Airport of Rodrigues Ltd

Proposed Expansion of Rodrigues Airport

APPENDICES 9.2 Specialists Reports

VOLUME 2 OF 4

Report Reference – 09053999

Prepared by

setec (Mauritius) Ltd

setec hydratec

Enviro-Consult Ltd

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Airport of Rodrigues Ltd

Proposed Expansion of Rodrigues Airport

Terrestrial Biodiversity Factual Report for the purpose of the Environmental and Social Impact Assessment Report

Report Reference – 09053999

Prepared by

setec (Mauritius) Ltd

ECO-MED

20 April 2023

Report Prepared by

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0 Non-Technical Executive Summary

0.1 Introduction

Plaine Corail Airport in Rodrigues Island is managed by Airport of Rodrigues Ltd. (ARL), a subsidiary of the Airports of Mauritius Co. Ltd. (AML).

An Environmental and Social Impact Assessment for the New runway at Plaine Corail Airport in Rodrigues Island was prepared in 2019 to meet the requirements of the Government of Mauritius and those of the Agence Française de Développement (AFD) and the European Union (EU).

In this context a factual baseline study was undertaken in 2019.

Airport of Rodrigues Ltd is now proposing to seek financing support from the World Bank for the proposed expansion of the Rodrigues Airport and is therefore required to update the ESIA to meet the requirements of the World Bank Environmental and Social Framework (ESF).

This study report is based on the one prepared in 2019 and updated as a result of new available data and additional field surveys undertaken in Rodrigues in April 2023.

0.2 Terrestrial Biodiversity baseline conditions

Figure 1 shows the Area of Influence used to describe the terrestrial biological baseline conditions.

Anse Quitor is a 10.34 ha declared Nature Reserve as per the Second Schedule of the Forests and Reserves Act 1984 as amended; it was gazetted in 1982. Anse Quitor is one of the 4 nature reserves in Rodrigues and is a coastal dry ecosystem, with a limestone substrate. A Biodiversity Restoration Project was funded by the World Bank i.e. weeding of all weed-infested areas and replanting areas weeded with native species (1995-2001).

Anse Quitor is an interesting area with caves in which many bones of the extinct Solitaire and tortoise have been found, and plants grown in crater-like holes where little soil has gathered. Furthermore, Anse Quitor Nature Reserve holds the unique endemic tree of *Zanthoxylum paniculatum* and the rare *Foetidia rodriguesiana, Terminalia benzoe, Antirhea bifurcata*, and *Gastonia rodriguesiana* grow along the river banks in this nature reserve (source GEF SGP, 2011).

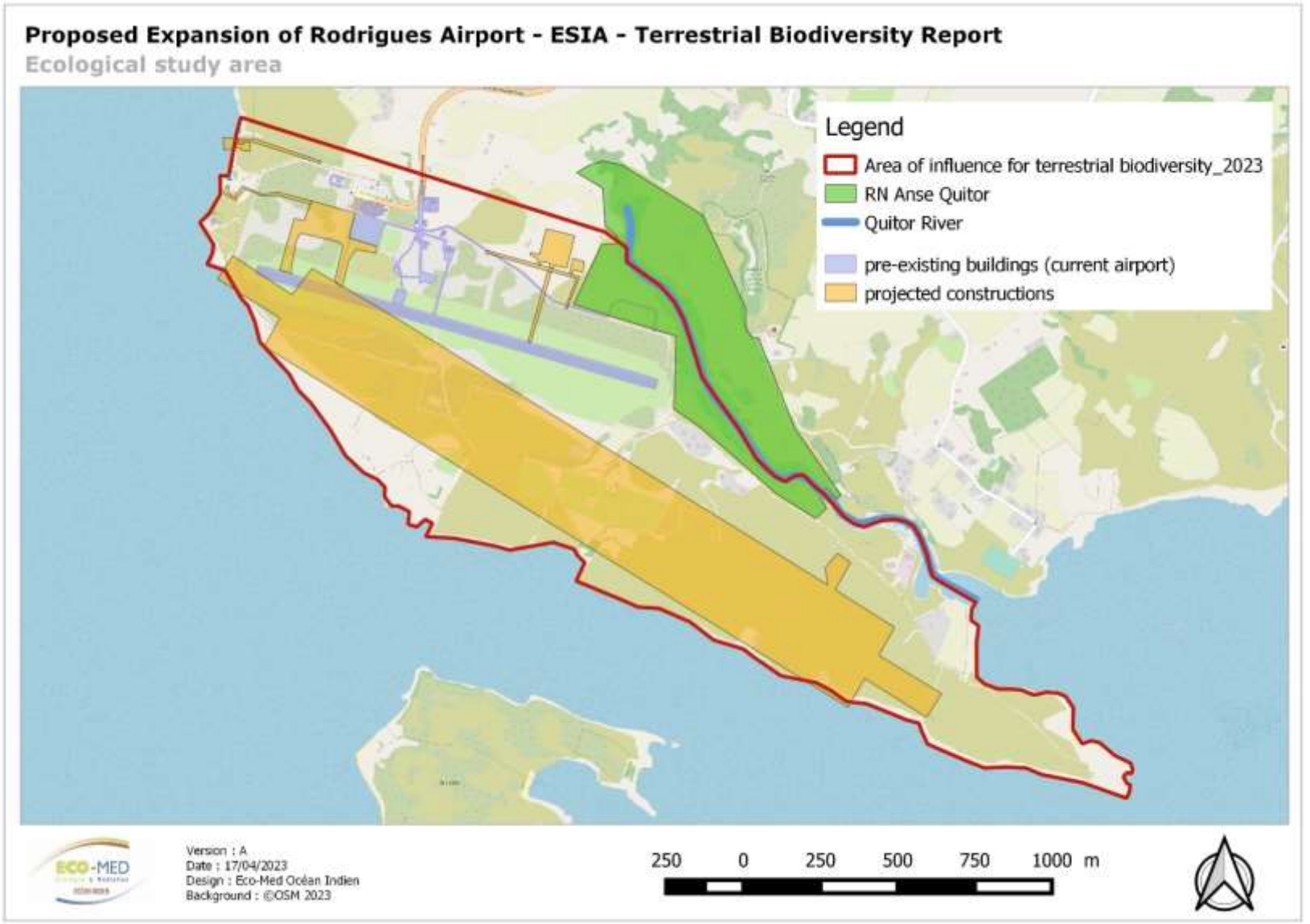


Figure 1: Area of influence – Terrestrial Biodiversity

0.2.1 Vegetation and flora

Ten terrestrial vegetation and habitat types are recorded in the area of influence (refer Table 1 and Figure 2).

Table 1: Habitat types recorded in the area of influence

ID	Sensitivity	Name	Area (ha)	% of the total surface
HA1	**Natural habitats**	Grazing lands on basaltic resurgences	5.9	**2.5%**
	Natural habitats	Grazing lands on calcarenic substratum	67	**29%**
HA2	**Natural habitats**	Coastal vegetation dominated by Ipomoea pes caprae (shore-line community)	11	**4.7%**
HA3	**Modified habitats**	Anthropized areas	73	**31%**
HA4	**Critical habitat**	Dry forest	17	**7.1%**
HA5	**Natural habitats**	Riparian vegetation	1.1	**0.5%**
HA6	**Natural habitats**	Estuarine habitat	8.2	**3.5%**
HA7	**Natural habitats**	Calcarenic dry lawns of anthropogenic origin	2.2	**0.9%**
HA8	**Modified habitats**	Coastal grasslands dominated by secondarized thickets (*Lantana camara*)	25	**11%**
HA9	**Modified habitats**	Secondarized thickets (*Leucaena leucocephala*)	24	**10%**

AQNR (dry forest) is defined as a ‘critical habitat’ as per ESS6 in as much as it meets the definition of such habitat (cf. 0.2.4)
below:

Native flora recorded in the area of influence and sensitivity assessment are listed in Table 2. The most threatened species recorded in the area of influence for terrestrial biodiversity, as per IUCN red list of threatened species: (updated 2022):

- Critically endangered (CR) species are recorded at the study site, such as *Hyophorbe verschaffeltii, Polyscias rodriguesiana, Latania verschaffeltii, Zanthoxylum paniculatum, Antirhea bifurcata, Foetidia rodriguesiana;*
- Endangered (EN) species are recorded at the study site, which are all partially located inside the project footprint such as *Diospyros diversifolia, Fernelia buxifolia; Clerodendrum laciniatum, Mathurina penduliflora, Pleurostylia putamen.*

Table 2: Native flora recorded in the area of influence and sensitivity assessment

Type	Items	Sub items	Area/number of specimens inside the area of influence	Sensitivity
Flora	Plant species of major sensitivity	*Foetidia rodriguesiana* - CR	4	**Major**
		Hyophorbe verschaffeltii - CR	43	
		Latania verschaffeltii - CR	10	
		Polyscias rodriguesiana - CR	7	
Flora	Plant species of high sensitivity	*Zanthoxylum paniculatum* – CR	1	**High**
		Antirhea bifurcate – CR	1	
		Clerodendrum laciniatum – EN	3	
		Diospyros diversifolia – EN	2	
		Fernelia buxifolia – EN	2	
		Mathurina penduliflora – EN	5	
		Pleurostylia putamen – EN	16	
		Terminalia bentzoe subsp. Rodriguesensis – VU	28	
		Pandanus heterocarpus – NT	69	
		Sarcanthemum coronopus – NT	37	
		Adiantum rhizophorum – *LC*	-	
Flora	Plant species of medium sensitivity	Phyllanthus dumentosus, Camptocarpus sphenophyllus, Secamone rodriguesiana, Nephrolepis biserrata, Phymatosorus scolopendria	-	**Medium**
Flora	Plant species of low sensitivity	Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Premna serratifolia, Thespesia populnea, Cynanchum viminale	-	**Low**

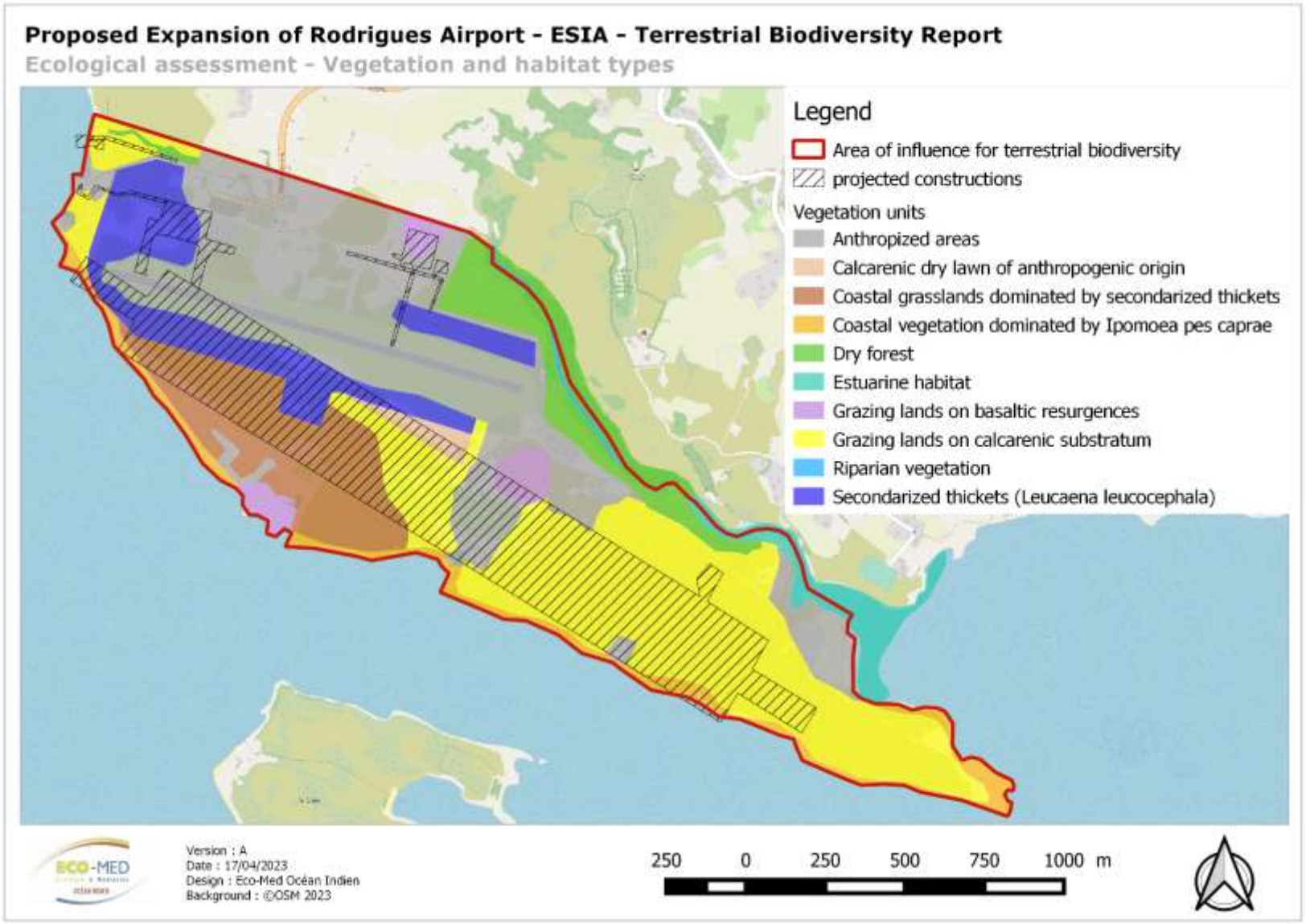


Figure 2: Vegetation and habitat types mapping

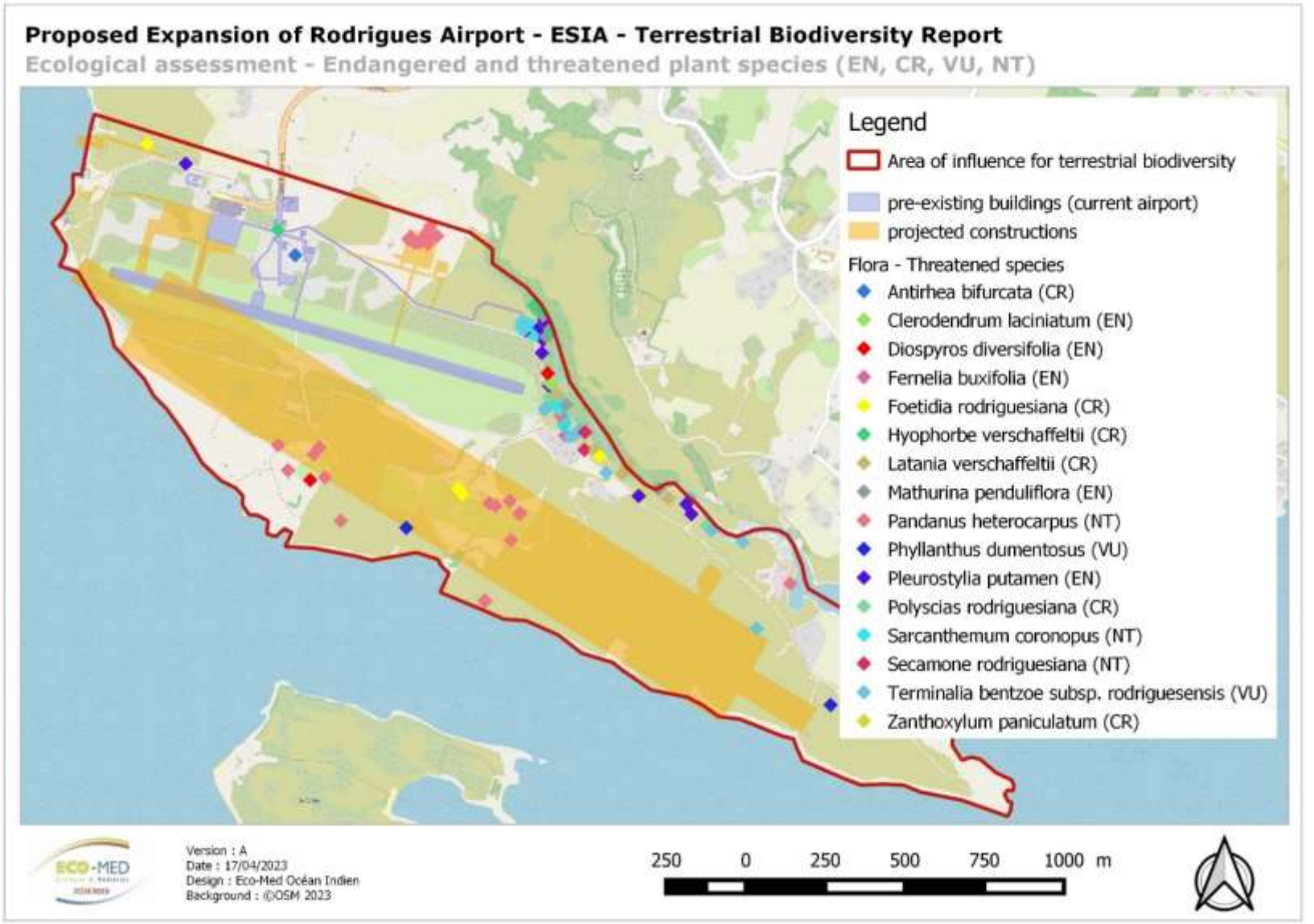


Figure 3: Endangered and threatened plant species map

0.2.2 Fauna

The baseline of terrestrial fauna is:

