic promise, creating long-lasting socio-economic challenges. Thus, a series of well-planned measures can be implemented to balance development goals with environmental and social concerns. By proactively planning for these challenges, government-funded reclamation projects can minimize negative impacts while fostering sustainable development.

5.5 CUMULATIVE IMPACTS

The cumulative socio-economic impacts of government-funded reclamation projects under the ECP4 program reflect both transformative potential and complex challenges. On the positive side, these projects act as powerful engines of economic growth, converting unused coastal zones into valuable land assets. This newly created land not only increases the national supply of developable space but also paves the way for large-scale commercial and residential developments. In turn, this stimulates a wide range of local industries, including construction, real estate, retail, and services, thereby creating demand across the economy and contributing to wealth and employment generation. These developments are also likely to boost tax revenues, allowing government to reinvest in essential public services and infrastructure.

Employment creation is one of the most significant benefits of reclamation. From initial planning to construction and eventual commercial use, these projects generate substantial job opportunities for both skilled and unskilled workers. Indeed, consultations with the IEA have revealed that businesses are currently hampered by a lack of industrial land to upscale their initiatives. Over time, this influx of employment can reduce national unemployment rates, raise household incomes, and improve overall quality of life. Reclamation also enhances the country's capacity for long-term development by creating modern infrastructure and space for sustainable planning. It positions the country to accommodate future population growth while making it more attractive to international investors seeking structured, forward-looking development zones.

However, these positive outcomes are accompanied by serious risks that must be carefully managed. One of the key concerns is the potential disruption of traditional livelihoods, especially those tied to the artisanal fishing sector. Reclamation often leads to habitat destruction—affecting coral reefs and fish nurseries—which directly impacts the income and food security of local fishing communities. Loss of access to marine resources may also erode cultural traditions and social cohesion within these communities. While there are examples, such as Eden Island, where marine life has adapted to built environments like rock armoring, these cases may not be replicable in all locations or sufficient to address stakeholder concerns.

Social tensions can also arise from labor practices. The hiring of foreign workers for this project by construction companies, often to reduce costs, can result in fewer opportunities for local labor. This not only limits the economic benefits to the local population but can also strain public services such as healthcare and housing. In areas where resources are already limited, such competition may intensify inequalities and fuel social resentment.

Environmental risks present another layer of cumulative impact. If the reclamation is poorly planned or implemented without adequate safeguards, it can lead to long-term ecological degradation such as coastal erosion, flooding, water quality degradation and biodiversity loss. These impacts not only threaten marine ecosystems but also undermine the sustainability of the very developments the projects aim to promote.

Visual impacts from such activities are also worth noting. They can degrade the aesthetic quality of coastal areas, affecting local communities' sense of place and potentially deterring tourists in regions where the economy heavily depends on the beauty of natural landscapes. These concerns are magnified when considered in the context of past and concurrent reclamation efforts. The cumulative nature of these impacts—across multiple sites and over time—requires a robust, adaptive management approach.

Long-term environmental monitoring, community engagement, and responsive mitigation strategies are essential to minimize risks and avoid unforeseen consequences. Ultimately, while the socio-economic benefits of government-funded reclamation projects can be substantial, their long-term success depends on inclusive planning processes that consider both immediate and cumulative impacts.

6. ANALYSIS OF THE ALTERNATIVES

The purpose of this chapter is to present and compare the different alternatives that have been considered for the project.

6.1 DESCRIPTION OF THE CONSIDERED ALTERNATIVES

No alternative locations to the proposed reclamation sites were presented by the stakeholders during the consultation period. Some stakeholders queried the need for the new reclamation, pointing to the existence of undeveloped parts of Ile Aurore that government was still unable to develop. Government, however, proposed alternatives to the original reclamation plan during the ESIA process. This took the form of a reduction at Providence Laguna from 24 hectares to 18 hectares, and an increase in the Zone 30 Extension reclamation by 6 hectares to 16 hectares. Therefore, the sites proposed within this ESIA remains the preferred options, and this chapter will therefore only consider a 'No Project' alternative.

6.2 NO-GO APPROACH

If there is no re-development project in the area, the outlined environmental and social impacts will not occur and will not require mitigation. However, the country's long-term strategic development goals would be compromised as a result. The additional land area—which would help alleviate the housing and land shortage, and provide space for businesses to achieve economies of scale—would go unrealised, thereby hindering opportunities for wealth, employment, and asset generation. Government has also consulted with the Industrial Estates Authority (IEA), who confirmed that there is a growing demand from businesses in Seychelles for industrial land, further underscoring the importance of this project in meeting current and future economic needs.

7. E&S, HAZARDS AND ASSESSMENT

7.1 INTRODUCTION

In accordance with the Environmental Protection Act (EPA) of Seychelles, any developer who intends to pursue a significant development which may present risks or impacts its immediate environment require a survey/study which is aimed at identifying all potential environmental impacts including mitigation measures to address these identified impacts before the projects are being approved and subsequently implemented. Environmental impacts are conditions that can cause harm to the immediate environment where the project is to be implemented and this includes effects onto the neighboring environment.

The Public Health Act (PHA) of the Seychelles further stipulates certain criteria of how public health and safety should be safeguarded and that no development whatsoever shall cause a nuisance to the public, health and safety. Furthermore, the Town and Country Planning Act (replaced by the Planning Act) makes provisions for minimum standard of construction and building requirement. In order to remain lawful and compliant to legal obligation and to prevent any unwanted environmental and public health and safety issues an Environmental Impact and operational risks assessment was initiated to determine the potential impact to environment and public health and safety in view of the proposed project.

This chapter provides analysis on the environmental impacts of the project in relation to pre-construction, construction, operation and social impacts of the proposed project. It is important to note that the marine survey chapter has already provided a detailed assessment of the risks associated with the marine/benthic component of this project. As a result, this matrix only includes a general reference to these risks.

7.2 METHODOLOGY

The methodology adopted for the environmental impact study consisted of the following stages:

- a) Identification of significant environmental components and assessment of their baseline status within the project zone.
 - b) Prediction and assessment of impacts from the various activities involved in the project implementation and operation. Assessment of existing structures and construction activities, operation system, and mode of disposal was also studied to identify those activities causing significant environmental impacts through an environmental impact matrix.
 - c) Evaluation of most significant impact and determination of an Environmental Management Plan to mitigate adverse impact on the quality of the surrounding environment.
 - d) Studying the related activities of the project's construction and its impact to the environment, human and socio-economic aspects.
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- e) Measurement and monitoring

7.3 IMPACT SIGNIFICANCE

The following risk rating scheme was used to assess the impacts. It based on the process of combining the severity of the impact with the likelihood of the impacts.

- a) Impact severity: how severe is the impact? What's the consequences if the impact is to occur.

The severity of an impact is a function of a range of considerations including:

- Impact magnitude
- Impact extent
- Impact duration
- Receptor sensitivity

- b) Likelihood of occurrence: how likely or what is possibility for the impact to occur

- c) Rating of the impact significance, which is the product of a combination of the above two variables.

Mitigation of Environmental Impact

Hierarchy of control

- a) Elimination
- b) Substitution
- c) Engineering control
- d) Administrative Control
- e) Personal Protective Equipment

Ratings for the assessment of Consequence Levels

Severity Level	Environment	Community
1	Negligible Almost no impact(s) to land, Biodiversity, ecosystem, water resources and air.	Low-level social impacts. Low-level infringement and minimal disturbance to of cultural heritage / structures. Minimal impact on human rights.
2	Low minor repairable impact to land, Biodiversity, ecosystem, water resources and air.	Minor medium-term social impacts on small number of people. Repairable damage to property and structures. Minor infringement of cultural heritage. Minor temporary human rights impacts.

3	Medium Moderate Impact to land, Biodiversity, Ecosystem, Water resources and air.	Moderate medium-term social impacts or frequent social issues. Moderate damage to structures of local cultural heritage significance. Moderate temporary human rights impacts.
4	High Catastrophic impact to land, Biodiversity, Ecosystem, water resources and air.	A complete breakdown of social order. Widespread damage to items of significant cultural importance. Severe long-term impacts on human rights.

Ratings for the assessment of Likelihood

Likelihood	Environment
High	Very Likely to occur on multiple occasions
Medium	May occur at least once during project phase
Low	May occur at least once during project phase
None	Unlikely - Will not occur

This Environmental and Social Impact Assessment (ESIA) matrix overleaf identifies the activities, associated environmental, social, and health and safety risks for the three proposed reclamation projects. The matrix provides an assessment of potential impacts during pre-construction, construction, and post-reclamation phases. It further outlines appropriate mitigation and preventive measures, estimates the residual impact levels after mitigation, and proposes monitoring requirements to ensure ongoing management of identified risks.

Environmental Impact & Operational Risk Assessment Matrix - Reclamation Projects						
Activities	Environmental / Social Impact	Health and Safety Hazards / Risks	Impact Level	Mitigation / Preventive Measures	Impact level after Mitigation Measures	Monitoring
Pre-work stage						
Site surveys and baseline assessments	None significant (positive if done properly)	Minor risk during site visits	Very Low	Use PPE, trained personnel	Very Low	None
Site clearance and preparation	Loss of vegetation, soil exposure, erosion	Machinery accidents, dust inhalation	Medium	Limit clearance zones, dust suppression (water spraying)	Low	Weekly inspections, erosion control checks
Labour force mobilization (local and foreign)	Social tension if foreign workers housed off-site	Communicable diseases, conflicts	Medium	Worker Code of Conduct, separate accommodation where needed, community sensitization programs	Low	Grievance mechanism tracking, monthly social surveys
Construction stage						
Dredging for reclamation material	Marine habitat disturbance, sediment dispersal harming reefs and seagrass	Vessel collision, drowning risk	High	Silt curtains, dredging windows to avoid sensitive periods, real-time turbidity monitoring	Medium	Daily water turbidity checks, marine ecology quarterly surveys
Filling and land reclamation works	Alteration of currents, sediment transport, coastal erosion risk	Equipment malfunction, slips/falls	High	Engineered sediment management plans, staged filling	Medium	Ad-hoc shoreline surveys, sediment movement monitoring
Construction near undersea cables and armoured water pipes	Damage to vital infrastructure	Service disruption accidents	Medium	Cable detection surveys, exclusion zones around cables/pipes, protective mats, stakeholders (SFA) already apprised to move the water pipes during consultation stage	Low	Daily checks during works near sensitive areas
Piling and/or vibrocompaction (if present)	Vibrations affecting nearby structures and services	Risk to structural integrity of nearby buildings	High	Vibration monitoring, advance notification to affected parties, adjust piling methods	Medium	Real-time vibration monitoring

Operation of heavy equipment	Air and noise pollution, oil spills	Mechanical injury, hearing damage	Medium	Regular maintenance, PPE, spill response kits, noise barriers	Low	Equipment logs monthly, noise levels bi-weekly
Increased site traffic and marine vessels	Traffic congestion, accidents, maritime safety risk	Collisions, accidents with public boats	Medium	Traffic Management Plan (land and marine), navigation warnings	Low	Incident reporting system, monthly reviews
Movement of dredger; Mobilization of dredger to site	Disturbance to marine traffic, noise pollution, risk of fuel spills	Collision with other vessels, fuel leakages causing fire hazards	Medium	Notify maritime authorities, schedule transport during low traffic hours, check fuel systems as a prep check	Low	Daily logs and marine traffic coordination
Anchoring of dredger	Damage to coral reefs or seagrass beds, seabed disturbance	Injury during anchoring, equipment malfunction	Medium	Use GPS and sonar to avoid sensitive habitats, conduct safety drills	Low	Underwater inspections, environmental monitoring reports
Operation of dredger during reclamation	Turbidity, smothering of benthic habitats, disruption to marine life	Exposure to moving equipment, risk of falls or entanglement	Medium	Use silt curtains, restrict operations to daylight hours, provide PPE and safety briefings	Low	Water quality testing, safety audits
Fueling and maintenance of dredger	Risk of oil and chemical spills	Fire and explosion risk, chemical exposure	Medium	Use drip trays, train staff on spill response, follow SOPs	Low	Regular inspections, incident reporting system
Demobilization of dredger from site	Temporary disruption to marine traffic, noise pollution	Fatigue-related incidents, navigation errors	Medium	Ensure rest periods, proper navigation planning	Low	Post-operation review, marine authority coordination
Dewatering of offshore sand backfill	Generation of sediment plume leading to loss of fines (sand, silt), smothering of marine habitats, reduced water quality	equipment instability, reduced visibility for divers or nearby vessels, Slipper site surfaces	High	Install silt curtains around discharge area, optimize dewatering rate to reduce plume, conduct dewatering during slack tides to minimize dispersion, monitor turbidity levels continuously, use settlement ponds or geo-bags where feasible	Medium	Continuous turbidity monitoring, weekly environmental inspections, photographic evidence of plume spread

Construction worker accommodation (on-site or off-site)	Overcrowding, pressure on local infrastructure, sewage, STP and overflow issues	Communicable diseases, hygiene issues	Medium	Adequate facilities, health checks, separation of worker camps	Low	Health audits monthly
Noise and vibration from reclamation and construction works	Disturbance to nearby residents, marine species	Worker hearing loss	High	Noise barriers, limited working hours, hearing PPE, early communications with communities	Low	Noise monitoring bi-weekly, complaints register
Post-Construction stage						
New land created	Change in local hydrodynamics, increased flood risk, sediment transport	N/A	High	Integrated coastal protection (e.g. breakwaters), flood risk management	Medium	Coastal hydrology surveys yearly
Reinstatement of undersea infrastructure (where needed)	Potential disturbance during final works	Risk of leaks, service disruption	NA	No undersea infrastructure detected for reinstatement	NA	Infrastructure integrity checks
Increased economic activity (industry)	Potential positive: employment; Potential negative: strain on infrastructure	N/A	High (positive)	Planning for capacity upgrades, training programs for locals	NA	Socio-economic surveys yearly
New impacts from altered maritime traffic	New maritime safety risks from land changes	Vessel accidents	Medium	Updated navigation charts, aids to navigation (buoys, markers)	Low	Incident monitoring quarterly
Opportunities/costs to local communities	Increased job opportunities	N/A	Medium (positive)	Local hiring policies, SME development programs	NA	Annual socio-economic review reports

8. ENVIRONMENT MANAGEMENT PLAN

8.1. INTRODUCTION

An Environmental Management Plan (EMP) for the proposed reclamation projects. The EMP is designed as a practical framework to ensure that the environmental and social impacts identified during the ESIA process are effectively managed throughout the project's lifecycle—from site preparation and construction to operation.

The primary objective of this EMP is to outline the mitigation, enhancement, and management measures required to minimize adverse environmental and social impacts while promoting sustainable development outcomes. This program is tailored to the specific environmental sensitivities and socio-economic conditions of the project area and is consistent with national environmental legislation and international best practices.

A critical component of the EMP will be the monitoring and reporting component, which establishes a structured approach to track compliance and assess environmental performance. The monitoring plan specifies key indicators, frequencies, responsibilities, and methodologies for evaluating the effectiveness of mitigation measures. The reporting framework ensures transparency and accountability by defining the format, timing, and recipients of environmental reports, including periodic updates to regulatory authorities and other stakeholders.

This chapter presents a summary Environmental Management Plan (EMP), beginning with an overview of the general implications applicable across all three sites, followed by a detailed examination of site-specific components for each location. It must be noted that previous EIAs for the Ile Aurore site comes with similar detailed EMPs and have been reviewed for inclusion in this chapter.

8.2. OBJECTIVES OF THE EMP

The broad objectives of the EMP are to ensure that:

- all environmental safeguards are carried out appropriately and site activities are well-managed
 - adverse impacts on the environment are minimised
 - the biodiversity of the site is conserved or enhanced
 - all relevant legislation is complied with, and
 - the project is monitored for environmental impact.
-

8.3. COMMUNICATION MEASURES

Clear communication channels will be needed for this project to ensure that all project personnel, contractors, stakeholders, and regulatory authorities are informed of environmental obligations, mitigation measures, and incident responses. In this light, an Environmental Control Officer (ECO) will be designated prior to commencement of reclamation works to ensure that the EMP is being adhered to.

The communication measures for this project will include, but shall not be limited to:

1. Internal Communication:

Regular environmental briefings and toolbox talks will be conducted to inform project staff and contractors of their environmental responsibilities and any changes to the EMP. Notice boards, emails, and internal reporting systems will be used to disseminate important updates.

2. Stakeholder Engagement:

Ongoing engagement with local and adjacent communities, authorities, and other stakeholders will be maintained through scheduled meetings and feedback mechanisms to address concerns, share project updates, and promote transparency.

3. Incident Reporting:

Through the site visits and audit reports, the ECO will ensure all incidents are logged, investigated, and communicated to the relevant parties in a timely manner.

4. Regulatory Communication:

In line with the above, the project will ensure timely submission of required environmental reports to regulatory bodies, including monitoring results, compliance audits, and any incident notifications, in accordance with legal requirements.

8.4. METHOD STATEMENTS

Method Statements will be required for all operational activities that may result in significant environmental impacts. These documents serve as detailed, activity-specific work plans that outline how potential environmental risks will be mitigated and managed on-site. They are critical to ensuring that environmental protection measures are appropriately tailored and implemented for high-risk or sensitive tasks.

The Contractor shall submit Method Statements for review and approval by both the Environmental Control Officer (ECO) and the proponent prior to the commencement of any activity identified as posing a greater risk to the environment or not sufficiently addressed in the Environmental Management Plan (REMP). This requirement may be triggered by pre-construction assessments, site-specific sensitivities, or at the discretion of the ECO or the proponent.

Method Statements are formal, written submissions that must describe:

- The proposed activity and its potential environmental impacts;
- Materials, labour and equipment to be used
- Specific mitigation and control measures to be implemented;
- The roles and responsibilities of personnel involved;
- The sequence and duration of the activity;
- Emergency response procedures, where relevant;
- Monitoring and reporting arrangements associated with the activity.

Once submitted, Method Statements will be reviewed and where deemed necessary or practical, they may also be endorsed by the environmental representative of the relevant authority, particularly in cases involving regulatory compliance or sensitive ecological contexts.

All approved Method Statements will be treated as legally binding components of the environmental management process. Failure to adhere to these Statements may result in corrective action, suspension of works, or penalties as per the contract and applicable legislation.

8.5. EMP TRAINING AND AWARENESS

The Contractor shall ensure that all site personnel receive comprehensive environmental awareness training, and that all workers participate in a structured induction prior to commencing work on-site. This induction shall emphasize the importance and implementation of the Environmental Management Plan (EMP), and shall be reinforced periodically throughout the duration of the contract.

As a minimum, the training and induction sessions shall cover the following:

- The importance of complying with the EMP and the legal, environmental, and reputational implications of non-compliance;
- The potential environmental impacts associated with reclamation and construction activities, and how these can be prevented or minimized through responsible work practices;
- The benefits of improved personal environmental performance, including health, safety, and operational efficiencies;
- Employees' specific roles and responsibilities under the EMP, including their obligations related to environmental protection and emergency preparedness;
- A clear explanation of the mitigation measures to be implemented when performing daily tasks or high-risk activities;
- Site-specific requirements outlined in the EMP, including the identification and respect of no-go areas, buffer zones, and environmentally sensitive features;
- An overview of the project's environmental management structure, including key personnel responsible for environmental compliance, reporting, and decision-making (e.g., the ECO, contractor, and Relevant Authority representatives).

All general site staff shall attend an initial induction presentation before beginning work. Additionally, time shall be allocated for employees to attend any follow-up lectures or refresher training sessions, as deemed necessary by the Environmental Control Officer (ECO). These may be triggered by updates to the EMP, observed non-compliance, or the introduction of new activities or personnel.

Records of all training sessions, including dates, attendee lists, and training materials, shall be maintained and made available for audit or upon request by the ECO or relevant regulatory authorities.