- Mammals: mainly bovid (cows, goats, sheep) and other domestic (cat, dog) or introduced animals (rats). There is only one native species, classified as endangered (IUCN): *Pteropus rodricensis*, an endemic bat. Only some individuals were observed flying over the area.
- Reptiles: mainly of exotic origin. Only one species is presumed to be native, *Lepidodactylus lugubris*.
- Birds: mainly exotic population. No species with a particular conservation status observed in the area.
- Molluscs: well represented by native and endemic species. *Tropidophora* desmazuresi & *Tropidophora articulata* have an "critical" and "endangered" status (IUCN red list). However only empty shells were found on the footprintproject. Alive animal are only found in Anse Quitor reserve.
- Arthropods (Insects, Arachnids, Myriapods, Crustaceans): no threatened species

0.2.3 Ecological continuities

The ecological network is presented in the table 3 below:

Table 3: List of ecological continuities included within the area of influence

Ecological continuites	Function	Species concerned
Anse Quitor river	**Terrestrial corridor**	Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (L*ygodactylus lugubris*)
Anse Quitor river	**Aerial corridor**	Bats (*Pteropus rodricensis*), marine birds (*Phaeton lepturus*)
Anse Quitor Nature Reserve	**Biodiversity reservoir**	Native plant species, i.e.: *Camptocarpus sphenophyllus, Clerodendrum laciniatum, Diospyros diversifolia, Fernelia buxifolia, Foetidia rodriguesiana, Hyophorbe verschaffeltii, Latania verschaffeltii, Mathurina penduliflora, Pleurostylia putamen, Polyscias rodriguesiana, Sarcanthemum coronopus, Secamone rodriguesiana, Terminalia bentzoe subsp. rodriguesensis, Zanthoxylum paniculatum…* Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (*Lygodactylus lugubris*) Endemic molluscs (*Tropidophora ssp, Omphalotropis littorinula*)
Coast	**Terrestrial corridor**	Waterbirds (*Butorides striata*), waders (N*umenius phaeopus, Arenaria interpres, Pluvialis squatarola*…)
Grazing lands		
Coast	**Aerial corridor**	Waterbirds (*Butorides striata*), waders (*Numenius phaeopus, Arenaria interpres*…), marine birds (*Phaeton lepturus, Anous ssp., Onychoprion ssp., Sterna dougallii, Ardenna pacifica, Gygis alba, etc*)
Grazing lands		

0.2.4 Critical habitats

As per the World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, “Habitat” is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. This ESS addresses all habitats, categorized as ‘modified habitat’, ‘natural habitat’, and ‘critical habitat’, along with ‘legally protected and internationally and regionally recognized areas of biodiversity value’ which may encompass habitat in any or all of these categories.

AQNR is defined as a ‘critical habitat’ as per ESS6 in as such as it meets the definition below:
Critical habitat is defined as areas with high biodiversity importance or value, including: (a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches; (b) Habitat of significant importance to endemic or restricted-range species; (c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species; (d) Highly threatened or unique ecosystems; and € Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

0.3 Potential impacts and measures

Potential environmental impacts and associated management measures are summarized in the next tables. Construction phase impacts which are temporary in nature are distinguished from the permanent impacts.

Impacts related to Operations are addressed in a third section.

0.3.1 Temporary impacts during works phase

Table 4: Summary of Temporary impacts during works phase

Context	Sub-context	Impact ID	Impact description	Positive / adverse	Impact rating before mitigation	Measure ID	Measure	Residual Impact rating
Biological	Terrestrial habitat	None	-	-	-	-	-	-
	Terrestrial flora	None	-	-	-	-	-	-
	Terrestrial fauna	BioT-Fau-W-Temp-1	Impact on Pteropus rodricensis (Chiroptera)	Adverse	Low	None	None	Low

0.3.2 Permanent and irreversible impacts during works phase

Table 5: Summary of Permanent and Irreversible Impacts during Works phase

Context	Sub-context	Impact ID	Impact description	Positive / adverse	Impact rating before mitigation	Measure ID	Measure	Residual Impact rating
Biological	Terrestrial habitat	BioT-Hab-W-Def-1	Impact on grazing lands on basaltic resurgences	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-2	Impact on grazing lands on calcarenic substratum	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-3	Impact on coastal vegetation dominated by Ipomoea pes caprae	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-4	Impact on anthropized areas	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-5	Impact on dry forest	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Negligible
						BioT-Av-2	Moving the control tower out of the nature reserve	
						BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
						BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
						BioT-Mit-5	Genetic conservation of populations of impacted rare species	
						BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity.	
						BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
		BioT-Hab-W-Def-6	Impact on riparian vegetation	Adverse	Negligible	None	None	Negligible
		BioT-Hab-W-Def-7	Impact on estuarine habitat	Adverse	Negligible	None	None	Negligible
		BioT-Hab-W-Def-8	Impact on calcarenic dry lawns of anthropogenic origin	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-9	Impact on coastal grasslands dominated by secondarized thickets (Lantana camara)	Adverse	Low	None	None	Low
		BioT-Hab-W-Def-10	Impact on secondarized thickets (Leucaena leucocephala)	Adverse	Low	None	None	Low
	Terrestrial flora	BioT-Flo-W-Def-1	Impact on native species with a major sensitivity	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
						BioT-Av-2	Moving the control tower out of the nature reserve	
						BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
						BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
						BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	
						BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
						BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
		BioT-Flo-W-Def-2	Impact on native species with a high sensitivity	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
						BioT-Av-2	Moving the control tower out of the nature reserve	

Context	Sub-context	Impact ID	Impact description	Positive / adverse	Impact rating before mitigation	Measure ID	Measure	Residual Impact rating
						BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
						BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
						BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	
						BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
						BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
		BioT-Flo-W-Def-3	Impact on native species with a high sensitivity	Adverse	Medium	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
						BioT-Av-2	Moving the control tower out of the nature reserve	
						BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
						BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
						BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	
						BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
						BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
		BioT-Flo-W-Def-4	Impact on native species with a low sensitivity	Adverse	Low	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
						BioT-Av-2	Moving the control tower out of the nature reserve	
						BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
						BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
						BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	
						BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
						BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
	Terrestrial fauna	BioT-Fau-W-Def-1	Impact on Pteropus rodricensis (Chiroptera)	Adverse	Low	None	None	Low
		BioT-Fau-W-Def-2	Impact on *Tropidophora ssp & Omphalotropis ssp* (Gastropoda)	Adverse	Medium	BioT-Mit-8	Collect molluscs from the Tropiphodora & Omphalotropis genus before and during earthwork	Low
		BioT-Fau-W-Def-3	Impact on Lygodactylus lugubris (Reptilia)	Adverse	Low	None	None	Low

Note: when no impacts are foreseen, ‘Impact ID’ column is marked ‘none’ and the following columns are hence not populated and marked ‘-‘

0.3.3 Permanent impacts during operation phase

Table 6: Summary of Permanent Impacts during Operation Phase

Context	Sub-context	Impact	Impact description	Positive / adverse	Impact rating before mitigation	Measure ID	Measure	Residual Impact rating
Biological	Terrestrial habitat	None	-	-	-	-	-	-
	Terrestrial flora	None	-	-	-	-	-	-
	Terrestrial fauna	None	-	-	-	-	-	-

Note: when no impacts are foreseen, ‘Impact ID’ column is marked ‘none’ and the following columns are hence not populated and marked ‘-‘

0.4 Terrestrial Biodiversity management plans for construction phase

Table 7 lists the plans to be developed and implemented to monitor the terrestrial biologic environmental measures in the impact study.

Specific guides for preparing plans are provided in Chapter 2 of the ESIA.

Table 8 summarizes the terrestrial biologic environmental measures in the impact study.

The estimated cost associated with the terrestrial biologic environmental management and monitoring are provided in Chapter 4. The costs are considered indicative at this stage and will be updated during the life cycle of the project.

Table 7: Terrestrial Biodiversity Management Plans for Construction Phase

Plan	Measures that the plan must allow to implement and monitor	Person in charge of implementation and control	Activity / Procedures to include
Biodiversity management and monitoring plan	BioT-Av-1 and 2 BioT-Mit-4 and 5 BioT-Comp-6 BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control	- A biodiversity management plan to follow the implementation of measures to be implemented before the works phase (BioT-Av-1 and 2 / BioT-Mit-4 and 5) - A biodiversity management plan to follow the measures to be carried out by RRA on an island scale (BioT-Comp-6 / BioT-Comp-7)
	BioT-Mit-3 and 8	External biodiversity specialists / Contractor Under ARL's control	- A biodiversity management plan to manage and follow the implementation of measures BioT-Mit-3 and 8.

Table 8: Summary of Terrestrial Biodiversity Measures and Monitoring for Construction Phase

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
Biodiversity	BioT-Av-1	Avoid remarkable trees located at the edge of the project Targeted species*: Antirhea bifurcata , Elaeodendron orientale, Fernelia buxifolia, Hyophorbe verschaffeltii, Terminalia bentzoe subsp. rodriguesensis*	This measure consists in avoiding the destruction of remarkable trees located at the boundaries of the project footprint by locally adapting the project boundaries. A total of 19 trees could be easily avoided.	Works phase Before the work begins. **Biodiversity management and monitoring plan**	These 19 trees must be marked prior to the works phase with permanent devices (fences, ribbons, paintings..) and tagged with an identification number (ID) in order to be properly followed during the works phase	Number of trees left after the works phase (out of the 19)	Reinforcing measure BioT-Mit-3	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Foundation, Forestry Services
	BioT-Av-2	Moving the control tower out of the nature reserve	This measure consists in avoiding the destruction of approximately 1 hectare of the buffer area of the Anse Quitor nature reserve. This measure allows to save 6 specimens of the following species: Elaeodendron orientale, Sarcanthemum coronopus, Terminalia bentzoe subsp. rodriguesensis	This measure must be anticipated in the project design **Biodiversity management and monitoring plan**	The official boundaries of the nature reserve will be provided by the forestry services	- Surface area left inside the Anse Quitor nature reserve (objective: 0) - Project design with a repositioning of the control tower	Reinforcing measure BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Foundation, Forestry Services for the official limits of the nature reserve
	BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	This measure consists in planting 80 specimens of rare and endangered endemic species within the airport limits after the extension airstrip project. This aims to protect, preserve and create an arboretum of endemic seeds that will be used afterwards to produce endemic plants for nature reserves in Rodrigues.	Works phase This measure must be implemented way before the works phase, in particular as regards with the collection of plant material from specimens outside the project area. **Biodiversity management and monitoring plan**	A partnership with the Forestry Services or the Mauritius Wildlife Foundation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the nature reserves of Rodrigues and/or Mauritius. Collection of plant material will be authorized in advance by the reserve managers in any case. A specific protocol will be designed for tree transplantation.	- number of plants produced (objective : 100) - number of species planted	Reinforcing measure BioT-Comp-7	External biodiversity specialists / Contractor Under ARL's control Potential partners : Wildlife Foundation, Forestry Services
	BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	This measure consists in transplanting all or part of the remarkable trees and ferns intended to be destroyed by the project: in priority, Diospyros, Terminalia, Foetidia, Antirhea, Nephrolepis	Works phase Before and or during works phase (machines will be available during the works phase which optimizes costs) **Biodiversity management and monitoring plan**	A competent and trained external coordinator on the transplantation protocol will be mobilized	- number of trees transplanted - number of trees transplanted which survive the 1st, 2nd, 3rd, 4th and 5th year after transplantation	Reinforcing measures BioT-Mit-3, BioT-Mit-5, BioT-Comp-6	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Foundation, Forestry Services

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
	BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	In response to the destruction of several rare species specimens, this measure consists in ensuring the production and reintroduction of clones and genetic ancestors of these species in order to preserve their genetic lineage in the long term. A total of 14 to 35 specimens will be produced, depending on the results obtained by vegetative and sexual propagation.	This measure must be implemented way before the works phase, in particular as regards with the collection of plant material from specimens intended for destruction inside the project footprint. Several campaigns have to be scheduled in order to target the right periods of fruiting **Biodiversity management and monitoring plan**	A partnership with the Forestry Services or the Mauritius Wildlife Foundation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the specimens located within the project footprint.	- number of plants produced (objective : 35) - number of species planted	Reinforcing measures BioT-Mit-3, BioT-Mit-4	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Foundation, Forestry Services
	BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	This measure consists in initiating a new approach for the management of extensive agriculture on the island of Rodrigues by proposing a turnkey operational action plan.	Planning over 24 months will allow satisfactory consultation times for the implementation of the action plan in the short term **Biodiversity management and monitoring plan**	This action plan can be approached by: 1- the inventory and consultation of all agricultural and ecologist partners throughout the project; 2- the establishment of the development challenges of livestock breeding in Rodrigues; 3- drawing up an inventory of actions that can improve the quality and productivity of livestock farming by promoting local biodiversity; 4- proposing a fine cartographic work accompanied by spatialized actions throughout the territory of Rodrigues.	- Obtaining an action plan validated by the regional assembly in 2022	Reinforcing measure BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners: Wildlife Foundation, Agricultural and Forestry Services, Regional Assemblee…

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
	BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	This measure consists in: • Rebuilding the fence around the Anse Quitor nature reserve, with one that would be similar to the fence around the airport in order to discourage grazing livestock inside the reserve. This measure is a short-term response to the grazing vs. biodiversity issue that has to be solved with the offset measure (BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity). • Reinforcing native species populations by planting 500 native plant specimens within the Anse Quitor nature reserve buffer area, located besides the future airport boundaries (see map below).	Harvesting (seeds, cuttings) and production must take place well before the works phase as well as the fencing work **Biodiversity management and monitoring plan**	- Check the watering quality of the plants; - Identify, locate and count exotic species and define appropriate control methods against invasive and potentially invasive exotic species; - Quantify the mortality rate and health status of native species. - Establish corrective measures if necessary, in order to always orientate this rehabilitation project in an ecologically correct direction.	- Number of plants planted - Mortality rate (total/species) - Number of placettes - Number of linear metres of fence	Reinforcing measures BioT-Mit-3, BioT-Mit-4	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners: Wildlife Foundation, Forestry Services
	BioT-Mit-8	Collect molluscs from the Tropiphodora & Omphalotropis genus before and during earthwork	This measure consists in collecting living individuals of native gasteropoda within the project footprint boundaries. Several campaigns will be conducted before the works phase and during earthwork. Sampling planning will allow the entire project area to be visited in an equivalent manner. If species are more abundant in some areas, these areas will be collected more thoroughly.	Works phase This measure must be implemented before and during the earthwork phase. Several campaigns have to be scheduled. **Biodiversity management and monitoring plan**	Learn how to distinguish the two different species recorded on site	- number of living specimens collected - number of species collected - number of survey campaigns	None	External biodiversity specialists / Contractor Under ARL's control Potential partners: Vincent Florens (Department of Biosciences, University of Mauritius, Réduit, Mauritius)

1 Terrestrial Biodiversity baseline conditions

1.1 Baseline issues assessment methodology (receptor sensitivity)

The first step is a presentation of the general state of the island of Rodrigues. This global presentation aims to define the current state (baseline) of the island, before the potential implementation of the project. It is therefore a description that takes into account several themes (physical context elements, natural context elements...).

The final objective of this exercise is to highlight all the "receptors" which could be affected, directly or indirectly, by the implementation of the project.

For each of these receptors, sensitivity was assessed according to the importance of the issue and its vulnerability.

In the context of this social impact assessment, and in order to adapt as precisely as possible to the local context of Rodrigues Island, the sensitivity of the receptor was judged in particular on the basis of the results of consultation meetings with local stakeholders, taking into account the importance given to them by local communities and authorities.

Thus, at the end of each section of the initial state, the issues are listed and their sensitivity is assessed and rated using the following methodology: 1 "low", 2 "medium", 3 "high" or 4 "major". To make reading easier, a gradient of blue is associated with each score to make the report more readable.

The higher the importance of the issue, the more intense the shade of blue.

Table 9: Receptor sensitivity

Receptor sensitivity	Low	Medium	High	Major

1.2 Area of Influence

Several areas of influence (AoI) have been defined to establish the baseline of the project's site. Each component of the environment is contextualized at the scale of the Island or the Indian Ocean according to the themes, then examined at the scale of a "large area of influence" and finally, if necessary, at the scale of a "restricted area of influence".

The "large area" includes the airport and its remote surroundings, which are known to be influenced by the direct and indirect impacts of the airport. The "restricted area" is the project footprint's direct surroundings, which are considered potentially directly impacted by the project.

The project's footprint is included in the restricted area.