8.6. MONITORING PROGRAMME

Monitoring forms an integral part of the EMP to ensure that management actions and controls have the desired effects and to provide ongoing information to review and update the strategies as required. The proposed monitoring plan overleaf suggests the activities that should be undertaken before, during and after the works, which can range from a fully integrative survey to basic analysis, depending on budget and other resources.

The Environmental and Social Monitoring Plan below identifies key environmental parameters (water quality, sediment, coral/fish status, etc.) to be monitored continuously or periodically to ensure compliance with environmental standards.

Environmental and Social Monitoring Plan				
Aspect	Monitoring Activity	Frequency	Responsibility	Method
Construction Phase Monitoring				
Sediment Transport	Monitor sediment movement and deposition; unbiased reports from relevant authority	Monthly	MACCE / ECO	Visual inspections, sediment traps.
Coral Reef and Habitat Health	Rapid assessments of coral and seagrass health; siltation impacts.	Weekly	Marine Park Authority / ECO	Standard rapid assessment protocols.
Oceanographic / Meteorological Data	Collect currents, tides, and weather data to guide dredging and screen placement.	Daily during dredging	Contractor / ECO	Current meters, tide gauges (if available)
Air Quality (Dust and Emissions)	Monitor visible dust and particulate matter levels.	Weekly	Contractor / ECO	Visual inspection, dust meters.
Noise Levels	Measure construction noise levels, especially during piling and vibrocompaction (If any)	Bi-weekly	Contractor / ECO	Sound level meters.
Vibration Monitoring	Monitor ground vibration impacts near sensitive infrastructure.	Continuous during vibrocompaction	Contractor / Structural Engineer / ECO	Vibration meters, complaints register monitoring
Sediment Control Measures	Inspect and maintain sediment curtains and bunds.	Daily	Contractor / ECO	Visual checks, maintenance records.

Worker Health and Safety	Monitor PPE use, worker conditions, and accommodation facilities.	Weekly	Contractor / HSE Officer / ECO	Site inspections, incident reports.
Maritime Safety	Monitor maritime traffic and site access safety.	Continuous	Marine authorities / ECO	Vessel movement tracking, incident reporting.
Social Impacts (Labour Force Monitoring)	Track location and conditions of foreign labour whether on-site and off-site.	Monthly	Contractor / ECO	Surveys, site inspections, grievance records.
Post Reclamation Phase Monitoring				
Entrance Channel Usage	Survey channel depth, monitor vessel traffic and navigational safety.	Semi-annually	Marine Authority / ECO	Bathymetric surveys, AIS tracking, vessel log reviews.
Shoreline Changes / Erosion	Monitor beach profiles and shoreline movement at and around the reclaimed area.	Annual (and after storms)	Coastal Engineer / ECO	GPS surveys, drone imagery, erosion measurements.
Water Quality (Post-project)	Continue testing turbidity, nutrients, salinity, and pollutants.	As directed by authority	MACCE / ECO	Water sampling and laboratory analysis.
Sediment Transport and Deposition	Monitor stability of reclaimed sediments and adjacent marine sediment dynamics.	Annual	Coastal Engineer / ECO	Sediment traps, bathymetric comparisons.
Coral Reef and Fish Communities	Survey coral health, fish population diversity and abundance.	Annual (as needed)	MACCE / ECO	Underwater visual census, photo transects, standard coral assessment protocols.

8.7. COMMUNITY INVOLVEMENT AND PARTICIPATION

Community involvement will be a key component of the environmental and social management of the reclamation projects at the proposed locations. Indeed, considerations of the community led the government to alter the original scope of the project at the start. Active engagement with local communities will help ensure transparency, build trust, and allow for early identification of any issues arising from project activities.

Throughout the construction and post-reclamation phases, regular information sessions should be held to update communities on project progress, anticipated disruptions, and planned mitigation measures. Information will be shared through appropriate media channels to ensure accessibility.

A localized grievance redress mechanism should be established and publicized, allowing community members to raise concerns or complaints easily. Grievances will be recorded, tracked, and resolved within a reasonable timeframe, with regular reviews to ensure the system's effectiveness.

Monitoring should also include periodic consultations with local communities to assess perceptions of the project, especially regarding the presence of foreign labour (if any), impacts on livelihoods, and any cultural sensitivities. Findings from community engagement activities should be documented and incorporated into monthly audit reports. This feedback will inform adaptive management decisions to enhance community benefits, minimize social risks, and strengthen the project's overall social sustainability.

9. CONCLUSION

In conclusion, the environmental and social impacts of the reclamation projects at the proposed locations have been thoroughly assessed. This report identifies key risks and offers mitigation measures to manage both environmental and social concerns throughout the project phases. Ongoing monitoring and community involvement will ensure that the projects are carried out in compliance with environmental standards and contribute to local socio-economic development. The implementation of these measures will support sustainable development, ensuring that the projects benefit both the environment and local communities while minimizing negative impacts.

ANNEX

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XY COORDINATES _ ZONE 30



XY COORDINATES _ PROVIDENCE LAGUNA



XY COORDINATES _ ILE AURORE



LIST OF NON-EXHAUSTIVE FISH SPECIES ZONE 30
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Category	Family	Genus	Species
Fish	Acanthuridae	<i>Acanthurus</i>	<i>trioptegus</i>
	Carangidae	<i>Caranx</i>	<i>sp indet. 1</i>
	Chaetodontidae	<i>Chaetodon</i>	<i>auriga</i>
			<i>trifascialis</i>
	Epinephelidae	<i>Aethaloperca</i>	<i>roga</i>
		<i>Epinephelus</i>	<i>sp indet. 1</i>
		<i>Plectropomus</i>	<i>laevis</i>
	Holocentridae	<i>Myripristis</i>	<i>sp indet. 1</i>
	Labridae	<i>Epibulus</i>	<i>insidiator</i>
		<i>Labroides</i>	<i>sp indet. 1</i>
	Lethrinidae	<i>Lethrinus</i>	<i>harak</i>
			<i>sp indet. 1</i>
	Nemipteridae	<i>Scolopsis</i>	<i>frenata</i>
	Pomacanthidae	<i>Pomacanthus</i>	<i>semicirculatus</i>
	Pomacentridae	<i>Abudefduf</i>	<i>sexfasciatus</i>
	Scaridae	<i>Scarus</i>	<i>sp1</i>
	Siganidae	<i>Siganus</i>	<i>corallinus</i>
	Sphyrinae	<i>Sphyrna</i>	<i>barracuda</i>
	Syngnathidae	<i>Corythoichthys</i>	<i>flavofasciatus</i>
	Zanclidae	<i>Zanclus</i>	<i>cornutus</i>
Invertebrates - Corals	Acroporidae	<i>Acropora</i>	<i>sp</i>
	Euphylliidae	<i>Galaxea</i>	<i>sp</i>
	Fungiidae	<i>Fungia</i>	<i>sp</i>
	Merulinidae	<i>Echinopora</i>	<i>sp</i>
		<i>Favites</i>	<i>sp</i>
		<i>Platygyra</i>	<i>sp</i>
	Poritidae	<i>Porites</i>	<i>sp</i>
Invertebrates - other	Demospongiae	-	<i>sp indet. 1</i>
	Cypraeidae	<i>Cypraea</i>	<i>tigris</i>
	Diadematidae	<i>Echinotrix</i>	<i>diadema</i>
	Holothuriidae	<i>Holothuria</i>	<i>atra</i>
	Ostreidae	-	<i>sp indet. 1</i>
	Stichopodidae	<i>Stichopus</i>	<i>chloronotus</i>
	Strombidae	<i>Lambis</i>	<i>lambis</i>
Macroalgae	Caulerpaceae	<i>Caulerpa</i>	<i>serrulata</i>
	Cladophoraceae	<i>Chaetomorpha</i>	<i>species</i>

	Halimedaceae	<i>Chlorodesmis</i>	<i>fastigia</i>
		<i>Halimeda</i>	<i>sp indet. 1</i>
	Sargassaceae	<i>Sargassum</i>	<i>sp indet. 1</i>
		<i>Turbinaria</i>	<i>sp indet. 1</i>

LIST OF FISH SPECIES PROVIDENCE LAGUNA

Category	Family	Genus	Species	
Fish	Acanthuridae	<i>Acanthurus</i>	<i>leucosternon</i>	
			<i>nigricauda</i>	
			<i>sp indet. 1</i>	
	Apogonidae	<i>Cheilodipterus</i>	<i>quinquelineatus</i>	
	Carangidae	<i>Caranx</i>	<i>melampygus</i>	
	Chaetodontidae	<i>Chaetodon</i>	<i>auriga</i>	
			<i>falcula</i>	
			<i>lunula</i>	
			<i>trifascialis</i>	
			<i>trifasciatus</i>	
			<i>zanzibarensis</i>	
	Dasyatidae	<i>Pastinachus</i>	<i>ater</i>	
	Ephippidae	<i>Platax</i>	<i>orbicularis</i>	
	Epinephelidae	<i>Aethaloperca</i>	<i>rogaa</i>	
			<i>Epinephelus</i>	<i>sp indet. 1</i>
				<i>sp indet. 2</i>
	Haemulidae	<i>Plectorhinchus</i>	<i>vittatus</i>	
	Holocentridae	<i>Sargocentron</i>	<i>sp indet. 1</i>	
				<i>spiniferum</i>
	Holocentridae	<i>Myripristis</i>	<i>sp indet. 1</i>	
	Labridae	<i>Epibulus</i>	<i>insidiator</i>	
			<i>Labroides</i>	<i>dimidiatus</i>
			<i>Labroides</i>	<i>sp indet. 1</i>
	Labridae	<i>Gomphosus</i>	<i>caeruleus</i>	
	Lethrinidae	<i>Lethrinus</i>	<i>harak</i>	
				<i>sp indet. 1</i>
	Monacanthidae	<i>Oxymonacanthus</i>	<i>longirostris</i>	
	Mullidae	<i>Parupeneus</i>	<i>barberinus</i>	
	Nemipteridae	<i>Scolopsis</i>	<i>frenata</i>	
	Pomacanthidae	<i>Pomacanthus</i>	<i>semicirculatus</i>	
	Pomacentridae	<i>Abudefduf</i>	<i>sexfasciatus</i>	
			<i>Chromis</i>	<i>sp indet. 1</i>
			<i>Dascyllus</i>	<i>aruanus</i>
	Scaridae	<i>Scarus</i>	<i>sp1</i>	
	Siganiidae	<i>Siganus</i>	<i>corallinus</i>	
				<i>sp indet. 1</i>
	Sphyraenidae	<i>Sphyraena</i>	<i>barracuda</i>	
	Synodontidae	<i>Synodus</i>	<i>sp</i>	
	Zanclidae	<i>Zanclus</i>	<i>cornutus</i>	
Invertebrates - Corals	Acroporidae	<i>Isopora</i>	<i>sp</i>	
	Acroporidae	<i>Acropora</i>	<i>sp</i>	
	Agariciidae	<i>Gardineroseris</i>	<i>sp</i>	
			<i>Pavona</i>	<i>sp</i>
	Euphylliidae	<i>Galaxea</i>	<i>sp</i>	
	Faviidae	<i>Favia</i>	<i>sp</i>	

Category	Family	Genus	Species
	Fungiidae	<i>Fungia</i>	<i>sp</i>
	Lobophylliidae	<i>Lobophyllia</i>	<i>sp</i>
	Merulinidae	<i>Echinopora</i>	<i>sp</i>
		<i>Favites</i>	<i>sp</i>
		<i>Platygyra</i>	<i>sp</i>
	Merulinidae	<i>Goniastrea</i>	<i>sp</i>
	Pocilloporidae	<i>Pocillopora</i>	<i>sp</i>
	Poritidae	<i>Porites</i>	<i>sp</i>
Invertebrates - other	Demospongiae		<i>sp indet. 1</i>
	Conidae	<i>Conus</i>	<i>sp indet. 1</i>
	Corallimorphidae		<i>sp indet. 1</i>
	Cypraeidae	<i>Cypraea</i>	<i>Tigris</i>
	Gryphaeidae		<i>sp indet. 1</i>
	Holothuriidae	<i>Holothuria</i>	<i>atra</i>
	Littorinidae	<i>Littoraria</i>	<i>sp indet. 1</i>
	Ophidiasteridae		<i>sp indet. 1</i>
	Serpulidae		<i>sp indet. 1</i>
	Sphenopidae	<i>Palythoa</i>	<i>sp indet. 1</i>
	Stichopodidae	<i>Stichopus</i>	<i>chloronotus</i>
			<i>sp indet. 1</i>
	Diadematidae	<i>Echinotrix</i>	<i>diadema</i>
Macroalgae	Dictyotaceae	<i>Padina</i>	<i>sp indet. 1</i>
	Halimedaceae	<i>Halimeda</i>	<i>macroloba</i>
			<i>sp indet. 1</i>
	Halimedaceae	<i>Chlorodesmis</i>	<i>fastigia</i>
	Sargassaceae	<i>Sargassum</i>	<i>sp indet. 1</i>
		<i>Turbinaria</i>	<i>sp indet. 1</i>

PHOTO GALLERY PROVIDENCE LAGUNA



FIGURE 19: REPRESENTATION OF CORAL DIVERSITY OBSERVED AT PROVIDENCE LAGUNA; *PLATYGYRA SP.* (A), *PORITES SP.* (B), *ECHINOPORA SP.* (C), *FUNGIA SP.* (D), *ACROPORA SP.* (E), *LOBOPHYLLIA SP.* (F), *PAVONA SP.* (G), *GARDINOSERIS SP.* (H).

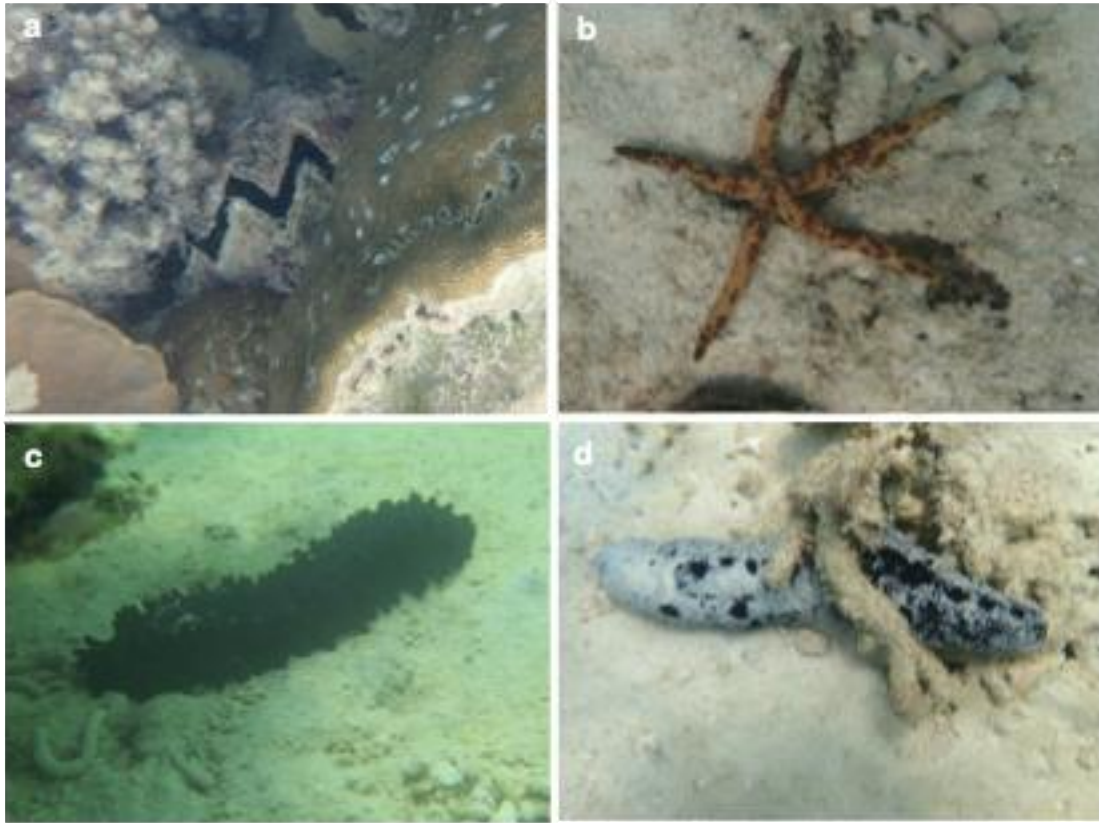


FIGURE 20: REPRESENTATION OF INVERTEBRATES DIVERSITY OBSERVED AT PROVIDENCE LAGUNA; *GRYPHEIDAE* (A), *OPHIDIASTERIDAE* (B), *STICHOPUS CHLORONOTUS* (C), *HOLOTHURIA ATRA* (D).

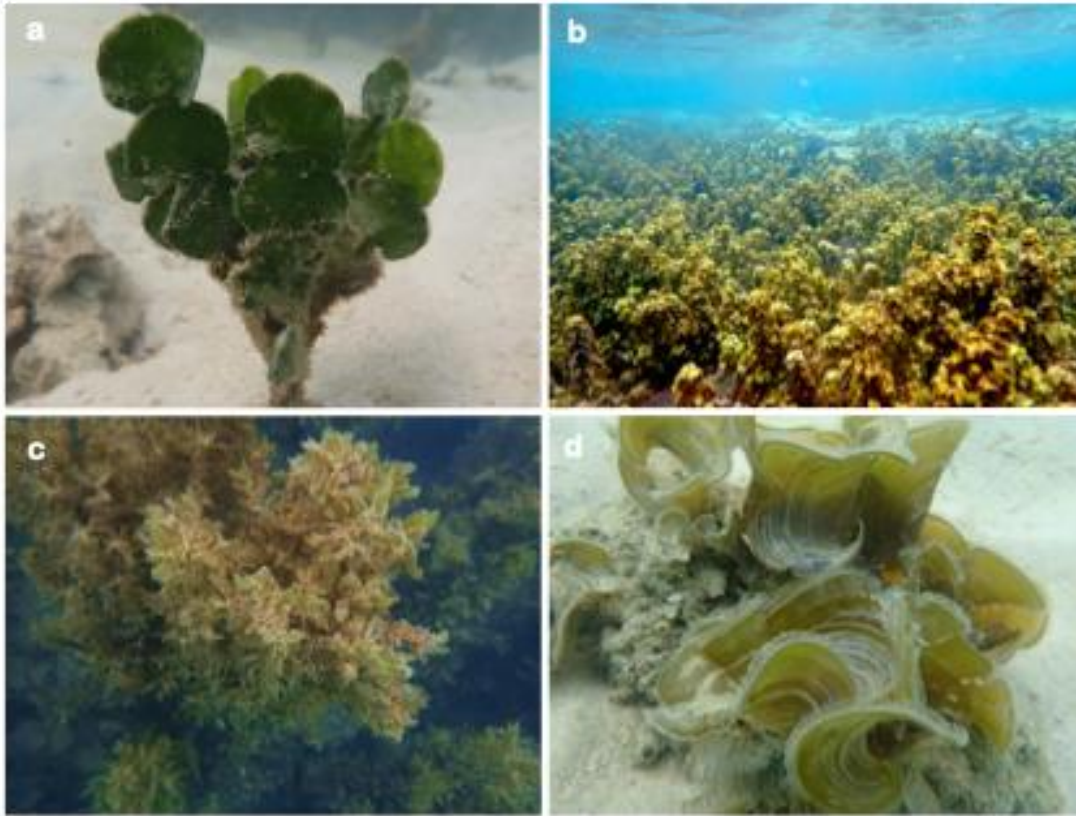


FIGURE 21: REPRESENTATION OF MACROALGAL DIVERSITY OBSERVED AT PROVIDENCE LAGUNA; *HALIMEDA MACROLOBA* (A), *TURBINARIA SP.* (B), *SARGASSUM SP.* (C), *PADINA SP.* (D).