Specific areas of influence had to be defined for some of the baseline components:

- the areas of influence for the terrestrial and marine natural environment are designed to adapt to the targeted species and ecosystems,
- the socio-economic area of influence is designed to adapt to the boundaries of the villages and areas used by the affected inhabitants or for the resettlement of displaced populations.

At the beginning of each section, the area of influence applied is specified.

The area of influence for physical context is mapped in figure 4 below.

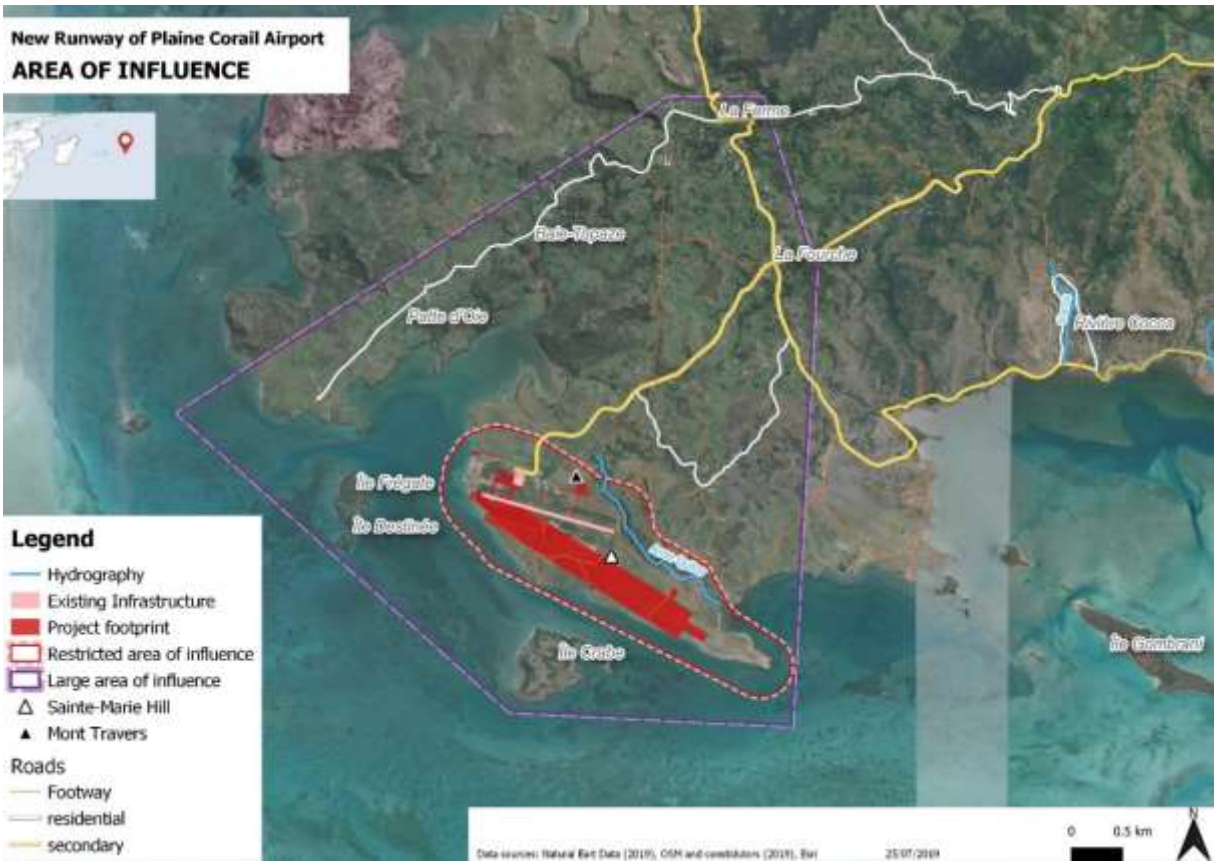


Figure 4: Area of Influence – Physical context

1.3 Terrestrial Biodiversity context

1.3.1 Area of influence

The area of influence from a terrestrial natural context is mapped on Figure 5 below.

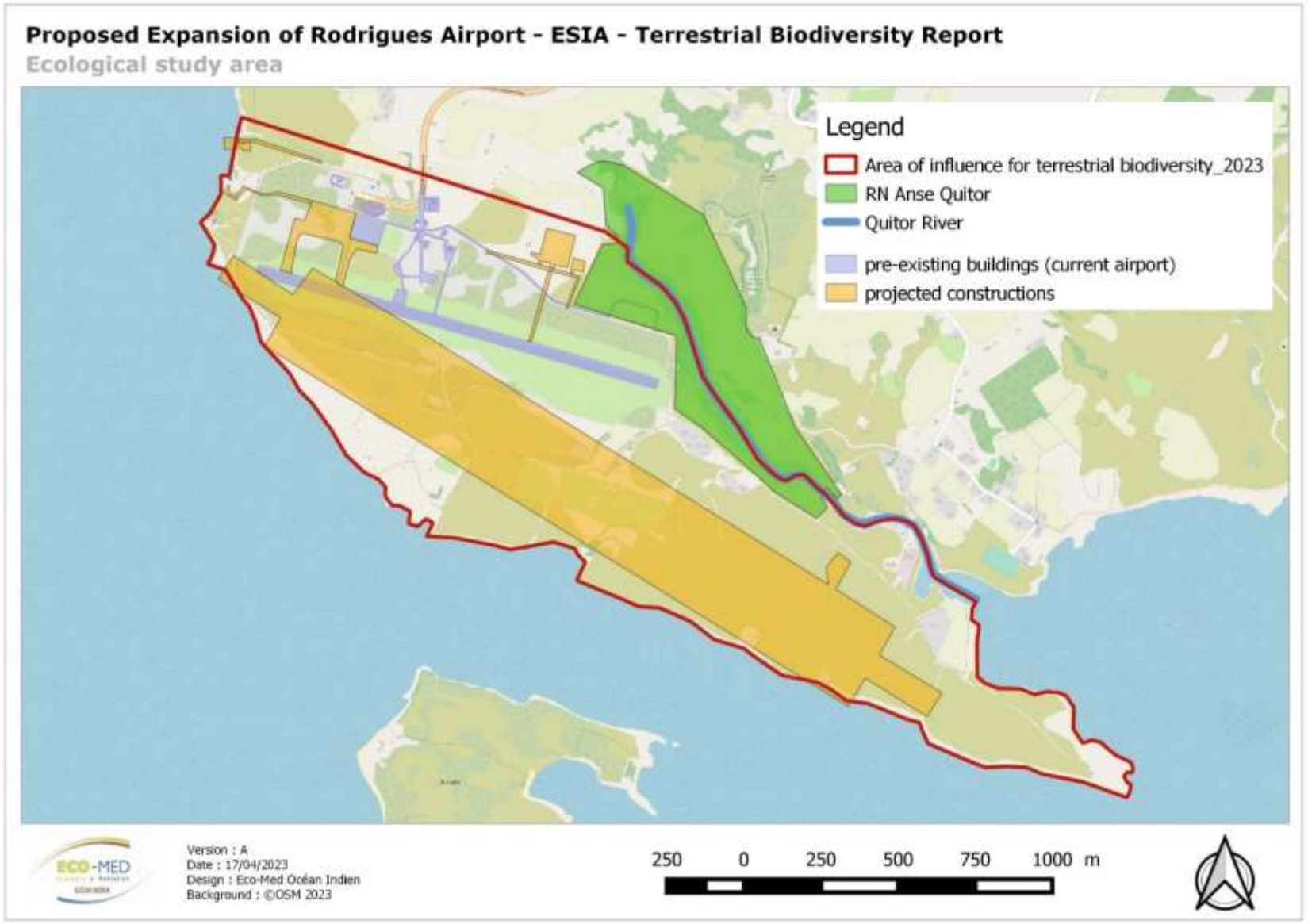


Figure 5: Area of influence – Ecological Study

1.3.2 Vegetation and flora

1.3.2.1 Methodology (2018)

Main habitats and significant land features within the site were initially inspected from aerial photographs (Google Earth 2019). This was followed by site inspections from the 1st to the 4th of April, 2019. Distinct floral habitats were noted during this field campaign. Flora species of interest (native, endemic, endangered, protected) were mapped with a handheld GPS (Garmin GPS Map62), and the number of plants recorded when necessary and/or possible.
Botanical names, author citations, IUCN Red List categories for Rodrigues and regional status follows Strahm et al. 1989, Walter et al. 1997, Rivers et al. 2015 and Kirsakye 2015, the Mauritius Herbarium and the IUCN Red List (2019).

Sensitivity assessment of the habitats
As per the World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, “Habitat” is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. This ESS addresses all habitats, categorized as ‘modified habitat’, ‘natural habitat’, and ‘critical habitat’, along with ‘legally protected and internationally and regionally recognized areas of biodiversity value’ which may encompass habitat in any or all of these categories.

Modified habitats are areas that may contain a large proportion of plant and/or animal species of nonnative origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include, for example, areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition.

Critical habitat is defined as areas with high biodiversity importance or value, including:

(a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;

(b) Habitat of significant importance to endemic or restricted-range species;

(c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;

(d) Highly threatened or unique ecosystems;

(e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

Sensitivity assessment of the native flora

The sensitivity of the native flora observed in the area of influence was assessed according to the following criteria:

- ⇒ Endemicity or indigenous status: indigenous = 1 point; endemic to the Mascarenes = 2 points; endemic to Rodrigues = 3 points.
- ⇒ Protection status: protected in Rodrigues = 1 point; protected under the Forestry Act (1983) = 3 points
- ⇒ Threat level according to the red list: LC = 0 point; NT = 1 point; VU = 2 points; EN = 3 points; CR = 4 points.

A maximum of 10 points can be assigned to a species. An adjustment by the expert can be made to correct deficiencies in the status of certain species.

Depending on the score obtained, the species is classified according to the following sensitivity levels:

Table 10: Scale value used to assess the plant species sensitivity

Receptor sensitivity	Scale value
Negligible	**Value < 2**
Low	**2 ≤ value < 4**
Medium	**4 ≤ value < 6**
High	**6 ≤ value < 8**
Major	**8 ≤ value < 10**

WARNING: Most of the vegetation (trees, shrubs) was burned (see Figure 6) because of salt sprays propagated by the last two cyclones that reached Rodrigues in early 2019. As a consequence, most of the trees, shrubs and thickets from the inner and shore-line communities were defoliated and thus difficult to identify properly in certain cases.

Figure 6: Example of burned vegetation

1.3.2.2 Results

This section describes the terrestrial vegetation and habitat types recorded in the area of influence for terrestrial biodiversity and briefly outlines the relative ecological ranking for each. Descriptions of the ten various vegetation types are provided in the table below and mapped in Figure 111.

Table 11: Habitat types recorded at the area of influence

ID	Sensitivity	Name	Area (ha)	% of the total surface
HA1	**Natural habitats**	Grazing lands on basaltic resurgences	5.9	**2.5%**
	Natural habitats	Grazing lands on calcarenic substratum	67	**29%**
HA2	**Natural habitats**	Coastal vegetation dominated by Ipomoea pes caprae (shore-line community)	11	**4.7%**
HA3	**Modified habitats**	Anthropized areas	73	**31%**
HA4	**Critical habitat**	Dry forest	17	**7.1%**
HA5	**Natural habitats**	Riparian vegetation	1.1	**0.5%**
HA6	**Natural habitats**	Estuarine habitat	8.2	**3.5%**
HA7	**Natural habitats**	Calcarenic dry lawns of anthropogenic origin	2.2	**0.9%**
HA8	**Modified habitats**	Coastal grasslands dominated by secondarized thickets (*Lantana camara*)	25	**11%**
HA9	**Modified habitats**	Secondarized thickets (*Leucaena leucocephala*)	24	**10%**

Originally, there was no natural open savannah or grasslands by the coast of Rodrigues. Drought, starvation and grazing are likely to be the most important factors responsible for the disappearance of forested lands throughout the island. Rodrigues, estimated to now support 3,000 cattle and 7,000 sheep and goats, had 4,000 and 12,000 respectively in 1981.

The study site comes on a limestone substratum (calcarenite) mostly turned into pastoral landscapes, though patches of basalt are punctually found (**Figure 9**). Species growing on calcarenite (mainly grasses) are generally the same as those growing on basalt and we found no relevant differences in the vegetation communities from the two substratum. **Grazing lands dominated by introduced grasses** now dominate the landscape in Plaine Corail. The pastoral landscapes cover about 43% of the total surface area of the study site. A **shore-line community** can be distinguished with halophytic/halotolerant species, such as *Portulaca oleraceae* or *Ipomoea pes-caprae*, the latter forming a dense mat of low growth, completely covering the soil (**Figure 9A**). The **inner littoral community** is now composed of intensely grazed grasses spiked with small twisted trees or shrubs which usually do not exceed more than 3 meters. A very large population of *Elaeodendron orientale* (“Bois

d'olives"), endemic to the Mascarenes, occurs in Plaine Corail and is of great interest within the limits of the area of influence (**Figure 9B**). Other introduced shrub or tree species can be found, such as *Euphorbia tiraculli*, *Wikstroemia indica* or *Prosopis juliflora.* Some scarce and threatened endemic trees and shrubs were able to survive within the grazing lands: i.e. *Foetidia rodriguesiana* (critically endangered) and *Phyllanthus dumentosus* (vulnerable). The range of grass species can also be seen as a component of biodiversity in the area of influence, with a broad array of prostrate and erect forb species that considerably enhance the floral biodiversity: *Cynanchum viminale* (vulnerable), *Fimbristylis* spp., *Cyperus* spp. or the prostrate and rare fern *Adiantum rhizophorum*. A dry calcarenic lawn sequence (**Figure 9F**) is noted on the area of influence (less than 1% of the total surface area), composed of a sparse but original herbaceous vegetation dominated by *Fimbristylis cymosa* and *Fimbristylis dichotoma*.

Lantana's thickets cover a large part of the grasslands. The species were introduced in the late 1920s and already considered widespread in the lowlands in 1970. It now covers more than 10% of the total surface area of the study site, which is probably underestimated as most of the thickets were totally burned by salt sprays after the tropical storm winds of the cyclone Gelena in March 2019.

Anse Quitor valley, right beside the island's airport, is one of the few reserves that had been created from the 1970s proposals for protecting the remnants of native vegetation. Anse Quitor was finally fenced in 1986 thanks to a FAO funding for revitalizing agriculture. Elsewhere, there are no intact native forests left on Rodrigues. Anse Quitor is known as one of two most important sites for endemic plants of **the lowland dry forest** (**Figure 9D**). It covers 30 ha, where about 7 ha has been weeded and planted with native species. The valley contains viable populations of several of Rodrigues's most important endemic plants, such as *Zanthoxylum paniculatum, Polyscias rodriguesiana* and large populations of the palms *Latania vershaffeltii* (**Figure 9A**) and *Hyophorbe verschaffeltii*. Restoration started in 1997 with the propagation of 28 native and endemic species, providing a long term security for several species that were intended to disappear in the near term.

The upper part of the Anse Quitor River is composed of degraded **freshwater riparian habitats (Figure 9H)**, a degradation probably accentuated by the floods caused recently by the past two cyclones in early 2019. Some sequences of riparian habitats are still preserved with shrubs composed of the native *Thespesia populnea*, which is resistant to salt spray and strong winds. The shrub's spreading lower branches leads to dense and impenetrable thickets that is very attractive for the reproduction of the striated heron (*Butorides striata*). Wetland plant communities are locally observed at the boundary between the freshwater banks and the estuarine habitats as we recorded the submersed *Paspalidium geminata* herbaceous community along with the native and rare *Cyperus iria.*

Figure 7: Submersed grass bed of Paspalidium geminata

The lower part of the Anse Quitor River forms an **estuarine ecosystem Figure 9G**) in which a mangrove restauration program seems to have been conducted in the past 10 years. We found two remnant specimens of mangrove trees with one species, *Rhizophora mucronata*. As reported in the literature, a mangrove replanting program has been implemented in Mauritius under which seven hectares have been planted with *Rhizophora mucronata* and *Bruguiera gymnorhiza*. Some 90 ha of mangroves have been planted in 11 sites in Rodrigues in an effort to create a barrier against terrigenous sediment runoff from reaching the sea, as part of a European Union Development Fund (EDF) project.

In total, **8% of the area of influence for terrestrial biodiversity (=Anse Quitor Nature Reserve) is composed of habitats associated with a high ecological value (meeting the criteria of "Critical Habitats")**, while 42% come with a medium value (grass land, calcarenic lawns, and riverine habitats), 39% with a negligible value (anthropized areas) and 11% with a low value. Most of the grazing lawns were associated with a medium value as it shelters a large population of *Elaeodendron* (Bois d'olives) and a few specimens of rare and threatened (per IUCN categorization) endemic species.