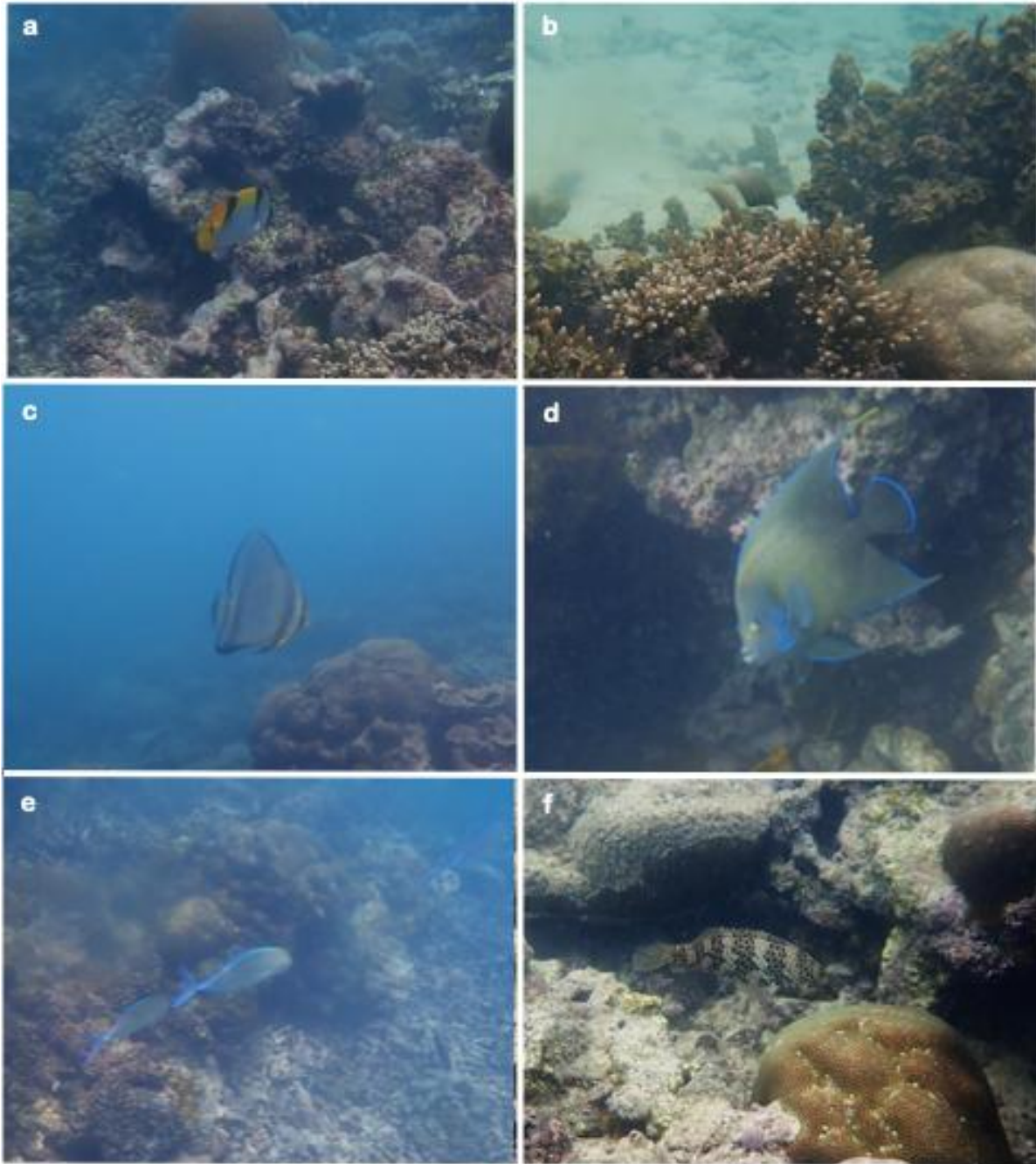


FIGURE 22: REPRESENTATION OF FISH DIVERSITY OBSERVED AT PROVIDENCE LAGUNA; *CHAETODON FALCULA* (A), *OXYMONACANTHUS LONGIROSTRIS* (B), *PLATAX ORBICULARIS* (C), *POMACANTHUS SEMICIRCULATUS* (D), *CARANX MELAMPYGUS* (E), *EPINEPHELUS SP.* (F).

NUMBER OF SPECIES PER IUCN RED LIST PROVIDENCE LAGUNA

TABLE 4: NUMBER OF SPECIES RECORDED PER FISH FAMILY AT PROVIDENCE LAGUNA

Family	Number of species
Chaetodontidae	6
Labridae	4
Acanthuridae	3
Pomacentridae	3
Epinephelidae	3
Holocentridae	3
Siganidae	2
Lethrinidae	2
Scaridae	1
Zanclidae	1
Sphyraenidae	1
Carangidae	1
Haemulidae	1
Monacanthidae	1
Apogonidae	1
Mullidae	1
Synodontidae	1
Nemipteridae	1
Ephippidae	1
Pomacanthidae	1
Total	38

TABLE 5: NUMBER OF SPECIES OBSERVED PER IUCN RED LIST CATEGORIES AT PROVIDENCE LAGUNA

IUCN Red List Categories	Number of species observed per category
Near Threatened	1
Vulnerable	2
Least Concern	25
Data Deficient	0
Not Evaluated	45

LIST OF SPECIES AURORE SOUTH

Category	Family	Genus	Species
Aves (Bird)	Ardeidae	<i>Butorides</i>	<i>striatus</i>
	Scolopacidae	<i>Numenius</i>	<i>phaeopus</i>
	Sterninae	<i>Sterna</i>	<i>sp indet. 1</i>
Fish	Acanthuridae	<i>Acanthurus</i>	<i>blochii</i>
			<i>leucocheilus</i>
			<i>lineatus</i>
			<i>triestegus</i>
			<i>xanthopterus</i>
		<i>Zebrasoma</i>	<i>desjardini</i>
	Balistidae	<i>Rhinecanthus</i>	<i>aculeatus</i>
	Belonidae	<i>Ablennes</i>	<i>hians</i>
	Carangidae	<i>Caranx</i>	<i>melampygus</i>
			<i>sp indet. 1</i>
		<i>Trachinotus</i>	<i>blochii</i>
	Carcharhinidae	<i>Carcharhinus</i>	<i>sp indet.1</i>
	Chaetodontidae	<i>Chaetodon</i>	<i>auriga</i>
			<i>lunula</i>
			<i>trifascialis</i>
			<i>trifasciatus</i>
			<i>zanzibariensis</i>
	Dasyatidae	<i>Pastinachus</i>	<i>ater</i>
	Ephippidae	<i>Platax</i>	<i>orbicularis</i>
	Epinephelidae	<i>Epinephelus</i>	<i>sp indet. 1</i>
	Haemulidae	<i>Plectorhinchus</i>	<i>albovittatus</i>
			<i>vittatus</i>
	Holocentridae	<i>Sargocentron</i>	<i>sp indet. 1</i>
			<i>spiniferum</i>
	Labridae	<i>Epibulus</i>	<i>insidiator</i>
		<i>Labroides</i>	<i>dimidiatus</i>
		<i>Labroides</i>	<i>sp indet. 1</i>
	Lethrinidae	<i>Lethrinus</i>	<i>harak</i>
			<i>sp indet. 1</i>
	Lutjanidae	<i>Lutjanus</i>	<i>sp</i>
	Monacanthidae	<i>Oxymonacanthus</i>	<i>longirostris</i>
	Mullidae	<i>Parupeneus</i>	<i>barberinus</i>
	Muraenidae	<i>Gymnothorax</i>	<i>sp</i>
	Nemipteridae	<i>Scolopsis</i>	<i>frenata</i>
	Pomacanthidae	<i>Pomacanthus</i>	<i>semicirculatus</i>
	Pomacentridae	<i>Abudefduf</i>	<i>sexfasciatus</i>
		<i>Amphiprion</i>	<i>akallopisos</i>
		<i>Pomacentrus</i>	<i>caeruleus</i>
			<i>sulfureus</i>
	Scaridae	<i>Scarus</i>	<i>sp indet. 1</i>
	Siganidae	<i>Siganus</i>	<i>sp indet. 1</i>
	Sphyraenidae	<i>Sphyraena</i>	<i>barracuda</i>
	Syngnathidae	<i>Corythoichthys</i>	<i>flavofasciatus</i>

Category	Family	Genus	Species
	Synodontidae	<i>Synodus</i>	<i>sp</i>
	Tetraodontidae	<i>Arothron</i>	<i>hispidus</i>
	Zanclidae	<i>Zanclus</i>	<i>cornutus</i>
Invertebrates - Corals	Acroporidae	<i>Acropora</i>	<i>sp</i>
	Antipathidae	<i>Cirrhopathes</i>	<i>sp indet. 1</i>
	Dendrophylliidae	<i>Turbinaria</i>	<i>sp</i>
	Euphylliidae	<i>Galaxea</i>	<i>sp</i>
	Fungiidae	<i>Fungia</i>	<i>sp</i>
	Merulinidae	<i>Echinopora</i>	<i>sp</i>
		<i>Platygyra</i>	<i>sp</i>
	Merulinidae	<i>Leptoria</i>	<i>sp</i>
	Plerogyridae	<i>Physogyra</i>	<i>lichtensteini</i>
	Pocilloporidae	<i>Stylophora</i>	<i>sp</i>
		<i>Pocillopora</i>	<i>sp</i>
	Poritidae	<i>Goniopora</i>	<i>sp</i>
		<i>Porites</i>	<i>sp</i>
Invertebrates - other	Polycladida		<i>sp indet. 1</i>
	Demospongia		<i>sp indet. 1</i>
	Demospongia		<i>sp indet. 2</i>
	Corallimorphidae		<i>sp indet. 1</i>
	Cypraeidae	<i>Cypraea</i>	<i>tigris</i>
		<i>Monetaria</i>	<i>moneta</i>
	Diadematidae	<i>Diadema</i>	<i>savignyi</i>
			<i>setosum</i>
		<i>Echinotrix</i>	<i>diadema</i>
	Holothuriidae	<i>Actinopyga</i>	<i>mauritiana</i>
		<i>Bohadschia</i>	<i>vitiensis</i>
		<i>Holothuria</i>	<i>atra</i>
	Nacellidae	<i>Cellana</i>	<i>sp indet. 1</i>
	Pinnidae	<i>Pinna</i>	<i>muricata</i>
	Stichodactylidae	<i>Radianthus</i>	<i>magnifica</i>
	Stichopodidae	<i>Stichopus</i>	<i>chloronotus</i>
			<i>sp indet. 1</i>
	Stomopneustidae	<i>Stomopneustes</i>	<i>variolaris</i>
	Strombidae	<i>Harpago</i>	<i>chiragra</i>
Macroalgae	Rhodophyta		<i>sp indet. 1</i>
	Rhodophyta		<i>sp indet. 2</i>
	Caulerpaceae	<i>Caulerpa</i>	<i>lentillifera</i>
			<i>racemosa</i>
			<i>serrulata</i>
			<i>sertularioides</i>
	Dictyotaceae	<i>Dictyota</i>	<i>sp indet. 1</i>
		<i>Padina</i>	<i>sp indet. 1</i>
	Gracilariaceae	<i>Gracilaria</i>	<i>salicornia</i>
	Halimedaceae	<i>Halimeda</i>	<i>sp indet. 1</i>
			<i>sp indet. 2</i>
	Halimedaceae	<i>Chlorodesmis</i>	<i>fastigia</i>
	Oscillatoriaceae	<i>Lyngbya</i>	<i>sp indet. 1</i>

Category	Family	Genus	Species
	Sargassaceae	<i>Sargassum</i>	<i>sp indet. 1</i>
		<i>Turbinaria</i>	<i>sp indet. 1</i>
			<i>sp indet. 2</i>
Seagrass	Cymodoceaceae	<i>Syringodium</i>	<i>isoetifolium</i>
	Hydrocharitaceae	<i>Enhalus</i>	<i>acoroides</i>
		<i>Halophila</i>	<i>sp indet.1</i>
		<i>Thalassia</i>	<i>hemprichii</i>

PHOTO GALLERY AURORE SOUTH

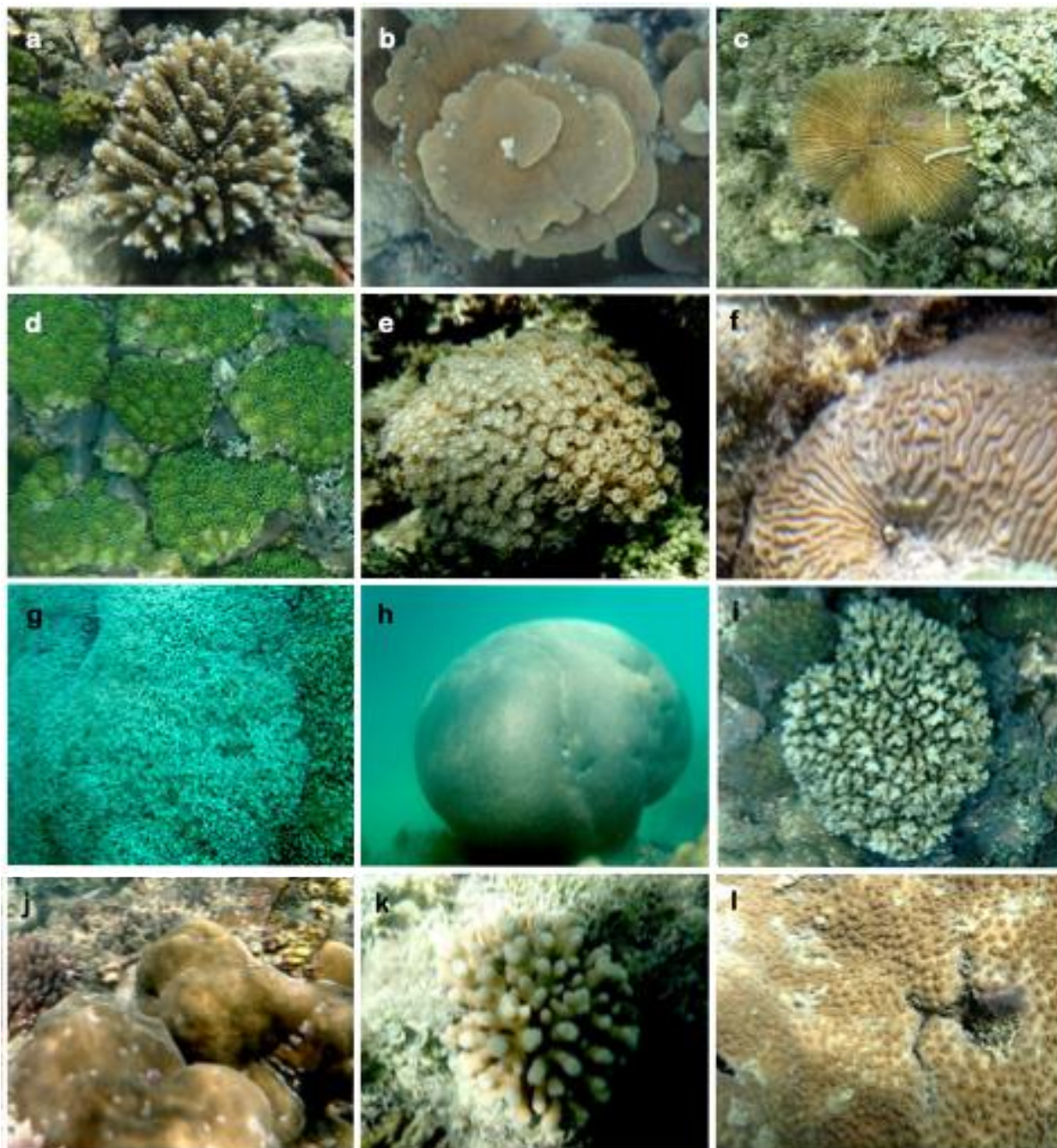


FIGURE 23: REPRESENTATION OF CORAL DIVERSITY OBSERVED AT AURORE SOUTH SITE; *ACROPORA SP.* (A), *ECHINOPORA SP.* (B), *FUNGIA SP.* (C), *GALAXEA SP.* (D), *GONIOPORA SP.* (E), *LEPTORIA SP.* (F), *PHYSOGYRA SP.* (G), *PLATYGYRA SP.* (H), *POCILLOPORA SP.* (I), *PORITES SP.* (J), *STYLOPHORA SP.* (K), *TURBINARIA SP.* (L).

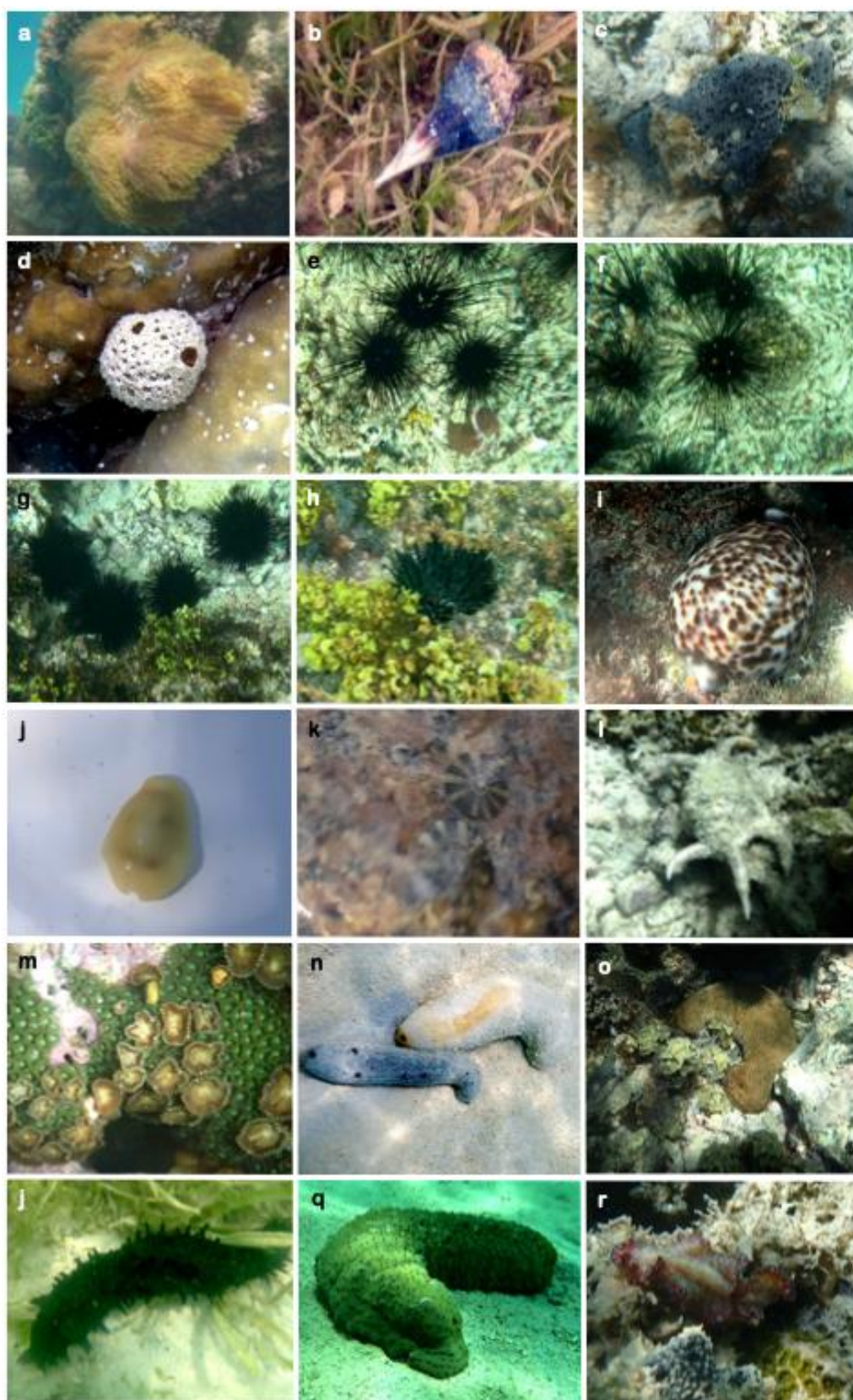


FIGURE 24: DIVERSITY OF NON-SCLERACTINIAN INVERTEBRATES OBSERVED AT AURORE SOUTH: *RADIANTHUS MAGNIFICA* (A), *PINNA MURICATA* (B), *DEMOSPONGIA* INDET. 1 (C), *DEMOSPONGIA* INDET. 2 (D), *DIADEMA SAVIGNYI* (E), *DIADEMA SETOSUM* (F), *ECHINOTRIX DIADEMA* (G), *STOMOPNEUSTES VARIOLARIS* (H), *CYPRAEA TIGRIS* (I), *MONETARIA MONETA* (J), *CELLANA* SP. (K), *HARPAGO CHIRAGRA* (L), *CORALLIMORPHARIA* INDET. 1 (M), *BOHADSCHIA VITIENSIS* &

HOLOTHURIA ATRA (N), *ACTINOPYGA MAURITIANA* (O), *STICHOPUS CHLORONOTUS* (P), *STICHOPUS SP. INDET. 1* (Q),
POLYCLADIDA INDET. 1 (R).