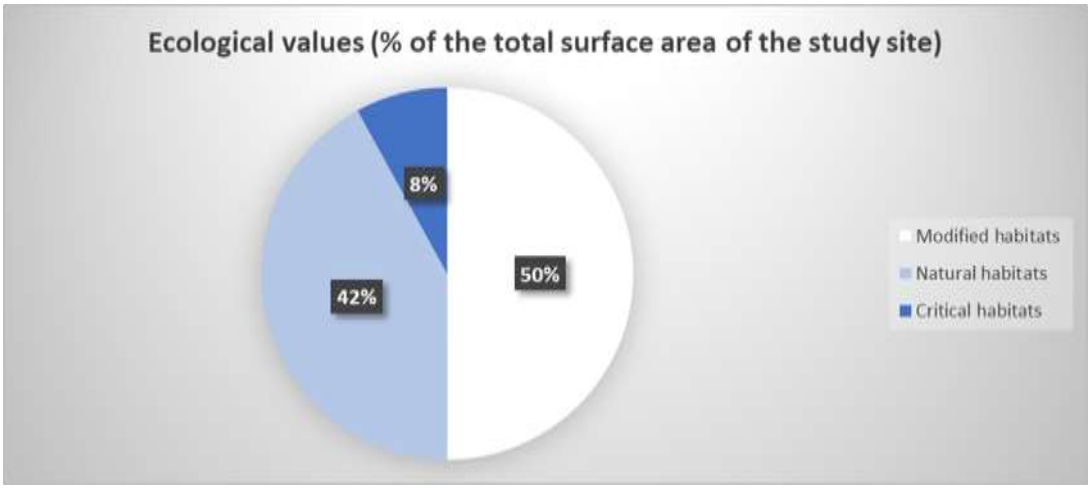


Figure 8: Ecological values of the vegetation on the area of influence

A – Mat of *Ipomoea pes-caprae*

B – Grasslands spiked with shrubs of *Elaeodendron orientale*

C – Leucaena leucoephala thickets

D – Anse Quitor Nature Reserve

F – Dry calcarenic lawns

G – Estuarine habitat (brackish waters)

H – Riparian habitats (fresh water)

Figure 9: Photographic plates of habitat types encountered at the area of influence

Figure 10: Rhizophora mucronota down the Anse Quitor River

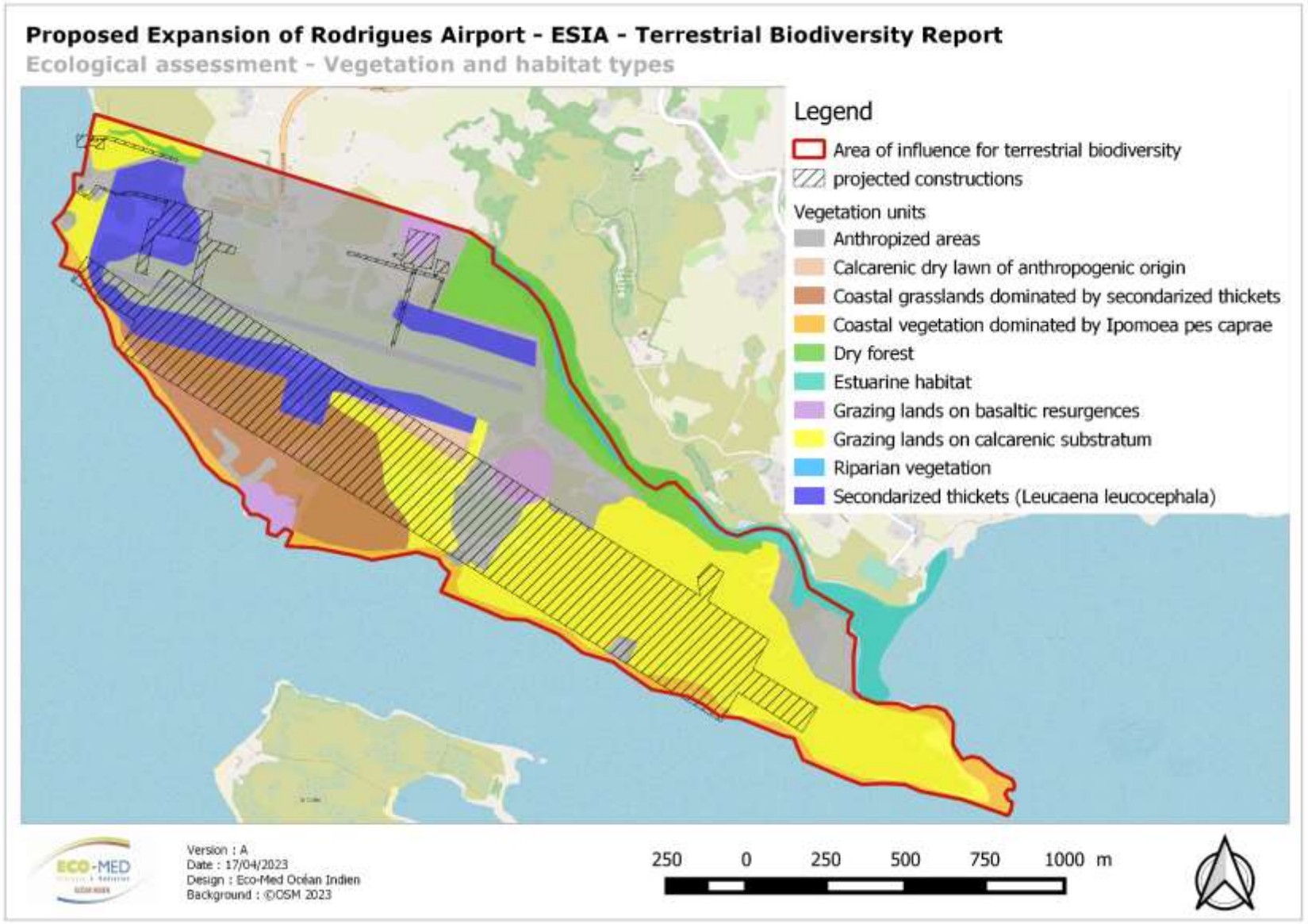


Figure 11: Vegetation and habitat types mapping

1.3.2.3 Flora

One hundred and nine plant species were recorded during the field survey (2019 & 2023), including 51 native species (15 are endemic to Rodrigues and 4 to the Mascarenes). 57 species are introduced on the study site and represent by far the major part of the total vegetation cover. Moreover, in the lowland dry forest of the Anse Quitor nature reserve, native plant communities (27 species) cover probably more than 50% of the total vegetation cover even if invasive species are still well represented (*Pongamia pinnata, Tabebuia pallida, Leucaena leucocephala*).

The most threatened species recorded in the area of influence for terrestrial biodiversity, as per IUCN red list of threatened species: (updated 2022):

- Critically endangered (CR) species are recorded at the study site, such as *Hyophorbe verschaffeltii, Polyscias rodriguesiana, Latania verschaffeltii, Zanthoxylum paniculatum, Antirhea bifurcata, Foetidia rodriguesiana;*
- Endangered (EN) species are recorded at the study site, which are all partially located inside the project footprint such as *Diospyros diversifolia, Fernelia buxifolia; Clerodendrum laciniatum, Mathurina penduliflora, Pleurostylia putamen.*

Table 12: Summary of the plant species status listed in the area of influence

Species status	Number of species
Unknown species	1
Endemic	15
Exotic	54
Indigenous	32
Naturalized	3
Sub-endemic	4
Total	**109**

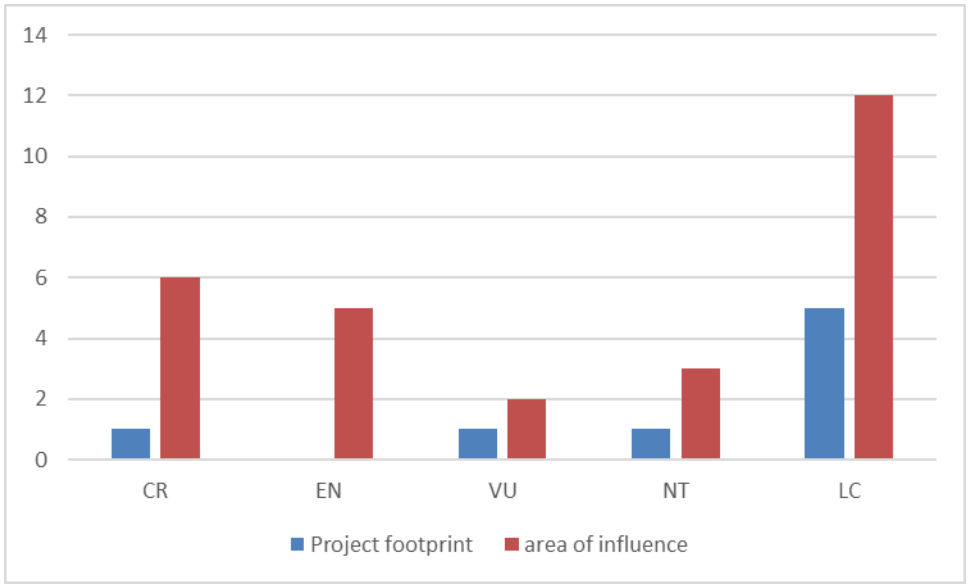


Figure 12: IUCN status and number of associated plant species through the study site/project area

Figure 13: Photographic plates with some native plant species recorded on the area of influence for terrestrial biodiversity (in red, species recorded inside the project footprint)

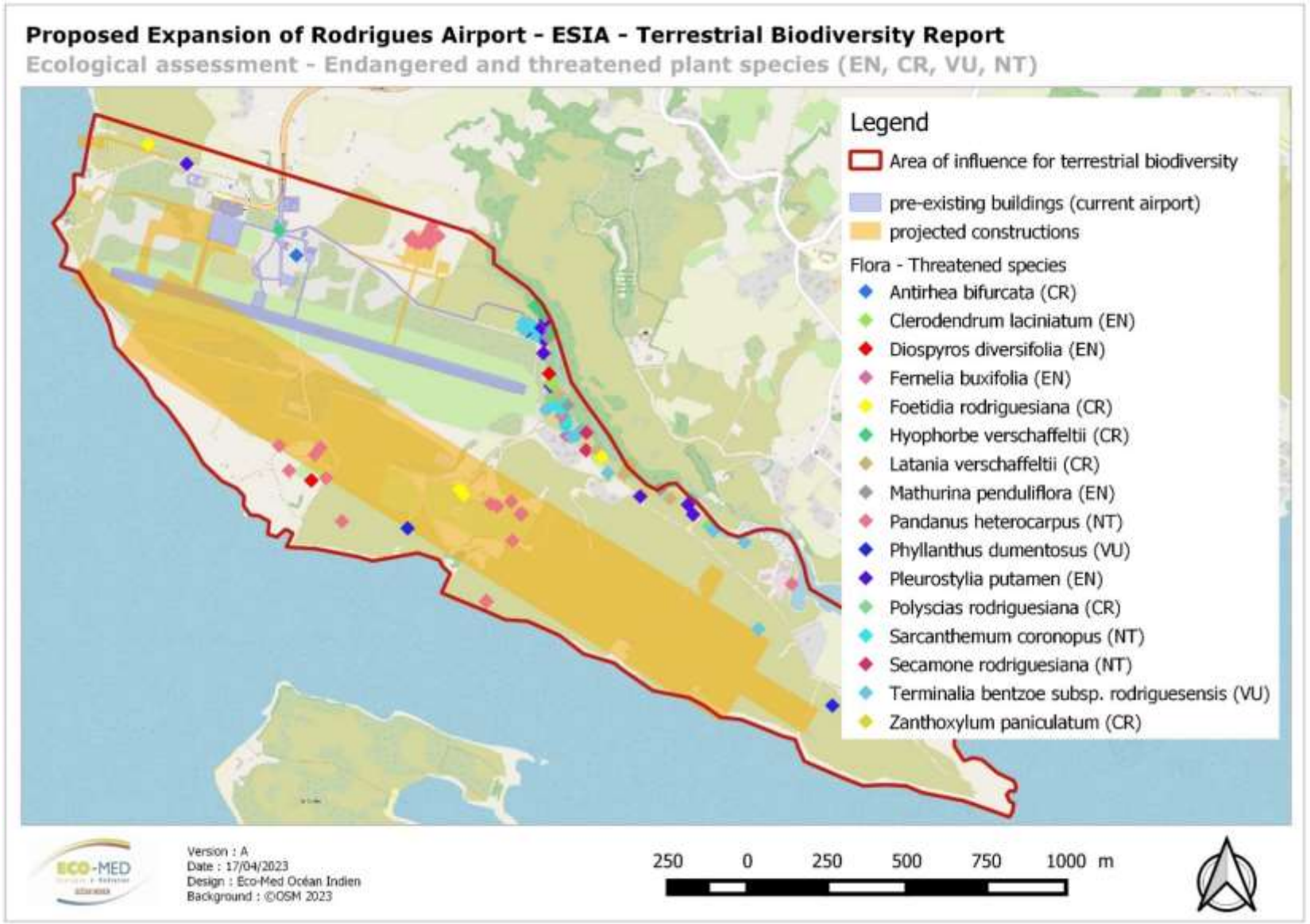


Figure 14: Endangered and threatened plant species map

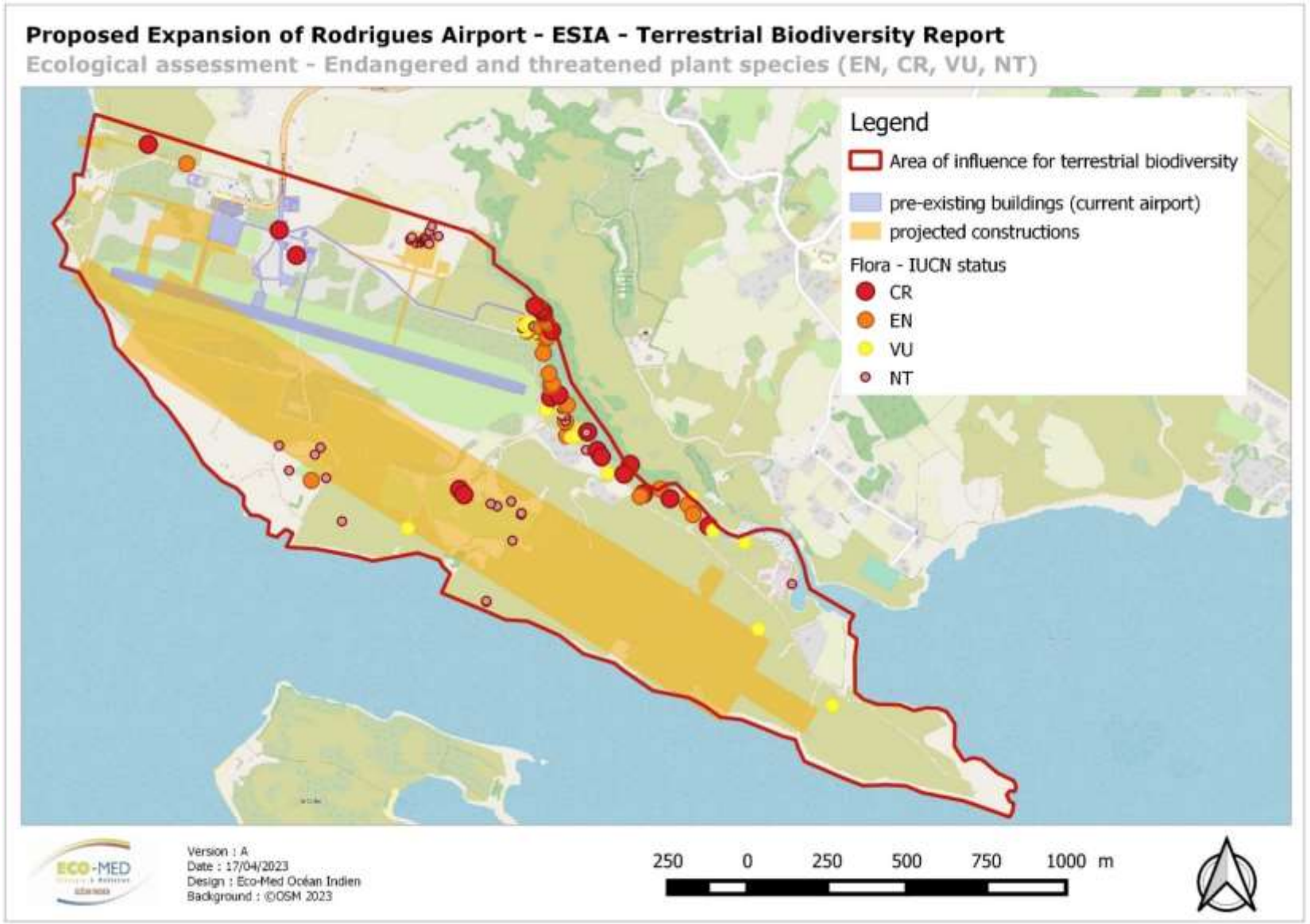


Figure 15: Endangered and threatened plant species map (status)