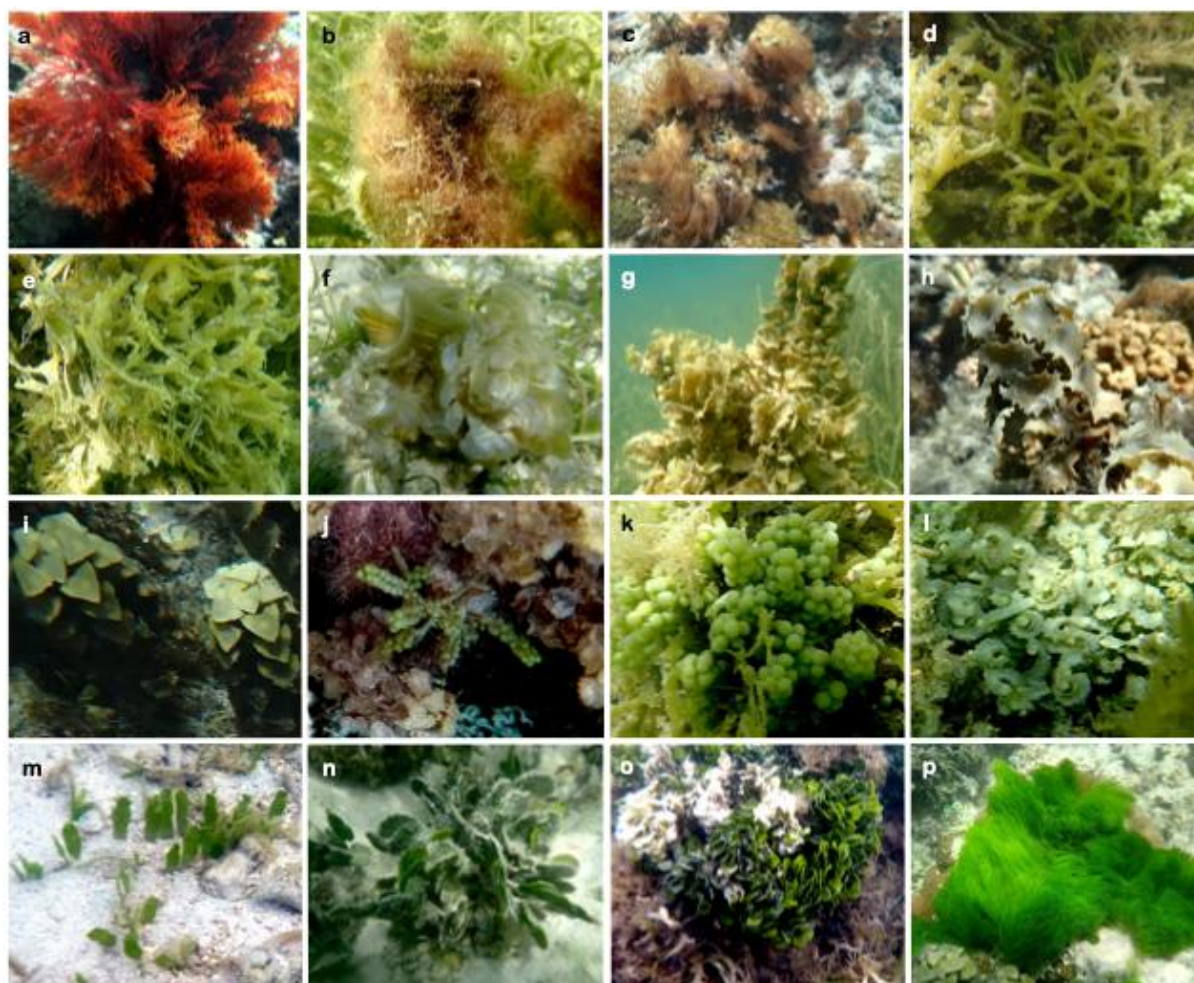


FIGURE 25: DIVERSITY OF MACROALGAE OBSERVED AT AURORE SOUTH: RHODOPHYTA SP INDET. 1 (A), RHODOPHYTA SP INDET. 2 (B), *LYNGBYA* SP INDET. 1 (C), *GRACILARIA SALICORNIA* (D), *DICTYOTA* SP INDET. 1 (E), *PADINA* SP INDET. 1 (F), *SARGASSUM* SP INDET. 1 (G), *TURBINARIA* SP INDET. 1 (H), *TURBINARIA* SP INDET. 2 (I), *CAULERPA LENTILLIFERA* (J), *CAULERPA RACEMOSE* (K), *CAULERPA SERRULATA* (L), *CAULERPA SERTULARIOIDES* (M), *HALIMEDA* SP INDET. 1 (N), *HALIMEDA* SP INDET. 2 (O), *CHLORODESMIS FASTIGIA* (P).

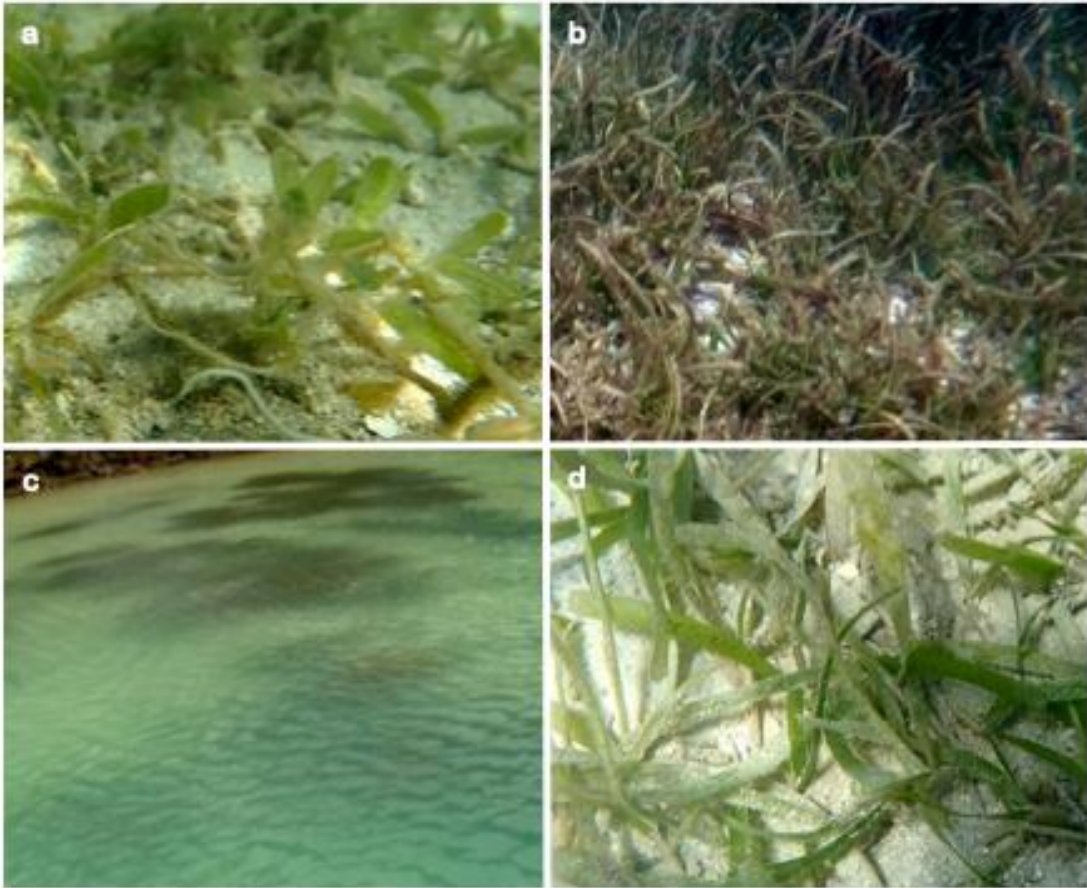


FIGURE 26: DIVERSITY OF SEAGRASS OBSERVED AT AURORE SOUTH: *HALOPHILA SP INDET.1* (A), *SYRINGODIUM ISOETIFOLIUM* (B), *ENHALUS ACOROIDES* (C), *THALASSIA HEMPRICHII* (D).