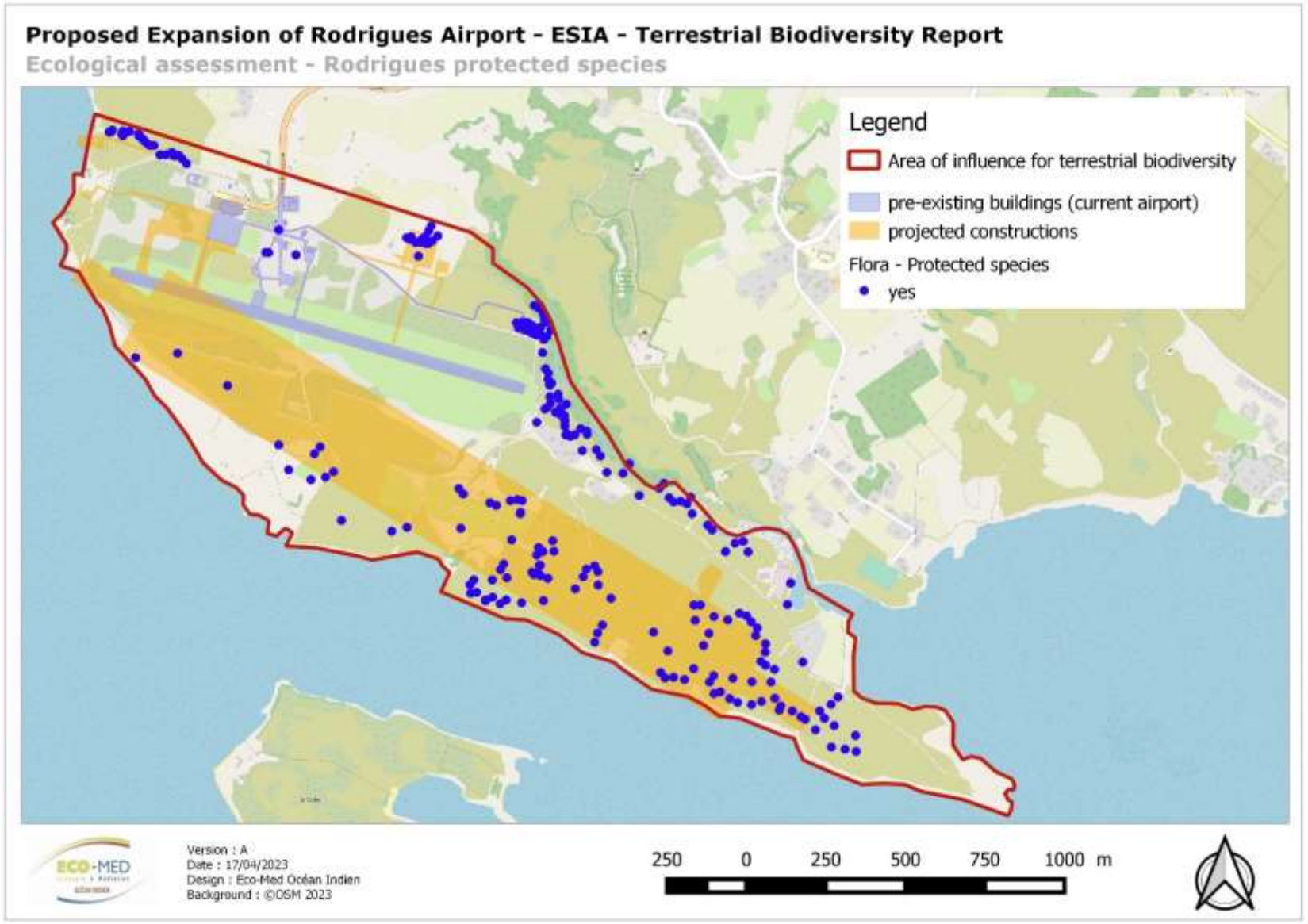


Figure 16: Rodrigues' protected species map

Table 13: List of plant species recorded on site (purple background: species recorded inside the project footprint) and sensitivity assessment for native species

Scientific name	French name	Family	Status	IUCN (status retained)	Sensitivity	Protection Forestry Services	Protection Forestry Act 1983
Foetidia rodriguesiana F. Friedmann	Bois puant	Lecythidaceae	Endemic	CR	Major	yes	
Hyophorbe verschaffeltii H. Wendl.	Palmiste marron	Arecaceae	Endemic	CR	Major	yes	
Latania verschaffeltii Lem.	Latanier jaune	Arecaceae	Endemic	CR	Major	yes	
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Bois blanc	Araliaceae	Endemic	CR	Major	yes	
Zanthoxylum paniculatum Balf. f.	Bois pasner	Rutaceae	Endemic	CR	High		
Antirhea bifurcata (Desr.) Hook.f.	Bois goudron	Rubiaceae	Sub-endemic	CR	High	yes	
Clerodendrum laciniatum Balf.f.	Bois cabri	Lamiaceae	Endemic	EN	High	yes	
Diospyros diversifolia Hiern	Bois d'ébène / Ebénier	Ebenaceae	Endemic	EN	High	yes	
Fernelia buxifolia Lam.	Bois bouteille	Rubiaceae	Sub-endemic	EN	High	yes	
Mathurina penduliflora Balf. f.	Bois gandine	Passifloraceae	Endemic	EN	High	yes	
Pleurostylia putamen Marais	Bois d'olive blanc	Celastraceae	Endemic	EN	High	yes	
Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens	Bois benjoin	Combretaceae	Endemic	VU	High	yes	
Pandanus heterocarpus Balf. f.	Vacoa parasol	Pandanaceae	Endemic	NT	High	yes	
Sarcanthemum coronopus Cass.		Asteraceae	Endemic	NT	High	yes	
Adiantum rhizophorum Sw.		Pteridaceae	Sub-endemic	LC	High		yes
Phyllanthus dumentosus Poir.		Phyllanthaceae	Indigenous	VU	Medium	yes	
Camptocarpus sphenophyllus (Balf. F.)		Asclepiadaceae	Endemic	NT	Medium		
Secamone rodriguesiana F.Friedmann		Apocynaceae	Endemic	NT	Medium		
Nephrolepis biserrata (Sw.) Schott	Fougère rivière	Nephrolepidaceae	Indigenous	LC	Medium		yes
Phymatosorus scolopendria (Burm. f.) Pic. Serm.	Patte de lézard	Polypodiaceae	Indigenous	LC	Medium		yes
Dodonaea viscosa Jacq.	Bois d'arnette	Sapindaceae	Indigenous	LC	Low	yes	
Dracaena reflexa Lam.	Bois de chandelle	Asparagaceae	Indigenous	LC	Low	yes	
Elaeodendron orientale Jacq.	Bois rouge	Celastraceae	Sub-endemic	LC	Low	yes	
Ficus reflexa Thunb.	Ti l'affouche	Moraceae	Indigenous	LC	Low	yes	
Ficus rubra Vahl	Affouche rouge	Moraceae	Indigenous	LC	Low	yes	
Premna serratifolia L.	Bois sureau	Lamiaceae	Sub-endemic	LC	Low	yes	
Thespesia populnea (L.) Sol. ex Corrêa	Sainte Marie	Malvaceae	Indigenous	LC	Low	yes	
Cynanchum viminale (L.) L.	Liane calé	Apocynaceae	Indigenous	VU	Low		
Achyranthes aspera L.	Herbe d'Eugène	Amaranthaceae	Indigenous	LC	Negligible		
Alternanthera sessilis (L.) DC.	Brède emballage	Amaranthaceae	Indigenous	LC	Negligible		
Alysicarpus vaginalis (L.) DC.		Fabaceae	Indigenous	LC	Negligible		
Boerhavia coccinea Mill.	Bécabar batard	Nyctaginaceae	Indigenous	LC	Negligible		
Bothriochloa pertusa (L.) A. Camus		Poaceae	Indigenous	LC	Negligible		
Caesalpinia bonduc (L.) Roxb.	Cadoque	Fabaceae	Indigenous	LC	Negligible		
Cynodon dactylon (L.) Pers.	Petit-chiendent	Poaceae	Indigenous	LC	Negligible		
Cyperus dubius Rottb.		Cyperaceae	Indigenous	LC	Negligible		
Cyperus iria L.		Cyperaceae	Indigenous	LC	Negligible		

Scientific name	French name	Family	Status	IUCN (status retained)	Sensitivity	Protection Forestry Services	Protection Forestry Act 1983
Cyperus rubicundus Vahl		Cyperaceae	Indigenous	LC	**Negligible**		
Dactyloctenium ctenioides (Steud.) Lorch ex Bosser		Poaceae	Indigenous	LC	**Negligible**		
Eragrostis tenella		Poaceae	Indigenous	LC	**Negligible**		
Euphorbia thymifolia L.	Rougette	Euphorbiaceae	Indigenous	LC	**Negligible**		
Fimbristylis cymosa R. Br.		Cyperaceae	Indigenous	LC	**Negligible**		
Fimbristylis dichotoma (L.) Vahl		Cyperaceae	Indigenous	LC	**Negligible**		
Heteropogon contortus (L.) P. Beauv. ex Roem. et Schult.	Herbe polisson	Poaceae	Indigenous	LC	**Negligible**		
Ipomoea pes-caprae (L.) R. Br.	Liane batatran	Convolvulaceae	Indigenous	LC	**Negligible**		
Ludwigia octovalvis (Jacq.) Raven	Herbe à bourrique	Onagraceae	Indigenous	LC	**Negligible**		
Paspalidium geminatum (Forssk.) Stapf.		Poaceae	Indigenous	LC	**Negligible**		
Portulaca oleracea L.	Pourpier rouge	Portulacaceae	Indigenous	LC	**Negligible**		
Rhizophora mucronata	Palétuvier rouge	Rhizophoraceae	?	LC	**Negligible**		
Striga asiatica (L.) Kuntze	Goutte de sang	Orobanchaceae	Indigenous	LC	**Negligible**		
Tournefortia argentea L.f.	Veloutier argenté	Boraginaceae	Indigenous	LC	**Negligible**		

1.3.2.3.1 Sensitivity assessment of native flora found in the area of influence

A number of species show a major and high level of sensitivity according to our assessment criteria (see 1.3.2.1Methodology). The results of the evaluation are presented in figures below.

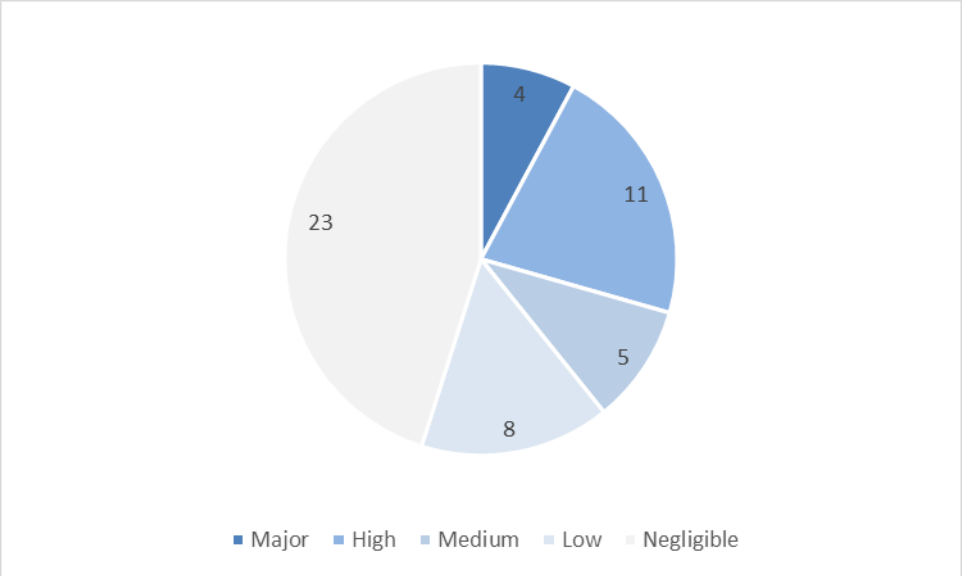


Figure 17: Assessment of the native flora sensitivity inside the area of influence

Table 14: Native flora recorded in the area of influence and sensitivity assessment

Type	Items	Sub items	Area/number of specimens inside the area of influence	Sensitivity
Flora	Plant species of major sensitivity	*Foetidia rodriguesiana* - CR	4	**Major**
		Hyophorbe verschaffeltii - CR	43	
		Latania verschaffeltii - CR	10	
		Polyscias rodriguesiana - CR	7	
Flora	Plant species of high sensitivity	*Zanthoxylum paniculatum* – CR	1	**High**
		Antirhea bifurcate – CR	1	
		Clerodendrum laciniatum – EN	3	
		Diospyros diversifolia – EN	2	
		Fernelia buxifolia – EN	2	
		Mathurina penduliflora – EN	5	
		Pleurostylia putamen – EN	16	
		Terminalia bentzoe subsp. Rodriguesensis – VU	28	
		Pandanus heterocarpus – NT	69	
		Sarcanthemum coronopus – NT	37	
		Adiantum rhizophorum – *LC*	-	
Flora	Plant species of medium sensitivity	Phyllanthus dumentosus, Camptocarpus sphenophyllus, Secamone rodriguesiana, Nephrolepis biserrata, Phymatosorus scolopendria	-	**Medium**
Flora	Plant species of low sensitivity	Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Premna serratifolia, Thespesia populnea, Cynanchum viminale	-	**Low**

1.3.2.3.2 Focus on the most threatened plant species

Some endemic species encountered inside the area of influence had become very rare on the island and show a very critical conservation status. To our knowledge, the following plants are on the edge of extinction and show a high or a major sensitivity:

- *Antirhea bifurcata (Desr.) Hook.f.*
- *Clerodendrum laciniatum Balf.f.*
- *Diospyros diversifolia Hiern*
- *Fernelia buxifolia Lam.*
- *Foetidia rodriguesiana F. Friedmann*
- *Hyophorbe verschaffeltii H. Wendl.*
- *Latania verschaffeltii Lem.*
- *Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett*
- *Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens*
- *Zanthoxylum paniculatum Balf. f.*

The species mentioned above in red are described in more detail below. It corresponds to the species located within the project's footprint or to species assessed at a major sensitivity level.

***Hyophorbe verschaffeltii* H. Wendl.**	
Hyophorbe verschaffeltii (the palmiste marron or spindle palm) is a critically endangered species of flowering plant in the Arecaceae family. It is endemic to Rodrigues island, but is widely grown in cultivation. Fewer than 60 individuals remain in the wild, occurring in Grand Montagne, Anse Quitor and Ravine de la Cascade, St Louis. There is no evidence of regeneration and grazing pressures are strong. There is also a threat of hybridisation with the introduced *H. lagenicaulis* (Johnson, 1998). In 2019, only 19 truly wild individuals were known from 9 locations, with dead stumps of old treesvisible in a number of localities	
Family	**Arecaceae**
Local name	**Palmiste marron**
Endemicity	**Rodrigues**
IUCN Status *It has been assessed CR by the IUCN in 1998 (Johnson 1998) and confirmed in 2021 (Tatayah, V., Jhangeer-Khan, R. & Bégué, J.A. 2021)*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **50** (Strahm 1989) or **60** (Johnson, 1998)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services, at least **43** recorded in Anse Quitor (Eco-Med Océan Indien) **66** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Area of influence / Project footprint)	**43** specimens are in Area of influence (not threatened by the project)
Receptor sensitivity	**Major**
	

Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett

Mainly occurs on Plaine Corail. Less than 50 individuals exist in the wild as isolated specimens. Grows on calcarenite and basalt. Attempts at propagation have been successful and young specimens have been planted in the wild (Strahm 1998).

Family	**Araliaceae**
Local name	**Bois blanc**
Endemicity	**Rodrigues**
IUCN Status *It has been assessed CR by the IUCN in 1998 (Strahm 1998) after having previously been assessed EN (Strahm 1989)*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **50** (Strahm 1998)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**7** specimens are reported from the forestry services (1999), at least **2** recorded in Anse Quitor in 2019 (Eco-Med Océan Indien) **6** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Area of influence / Project footprint)	**2** specimens are in Area of influence (not threatened by the project)
Receptor sensitivity	**Major**

Foetidia rodriguesiana F. Friedmann

Seventeen species of *Foetidia* are recognized; one from East Africa, two from the Mascarene Islands and the remaining fourteen from Madagascar. One species is confined to forest remnants on Rodrigues island. This species is present in Anse Quitor region, Anse Baleine, Mourouk valley, Cascade St Louis, Graviers, Baie Malgache, Terre Rouge, Anse aux Anglais and have been planted in the Grand Montagne Nature Reserve. Due to the low number in propagation and the very low number of individuals that still exist, this species is potentially on a decline together with the rapid invasion of exotic species (animals and plants) in these locations (WF, pers. Com.). Wild regeneration is very rare because young trees are eaten by animals (Payandee, pers. Com). The species has been assessed "Critically Endangered" under the IUCN Red Listing in 2021.