FIGURE 27: SHARK OBSERVED FROM UAV

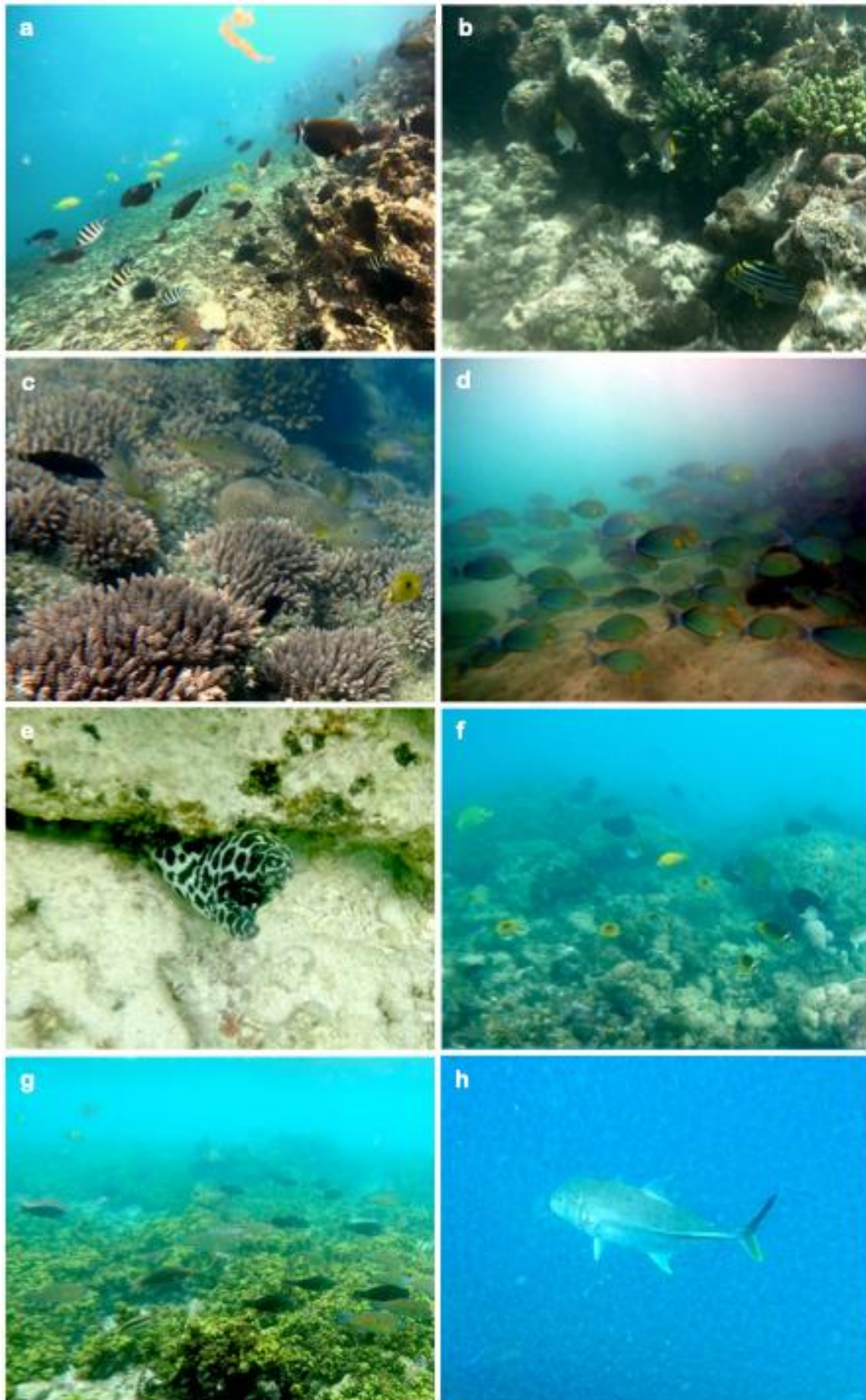


FIGURE 28: DIVERSITY OF FISH FAMILIES OBSERVED AT AURORE SOUTH: ACANTHURIDAE, SIGANIDAE, LABRIDAE, SCARIDAE & POMACENTRIDAE (A), CHAETODONTIDAE & HAEMULIDAE (B), LUTJANIDAE & CHAETODONTIDAE (C), ACANTHURIDAE (D), MURAENIDAE (E), CHAETODONTIDAE, POMACANTHIDAE (F), SCARIDAE, MULLIDAE & POMACENTRIDAE (G), CARANGIDAE (H).

NUMBER OF SPECIES RECORDED PER FISH FAMILY AURORE SOUTH

Class	Family	Number of species
Teleostei	Acanthuridae	6
	Chaetodontidae	5
	Pomacentridae	4
	Carangidae	3
	Labridae	3
	Holocentridae	2
	Haemulidae	2
	Lethrinidae	2
	Nemipteridae	1
	Siganidae	1
	Balistidae	1
	Ephippidae	1
	Syngnathidae	1
	Synodontidae	1
	Pomacanthidae	1
	Tetraodontidae	1
	Scaridae	1
	Epinephelidae	1
	Sphyaenidae	1
	Mullidae	1
Belonidae	1	
Muraenidae	1	
Zanclidae	1	
Lutjanidae	1	
Monacanthidae	1	
Sub-Total		44
Elasmobranchii	Dasyatidae	1
	Carcharhinidae	1
Sub-Total		2
Total		46



FIGURE 29: FISH TRAP OBSERVED DURING FIELD SURVEYS

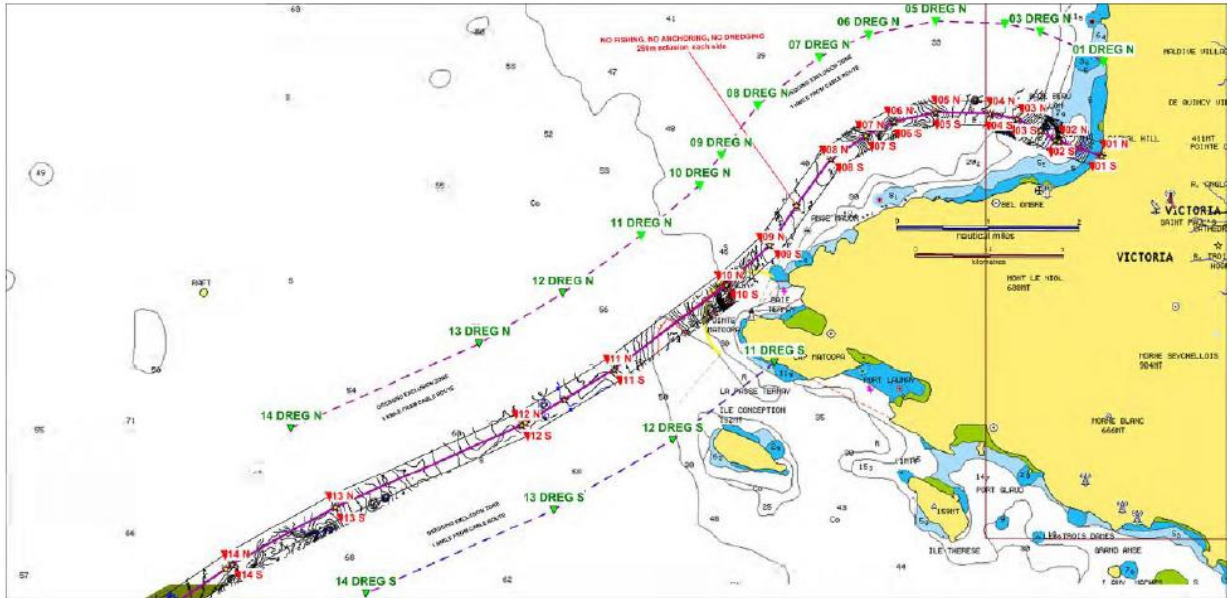
FISH SPECIES PER IUCN RED LIST AURORE SOUTH

Thirty-seven species recorded are listed in the IUCN Red list (Table 5). This includes one species of Butterflyfish (*Chaetodon trifascialis*) is classified as Near Threatened (NT), four species namely the Broad Cowtail Stingray (*Pastinachus ater*), the Harlequin filefish (*Oxymonacanthus longirostris*), the Pearl bubble coral (*Physogyra lichtensteini*) and the Yellow surfish (*Actinopyga mauritiana*) are listed as Vulnerable (VU). Thirty-one species of which Twentynine Teleostei from the following families Acanthuridae, Chaetodontidae, Nemipteridae, Pomacanthidae, Zanclidae, Ephippidae, Belonidae, Sphyraenidae, Carangidae, Haemulidae, Labridae, Lethrinidae, Holocentridae, Mullidae, Pomacentridae, Syngnathidae, Tetraodontidae, Balistidae and two sea cucumbers namely the lollyfish (*Holothuria atra*) and the greenfish sea cucumber (*Stichopus chloronotus*) are listed as Least Concern(LC) and lastly one species of sea cucumber (*Bohadschia vitiensis*) is listed as data deficient.

IUCN Red List Categories	Number of species observed per category
Near Threatened	1
Vulnerable	4
Least Concern	31
Data Deficient	1
Not Evaluated or Not identified to species level	64

EXCLUSION ZONE FOR PEACE PIPE

Example of Min 250 m exclusion zone for Peace Pipe



BRIEF: PUBLIC MEETINGS

Brief:

The following public meetings, (*which were advertised as per attached*), was held in August'24 and October'24, with the aim to inform the public of Government's plans to address the issue of Industrial Land Scarcity to the public, through the following 3 proposed reclamation projects;

- I. Providence Zone 18 (Lagoon Area)
- II. Providence Zone 5 Extension
- III. Providence Zone 20 Extension

	1st Public Meeting	2nd Public Meeting
Date:	28 th Aug'24	29 th Oct'24
Venue:	SBS Conference Room	STC Conference Room
Meeting Panel:	Minister (MIEI) PS (MIEI) CEO (IEA) Lease Manager (IEA) Lease Director (MLH)	Minister (MIEI) PS (MIEI) CEO (IEA) Lease Manager (IEA)
Number of Participants: [as per attached list]	<i>MIEI to provide list (Chloe/Farah)</i>	33 Participants
Key Points Raised/Discussed:	<ul style="list-style-type: none"> ▲ Land Scarcity Issue in Seychelles ▲ Ongoing increase in land demands (applications) ▲ Lack of land supply to meet demand ▲ How to make better use of existing scarce land resources ▲ The current effect on business community due to lack of space/land, and overall adverse impacts on the country's quality of life and investment opportunities. ▲ IEA's Land application statistics & categories in terms of land use ▲ What is being done to ensure fairness & to provide deserving applicants with land needed. ▲ IEA's Lease cancellation processes due to breach of lease agreement ▲ Government's plan to increase land stock through the 3 mentioned proposed reclamation projects. ▲ The benefits of the proposed reclamation projects 	