Family	**Lecythidaceae**
Local name	**Bois puant**
Endemicity	**Rodrigues**
IUCN Status *It has been classified Endangered (EN) in 1989 by Strahm, a status confirmed in 1997 (Walter and Gillett, 1997) and in 2015 (Rivers et al., 2015). Kyrsakye et al. proposed a CR status but all evaluation criteria were not properly taken into account to validate the analysis* *Commission for Forestry in Rodrigues suggest that the species should be downgraded to VU (R. Payandee, pers. Com.). Human-aided interventions led to increase significantly the number of individuals from at least 50 in 1989 to 100 specimens today.* *CR Status is confirmed in 2021 (Tatayah, V., Jhangeer-Khan, R. & Bégué, J.A. 2021)*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably between **50** (Strahm 1989) and **100** (WF, com. Pers.) **4** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**2** are reported from the forestry services
Number of specimens (Area of influence / Project footprint)	**4** specimens are in Area of influence, 2 of them directly threatened by the project
Receptor sensitivity	**High**

***Antirhea bifurcata* (Desr.) Hook.f.**	
Endemic to the islands of Mauritius and Rodrigues, almost extinct in Rodrigues (Flore des Mascareignes). 2 specimens were reported in Plaine Corail in 1978 but only one was rediscovered in 1980. It seems still a fairly common species in the lowland forests of Mauritius. Differences between the individuals from Mauritius and Rodrigues might indicate that there could be an endemic variety on each of the 2 islands.	
Family	**Rubiaceae**
Local name	**Bois Goudron**
Endemicity	**Rodrigues, Mauritius**
IUCN Status *It has been classified Endangered (EN) in 1989 by Strahm, and re-evaluated "Rare" in 1997 by Walter et al. In Rodrigues, local status CR (non published) should be kept as the species had become very rare.*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **10** (Strahm 1989)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services **1** specimen inside the airport area
Number of specimens (Area of influence / Project footprint)	**1** specimen in airport zone
Receptor sensitivity	**High**

***Diospyros diversifolia* Hiern**	
Endemic to Rodrigues. Strahm reports that the species is occasionally found in many localities with regeneration, even on badly degraded slopes with practically nothing except *Elaeodendron orientale*. Conservation works were carried out very successfully by WWF and the Forestry Services (50 000 plants planted)	
Family	**Ebenaceae**
Local name	**Bois d'Ebène**
Endemicity	**Rodrigues**
IUCN Status *It has been classified Vulnerable (VU) in 1989 by Strahm, and re-evaluated and confirmed as "VU" in 1997 by Walter et al.* *Kirsakye et al. (2015) propose a re assessment to the level Endangered "EN". This status is confirmed in 2021 (Tatayah, V., Jhangeer-Khan, R. & Bégué, J.A. 2021)*	**EN ↑**
Rarity	Mauritian Wildlife): Mourouk valley, Cascade St louis, English Bay (Baie aux Anglais), Creve Coeur, Cascade Pigeon, Oyster Bay (Baie aux Huitres), Cascade Pistache, Plaine Corail, Dan Coco, Riviere Coco, Anse Raffin, Anse Baleine, Cascade Victoire, Port Sud Est
Number of specimens in the wild (Rodrigues)	**Unknown**
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services **1** specimen reported inside the airport area
Number of specimens (Area of influence / Project footprint)	**2** specimens, 1 near the footprint project
Receptor sensitivity	**High**

***Terminalia bentzoe* (L.) G.Forst.. subsp. *rodriguesensis* Wickens**	
Very occasionally seen with little regeneration. Recorded from Anse Mourouk, Anse aux Anglais, Rivière Baleine, Mont Chéri, Plaine Corail and Anse Quitor, with a small population on Ile Aux Crabes (Strahm 1989).	
Family	**Combretaceae**
Local name	**Bois Benjoin**
Endemicity	**Rodrigues (subspecies)**
IUCN Status *It has been classified Vulnerable (VU) in 1989 by Strahm, and re-evaluated and confirmed as "VU" in 1997 by Walter et al. and Kirsakye et al. (2015)*	**VU**
Rarity	**Rare?**
Number of specimens in the wild (Rodrigues)	Less than 50 (Source: Mauritian Wildlife): Mourouk Valley, Cascade St louis, St Francois, Anse Ally, English Bay, Pointe Canon, Oyster Bay, Ile Aux Crabes, Plaine Corail, Anse Quitor, Anse Baleine
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**3** are reported from the forestry services **24** are recorded by Eco-Med Océan Indien in 2019
Number of specimens (Area of influence / Project footprint)	**28** specimens are in Area of influence (1 near the project footprint)
Receptor sensitivity	**High**

Fernelia buxifolia Lam.

Endemic to the Mascarenes (La Réunion, Mauritius, Rodrigues). Found in Rodrigues in La Plaine Corail, Anse Mourouc, Cascade Saint-Louis, Grande Montagne, Mont Limon, Mont Malartic, Cascade Victoire, Mont Lubin. Populations from Rodrigues might belong to a different taxa, the leaves are less elliptical than the typical *F. buxifolia* and resembles *F. obovata* (Flore des Mascareignes). This species has still been drastically reduced in number in just over a century (Strahm, 1989).

Family	**Rubiaceae**
Local name	**Bois Bouteille**
Endemicity	**Mascarenes**
IUCN Status *It has been classified EN in La Réunion (IUCN 2010). The same category has been applied by Kirsakye et al. (2015) and should be kept for Rodrigues*	**EN**
Rarity	**Very Rare?**
Number of specimens in the wild (Rodrigues)	Probably **a dozen** of specimens according to Strahm (1989)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**2** are reported from the forestry services **2** are recorded by Eco-Med Océan Indien in 2019
Number of specimens (Area of influence / Project footprint)	**2** specimens are in Area of influence (not threatened by the project)
Receptor sensitivity	**High**

1.3.3 Fauna

Baselines studies have been carried out on mammals, birds, reptiles, molluscs, crustaceans, insects, arachnids and myriapods. The inventories carried out and the bibliographical review reveal a rich and varied animal biodiversity, but also endangered species endemics such as *Pteropus rodricensis* and *Tropidophora articulata*.

1.3.3.1 Mammals

Like in the whole of Rodrigues Island, the mammal populations on the site are mainly bovid (cows, goats, sheep) and other domestic (cat, dog) or introduced animals (rats).

The only native species is an endemic bat: *Pteropus rodricensis*. This species is classified as endangered (IUCN). No roost was found near the study site. Closest (~3km) would be at La Ferme, Grand Var or Riviere coco. Originally the main roost was a Cascade Pigeon, now 8-9 roots across the island in areas were feed is available, e.g. *Ficus*.

Note that this species is not known to roost in caves, but only on high trees.

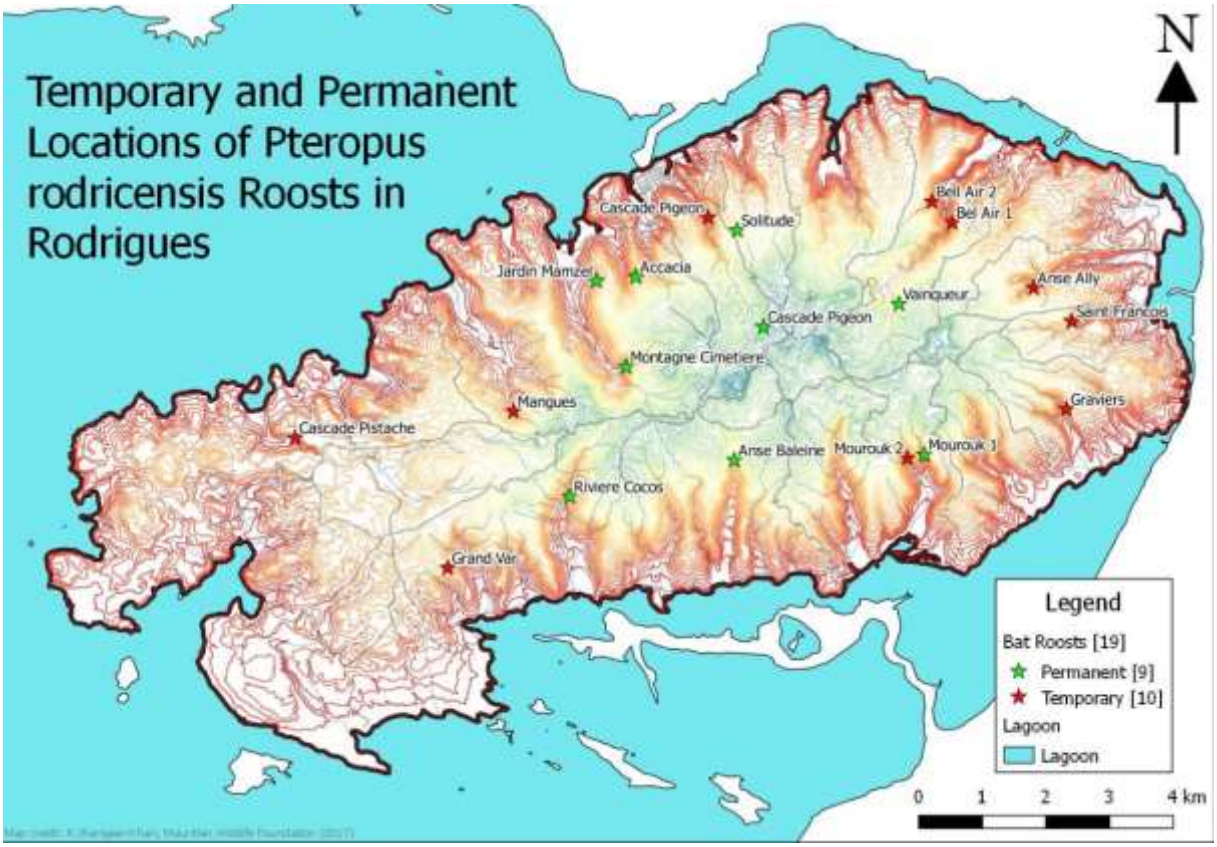


Figure 18: Locations of Pteropus rodricensis roosts in Rodrigues (R. Jhangeer-Khan, mauritian Wildlife Fondation, 2017)

The population inventory has been completed with the April 2023 field survey. The observations confirm the conclusions already advanced.

Several bats are observed at the end of the day (Several tens in April 2019 and up to 12 individuals in April 2023), but only some individuals were seen punctually flying over the area of influence. They frequent Anse Quitor to eat there, but they have not been seen flying over

the airport area. There is no major resting or feeding site beyond the Anse Quitor reserve when they arrive from the North.

Around the Area of influence, the habitat favourable for flyingfoxes like *Pteropus rodricensis* correspond to the dry forest sectors (Anse Quitor). These habitats are rare on an island scale, but they also frequent other forest habitats or private gardens (fruit trees).

According to the local experts, *Pteropus rodricensis* is not rare and its numbers are increasing. MWF has been conducting monitoring for about 50 years. The population has grown from less than 100 in 1974 to around 20,000 today (S. Kirsakye, 2022). Falls in numbers are observed occasionally after intense cyclonic episodes.

Ultrasonic recording devices allow us to confirm the absence of Microchiroptera species on site (no mention of such species has been reported on Rodrigues before).

Figure 19: Mammals on site: Pteropus rodricensis / Bos taurus / Capra hircus (©ECO-MED Océan Indien, 2019)

Table 15: List of mammals observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Carnivora	Canidae	*Canis familiaris*	Introduced		Dog	NA
Carnivora	Felidae	*Felis catus*	Introduced		Domestic cat	NA
Cetartiodactyla	Bovidae	*Bos taurus*	Introduced		Cow	NA
Cetartiodactyla	Bovidae	*Capra hircus*	Introduced		Feral Goat	NA
Cetartiodactyla	Bovidae	*Ovis aries*	Introduced		Red Sheep	NA
Chiroptera	Pteropodidae	*Pteropus rodricensis*	**Endemic**	**x**	Rodrigues Flying Fox	**EN**
Rodentia	Muridae	*Rattus*	Introduced		rats	NA

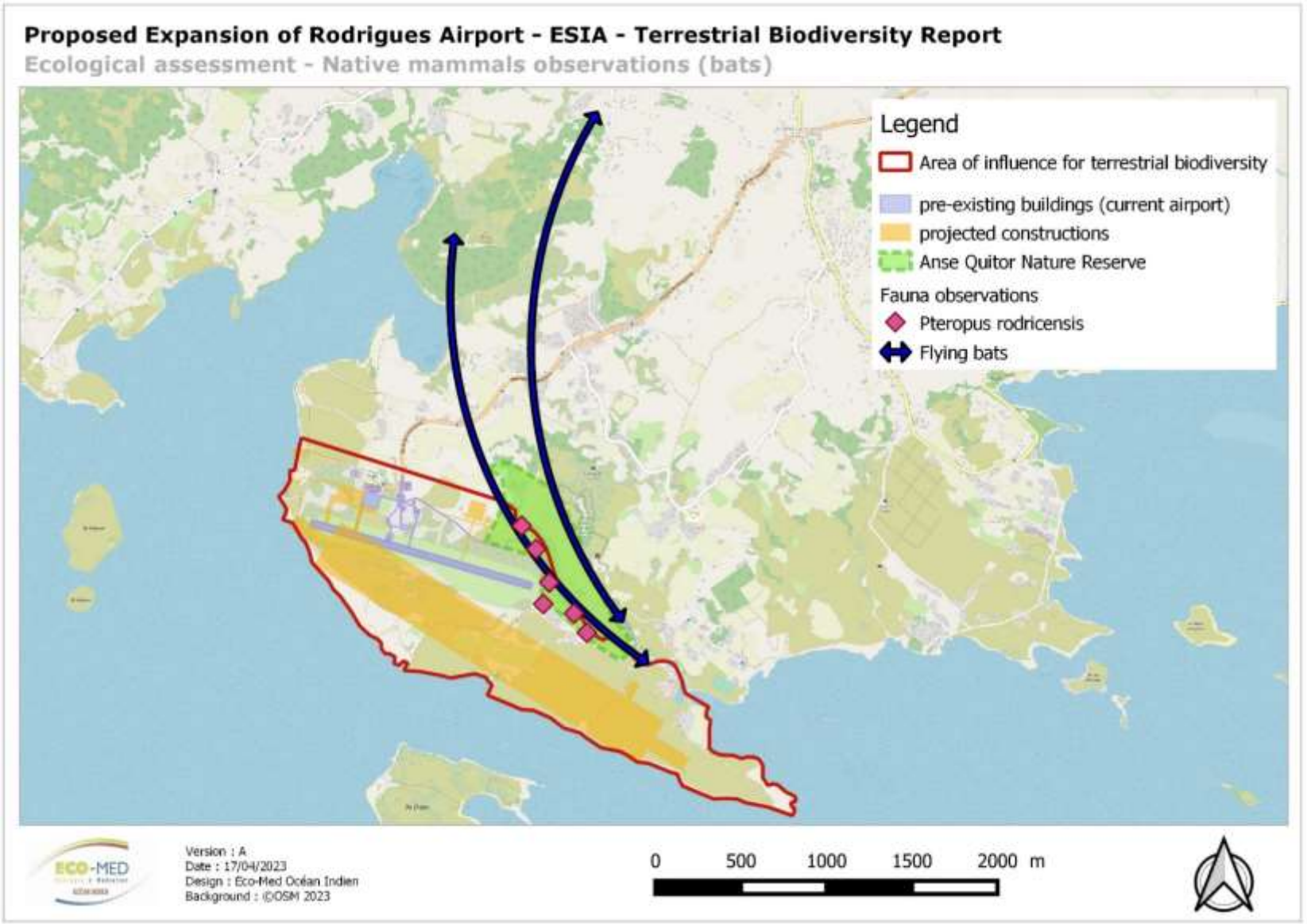


Figure 20: Native mammal observation mapping

1.3.3.2 Reptiles

The terrestrial reptiles observed are mainly of exotic origin. The lizard species *Hemidactylus frenatus* is the most common. It has adapted locally with a terrestrial behaviour, sheltering under the omnipresent rocks.

The only species supposedly native to Rodrigues (there is scientific controversy), is *Lepidodactylus lugubris* and was observed 3 times (see map below). Its more arboreal behaviour hinders its occurrence on the site, which is particularly devoid of trees. This species does not have an unfavourable conservation status.

Figure 21: Reptiles on site: Hemidactylus frenatus / Lepidodactylus lugubris (©ECO-MED Océan Indien, 2019)

Table 16: List of reptiles observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Squamata	Agamidae	*Calotes versicolor*	Introduced		-	LC
Squamata	Gekkonidae	*Hemidactylus frenatus*	Introduced		Common House Gecko	LC
Squamata	Gekkonidae	*Hemidactylus parvimaculatus*	Introduced		-	LC
Squamata	Gekkonidae	*Lepidodactylus lugubris*	**Native**	**x**	Sad Gecko	LC
Squamata	Typhlopidae	*Indotyphlops braminus*	Introduced		Braminy Bling Snake	LC

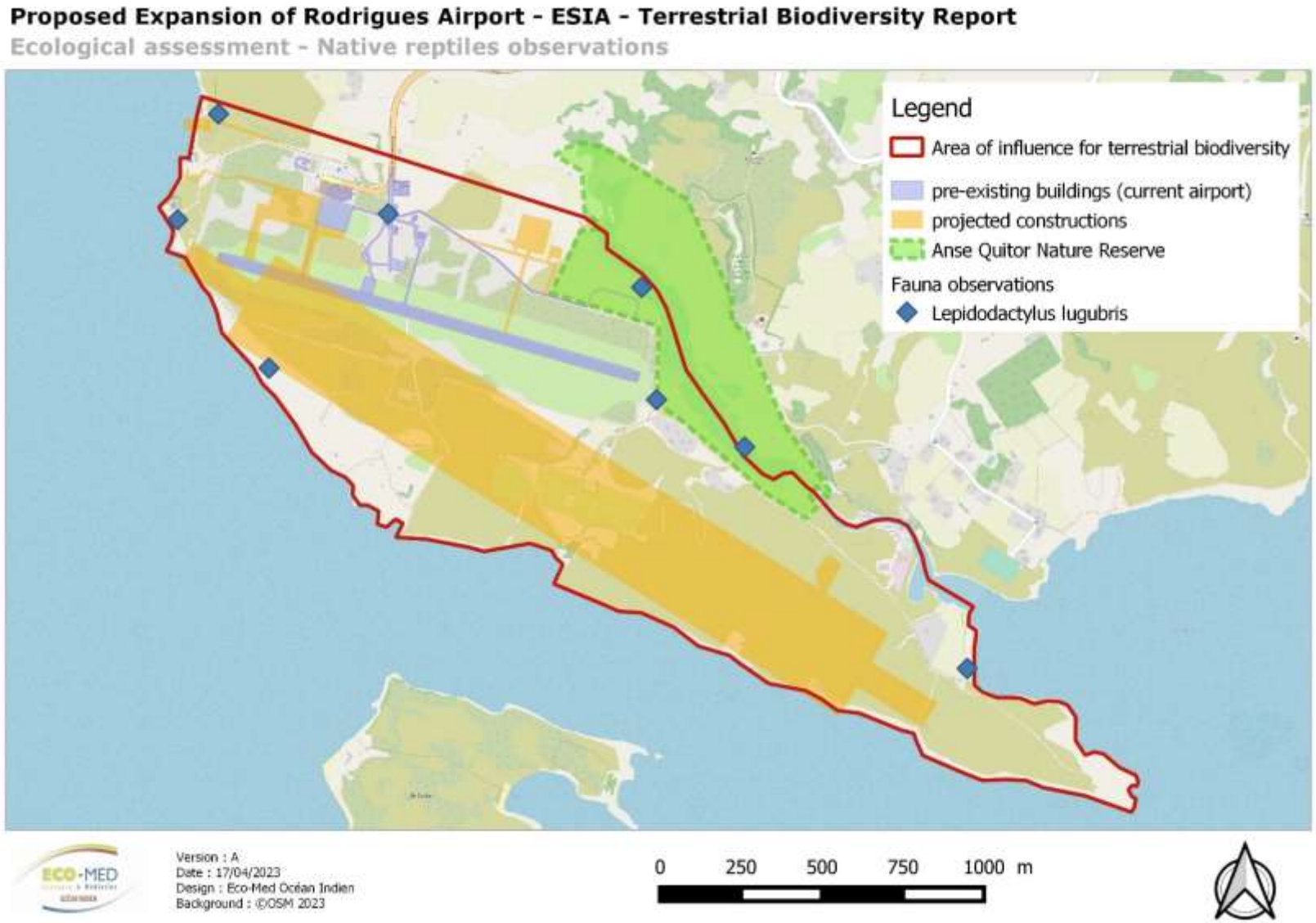


Figure 22: Native reptile observation mapping

1.3.3.3 Birds

The bird populations observed are mainly exotic. *Acridotheres tristis, Geopelia striata, Passer domesticus, Estrilda astrild* are the most common.

Four indigenous (or migratory) species frequent the site for their food: *Butorides striata*, *Arenaria interpres, Numenius phaeopus, Pluvialis squatarola*. They are mainly observed on the banks of Anse Quitor and on the coast. *Numenius phaeopus* is also observed on grassy areas along the airport runways. *Butorides striata* is likely to nest in trees along the Anse Quitor River. *Pluvialis squatarola, Arenaria interpres* and *Numenius phaeopus* are assumed to be migratory, as their nesting is not locally reported.

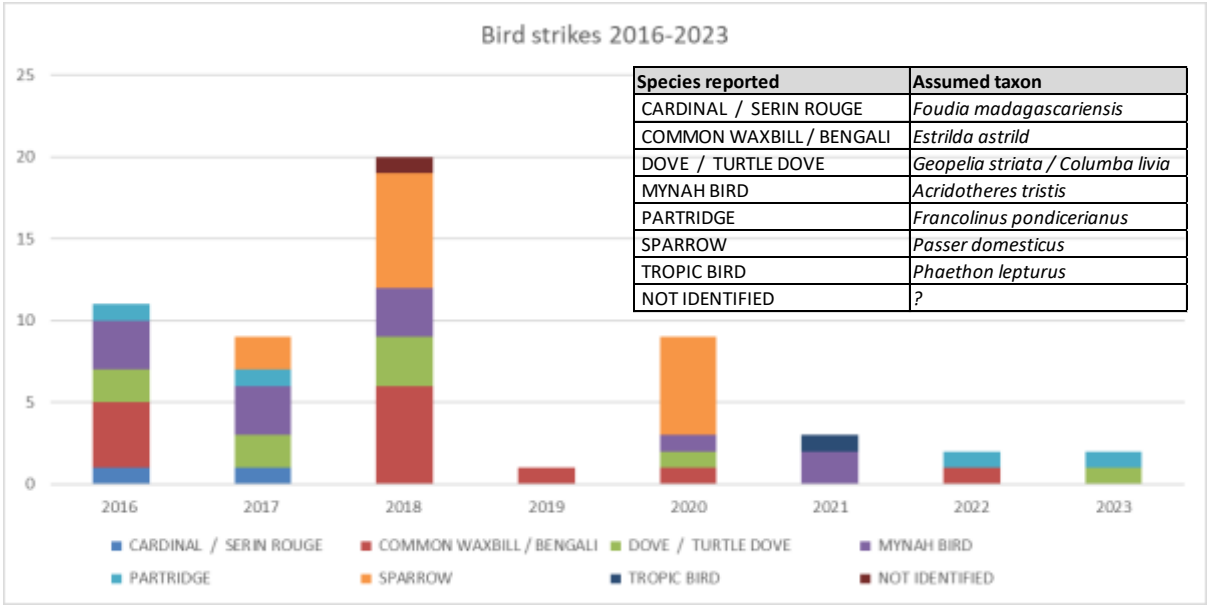
Phaethon lepturus, also native, was observed flying over the site. It is likely to nest on the cliffs of Anse Quitor.

No single bird species has a particular conservation status issue.

Two species of endemic passerines present a very strong local challenge in Rodrigues: *Acrocephalus rodericanus* and *Foudia flavicans*. Although Anse Quitor is a suitable native habitat, these species do not appear to be established at this time. However, the presence of a female *Foudia* has recently been reported (pers. comm. Aurèle Anquetil André & Mauritian Wildlife Foundation (**WF**)). The current population dynamics could lead them to gain this territory effectively adding an additional challenge to this nature reserve.

Finally, it should be noted that the site is obviously overflown by seabirds regularly observed on Rodrigues and nesting on the lagoon islets (Ile aux sables, Iles aux Cocos, Ile Frégate): *Anous ssp., Onychoprion ssp., Sterna dougallii, Ardenna pacificus, Gygis alba, etc.*

In terms of aircraft collisions with birds, the airport records the following statistics:



Species reported	Assumed taxon
CARDINAL / SERIN ROUGE	*Foudia madagascariensis*
COMMON WAXBILL / BENGALI	*Estrilda astrild*
DOVE / TURTLE DOVE	*Geopelia striata / Columba livia*
MYNAH BIRD	*Acridotheres tristis*
PARTRIDGE	*Francolinus pondicerianus*
SPARROW	*Passer domesticus*
TROPIC BIRD	*Phaethon lepturus*
NOT IDENTIFIED	*?*

Figure 23: Bird strike statistics (2016-2023)

These statistics confirm the predominance of alien species and the real impact of airport activity on this group.

Figure 24: Birds on site: Butorides striata / Numenius phaeopus / Arenaria interpres (©ECO-MED Océan Indien, 2023)

Table 17: List of birds observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Anseriformes	Anatidae	*Anser*	Introduced		-	NA
Charadriiformes	Scolopacidae	*Arenaria interpres*	**Native**	**x**	Turnstone	LC
Charadriiformes	Scolopacidae	*Numenius phaeopus*	**Native**	**x**	Whimbrel	LC
Columbiformes	Columbidae	*Columba livia*	Introduced		Rock Pigeon	LC
Columbiformes	Columbidae	*Geopelia striata*	Introduced		Zebra Dove	LC
Galliformes	Phasianidae	*Francolinus pondicerianus*	Introduced		Gray Francolin	LC
Passeriformes	Estrildidae	*Estrilda astrild*	Introduced		Common Waxbill	LC
Passeriformes	Fringillidae	*Serinus mozambicus*	Introduced		Yellow-fronted Canary	LC
Passeriformes	Passeridae	*Passer domesticus*	Introduced		House Sparrow	LC
Passeriformes	Ploceidae	*Foudia madagascariensis*	Introduced		Madagascar Red Fody	LC
Passeriformes	Sturnidae	*Acridotheres tristis*	Introduced		Common myna	LC
Pelecaniformes	Ardeidae	*Butorides striata*	**Native**	**x**	Striated Heron	LC
Phaethontiformes	Phaethontidae	*Phaethon lepturus*	**Native**	**x**	White-tailed Tropicbird	LC
Charadriiformes	Charadriidae	*Pluvialis squatarola*	**Native**	**x**	Grey Plover	LC

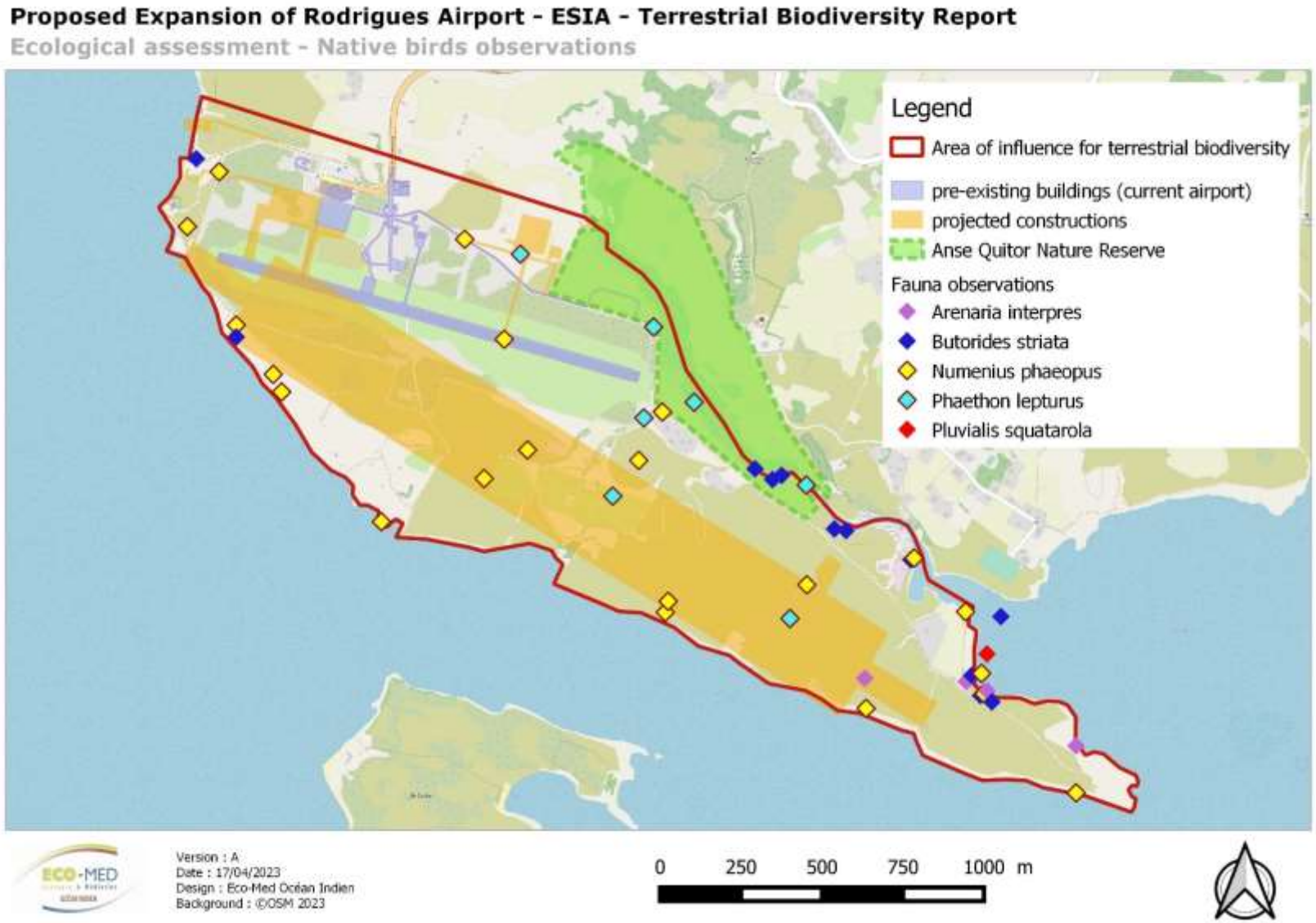


Figure 25: Native bird observations mapping

1.3.3.4 Molluscs

Representative of the fauna of Rodrigues, the mollusc group is well represented here by native, even endemic species. Despite the omnipresence of potentially harmful exotic species (*Lissachatina fulica*, *Euglandina rosea*), species such as *Tropidophora ssp*. are widely present in the area of influence.

The habitats favourable for ***Tropidophora articulata*** correspond to the calcareous substrates, which are relatively rare on an island scale. The "endangered" status of *Tropidophora articulata*, assessed by “The IUCN Red List of Threatened Species” in 1996, makes it a particularly sensitive point here. However, mainly empty (subfossil) shells were found. The *Tropidophora articulata* populations inventory has been completed with the April 2023 field survey. The area of influence has been investigated in depth (on the ground, in the litter, under the rocks, on the trunks, during the day, at night, with rainy weather). No living individuals of this species were found, confirming past findings of consulted experts. Subfossil shells have been identified in numbers. A specific map is proposed below. This species is known to be extremly abundant in a subfossil state (Owen L. Griffiths and Vincent F. B. Florens. 2006). It still survives in very low numbers over most of the island, especially in patches of degraded forest such as at Grande Montagne an Mt. Malartic.The only station where we found him alive is Anse Quitor (in 2019 only).

Tropidophora **desmazuresi** is also present on the site. It was considered by IUCN to be “Extinct” (Griffiths, 1996). Griffiths mentions him as CR in his 2006 book. The only locality presenting it as alive was Anse Mourouk, which we confirmed in 2023 by going there. Anse Quitor is therefore a second confirmed station.

Figure 26: Molluscs on site: Tropidophora articulata (subfossil) / T. articulata (alive) / T. desmazuresi / Melanoides tuberculata (©ECO-MED Océan Indien, 2019 & 2023)

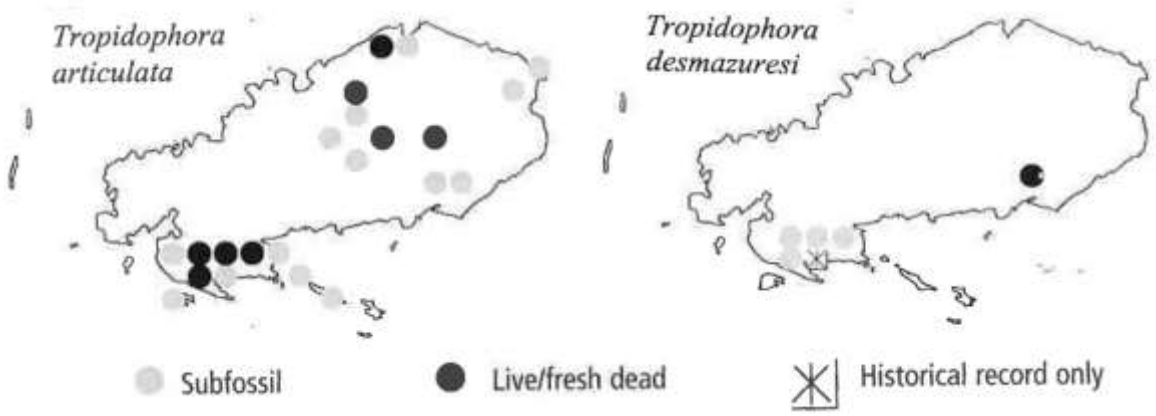


Figure 27: Distribution map of Tropidophora ssp in Rodrigues Island (Owen L. Griffiths and Vincent F. B. Florens. 2006)

Table 18: List of molluscs observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Littorinimorpha	Pomatiidae	*Tropidophora desmazuresi*	**Endemic**	**x**	-	**CR** *(EX)*
Stylommatophora	Assimineidae	*Omphalotropis littorinula*	**Endemic**	**x**	-	**LC**
Littorinimorpha	Pomatiidae	*Tropidophora articulata*	**Sub-endémique**	**x**	-	**EN**
Caenogastropoda	Thiaridae	*Melanoides tuberculata*	**Native**	**x**	Red-rimmed Melania	LC
Stylommatophora	Achatinidae	*Lissachatina fulica*	Introduced		Giant African snail	NA
Stylommatophora	Achatinidae	*Subulina octona*	Introduced		The eight-whorled Achatina	NA
Stylommatophora	Spiraxidae	*Euglandina rosea*	Introduced		Cannibal snail	NA
Systellommatophora	Veronicellidae	*Laevicaulis alte*	Introduced			NA
Systellommatophora	Veronicellidae	*Semperula maculata*	Introduced			NA

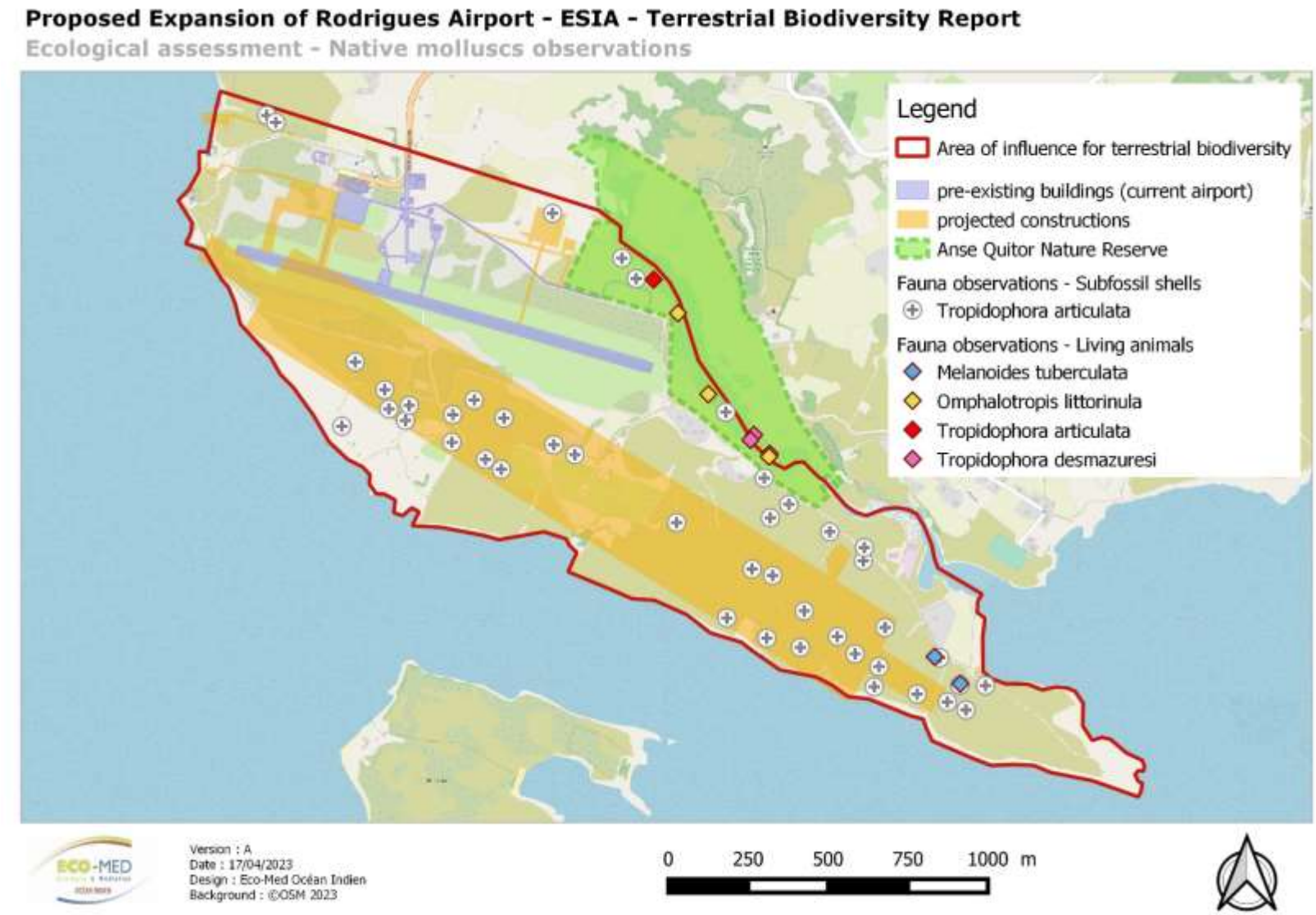


Figure 28: Native mollucs observations mapping

1.3.3.5 Crustaceans

Five taxa are observed on the site. No terrestrial crustacean species with an unfavourable conservation status is known to Rodrigues.

Figure 29: Crustacean on site: Cardisoma carnifex / Ocypode ceratophthalmus / Isopoda sp. (©ECO-MED Océan Indien, 2019 & 2023)

Table 19: List of crustaceans observed on site

Class	Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Malacostraca	Decapoda	Coenobitidae	*Coenobita rugosus*	**Native**	**x**	-	NA
Malacostraca	Decapoda	Gecarcinidae	*Cardisoma carnifex*	**Native**	**x**	-	NA
Malacostraca	Decapoda	Ocypodidae	*Ocypode ceratophthalmus*	**Native**	**x**	-	NA
Malacostraca	Decapoda	Sesarmidae	*Neosarmatium meinerti*	**Native**	**x**	-	NA
Malacostraca	Isopoda	Oniscidae	*Isopoda (Gen. sp.)*	Native?			NA

1.3.3.6 Insects

The insect taxa known to Rodrigues and having a high conservation status belong to the orders Lepidoptera, Odonata and Orthoptera.

These species have been researched more specifically. For the other groups, these are more opportunistic observations.

It should be noted that the first inventory period, one week after the passage of the cyclone Joaninha (26 March 2019), was not favourable to a representative vision of the usual diversity for this site. Therefore, as part of the updated ESIA study, a rapid assessment has been conducted during April 2023 survey.

The species identified, although some of them are native, do not present a significant challenge for this project.

The water points, rare on the site, are particularly attractive places for wildlife and in particular entomofauna: river, karst collapses, old quarry.

Figure 30: Insects on site: Junonia rhadama/Ischnura senegalensis/Gryllodes sigillatus (©ECO-MED Océan Indien, 2019)

Table 20: List of insects observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Blattodea	Blaberidae	*Pycnoscelus surinamensis*	**Native**	**x**	Surinam Cockroach	NA
Blattodea	Blattidae	*Blattidae (Gen. sp.)*	Native?		-	NA
Blattodea	Blattidae	*Neostylopyga rhombifolia*	Introduced			NA
Blattodea	Blattidae	*Periplaneta*	Native?		-	NA
Hemiptera	Pyrrhocoridae	*Dysdercus fasciatus*	**Native**	**x**	-	NA
Hymenoptera	Apidae	*Apis mellifera*	Introduced		Honey Bee	NA
Hymenoptera	Apidae	*Xylocopa*	Native?		-	NA
Hymenoptera	Vespidae	*Polistes olivaceus*	**Native**	**x**	-	NA
Lepidoptera	Crambidae	*Spoladea recurvalis*	**Native**	**x**	-	NA
Lepidoptera	Erebidae	*Achaea*	Native?			NA
Lepidoptera	Erebidae	*Hydrillodes uliginosalis*	**Native**	**x**	-	NA
Lepidoptera	Erebidae	*Remigia conveniens*	**Native**	**x**	-	NA
Lepidoptera	Erebidae	*Trigonodes hyppasia*	**Native**	**x**	-	NA
Lepidoptera	Erebidae	*Utetheisa*	Native?			NA
Lepidoptera	Hesperiidae	*Borbo borbonica*	**Native**	**x**	-	NA
Lepidoptera	Hesperiidae	*Hesperiidae (Gen. sp.)*	Native?			NA
Lepidoptera	Lycaenidae	*Leptotes pirithous*	**Native**	**x**	Lang's Short-tailed Blue	NA
Lepidoptera	Lycaenidae	*Zizeeria knysna*	**Native**	**x**	-	NA
Lepidoptera	Lycaenidae	*Zizina antanossa*	**Native**	**x**	-	NA
Lepidoptera	Noctuidae	*Callopistria*	Native?			NA
Lepidoptera	Nolidae	*Earias biplaga*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Danaus chrysippus*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Hypolimnas misippus*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Junonia rhadama*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Melanitis leda*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Phalanta phalantha*	**Native**	**x**	-	NA
Lepidoptera	Pieridae	*Catopsilia florella*	**Native**	**x**	-	NA
Lepidoptera	Sphingidae	*Agrius convolvuli*	**Native**	**x**	-	NA
Odonata	Coenagrionidae	*Ischnura senegalensis*	**Native**	**x**	Tropical Bluetail	LC
Odonata	Libellulidae	*Pantala flavescens*	**Native**	**x**	Globe Wanderer	LC
Odonata	Libellulidae	*Tramea*	Native?			NA
Orthoptera	Acrididae	*Locusta migratoria*	**Native**	**x**	-	NA
Orthoptera	Gryllidae	*Gryllodes sigillatus*	**Native**	**x**	-	NA
Orthoptera	Gryllidae	*Gryllus bimaculatus*	Introduced		-	NA
Orthoptera	Tettigoniidae	*Conocephalus iris*	**Native**	**x**	Yellowtail Meadow Katydid	NA
Orthoptera	Trigonidiidae	*Trigonidium cicindeloides*	**Native**	**x**	-	NA

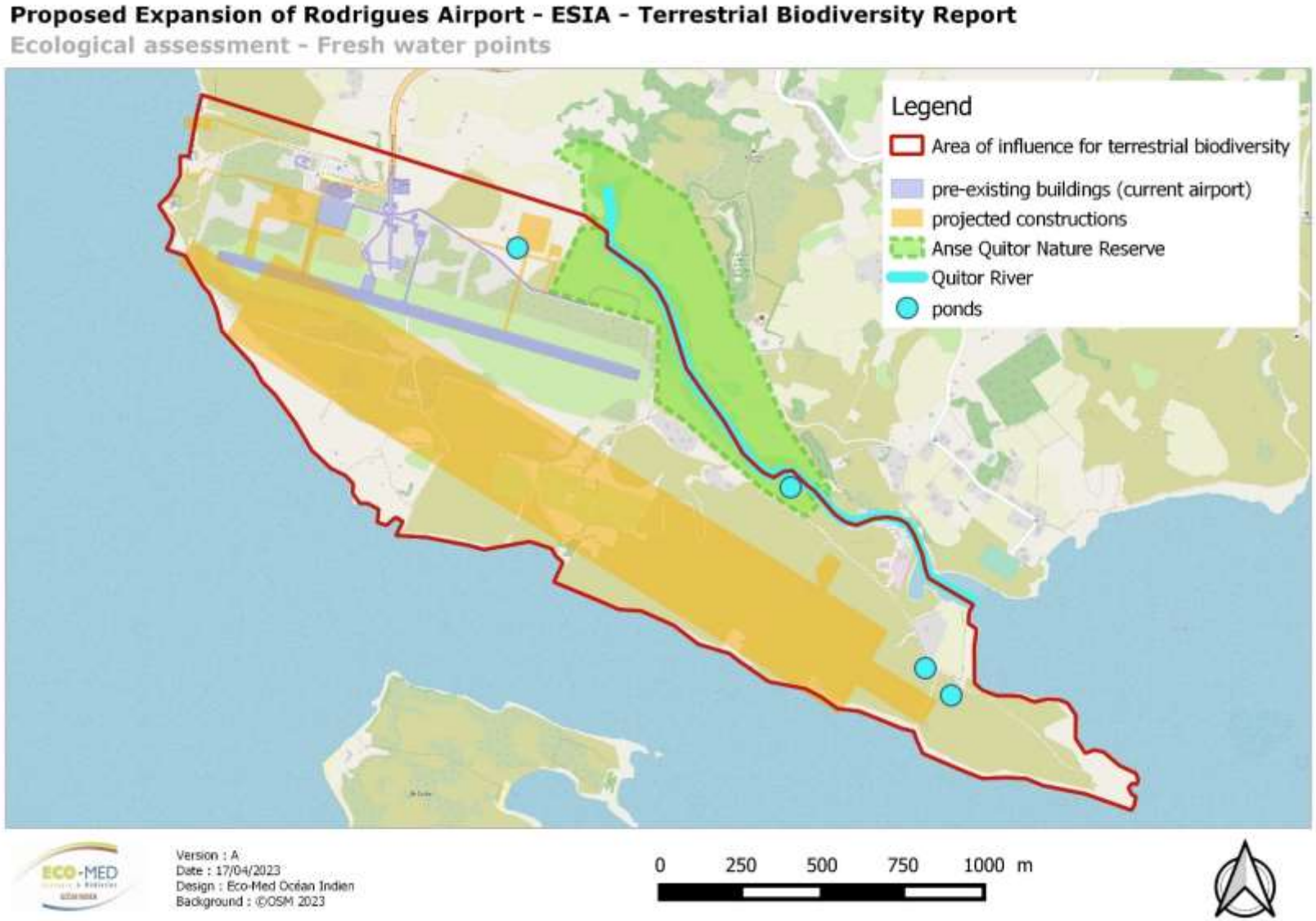


Figure 31: Fresh water point on site

1.3.3.7 Arachnids

The diversity of Rodrigues arachnids is poorly documented in the literature. We sighted 14 species, some of which could not be identified. In fact, endemicity and threat status are difficult to assess for this group. However, no threatened species in families including these unidentified species are known to Rodrigues to date.

Figure 32: Arachnids on site: Nephila inaurata/Salticidae sp./Smeringopus pallidus/Isometrus maculatus (©ECO-MED Océan Indien, 2019)

Table 21: List of arachnids observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Araneae	Araneidae	*Cyrtophora citricola*	**Native**	**x**	-	NA
Araneae	Araneidae	*Neoscona moreli*	**Native**	**x**	-	NA
Araneae	Nephilidae	*Nephilidae (Gen. sp.)*	Native?		-	NA
Araneae	Nephilidae	*Trichonephila inaurata*	**Native**	**x**	-	LC
Araneae	Oxyopidae	*Oxyopidae (Gen. sp.)*	Native?		-	NA
Araneae	Pholcidae	*Smeringopus pallidus*	**Native**	**x**	Cellar Spider	NA
Araneae	Salticidae	*Hasarius adansoni*	**Native**	**x**	-	LC
Araneae	Salticidae	*Menemerus*	Native?		-	NA
Araneae	Salticidae	*Plexippus*	Native?		-	NA
Araneae	Sparassidae	*Heteropoda venatoria*	**Native**	**x**	-	NA
Araneae	Sparassidae	*Olios lamarcki*	**Native**	**x**	-	NA
Araneae	Tetragnathidae	*Leucauge*	**Native**	**x**	-	NA
Araneae	Tetragnathidae	*Tetragnathidae (Gen. sp.)*	Native?		-	NA
Araneae	Theridiidae	*Theridion*	Native?		-	NA
Araneae	Thomisidae	*Thomisus*	Native?		-	NA
Araneae	Uloboridae	*Zosis*	Native?		-	NA
Scorpiones	Buthidae	*Isometrus maculatus*	Introduced		-	NA

1.3.3.8 Myriapods

The three species of myriapods, which were commonly observed on the site, are not of significant interest.

Figure 33: Myriapods on site: Orthomorpha coarctata/Pachybolidae sp. (©ECO-MED Océan Indien, 2019)

Table 22: List of myriapods observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Polydesmida	Paradoxosomatidae	*Orthomorpha coarctata*	Introduced		Flatback Millipede	NA
Spirobolida	Pachybolidae	*Gen. sp.*	Native?		-	NA
Scolopendromorpha	Scolopendridae	*Scolopendra subspinipes*	**Native**	**x**	Vietnamese Giant Centipede	NA

1.3.3.9 Sensitivity assessment of native fauna found inside the area of influence

The sensitivity of the native fauna observed in the area of influence was assessed according to the following criteria:

⇒ Endemicity or indigenous status: indigenous = 1 point; endemic to the Mascarenes (sub endemicity) = 2 points; endemic to Rodrigues = 3 points.

⇒ Protection status: protected in Rodrigues = 1 point; protected under the Forestry Act (1983) = 3 points

⇒ Threat level according to the red list: LC = 0 point; NT = 1 point; VU = 2 points; EN = 3 points; CR = 4 points.

A maximum of 10 points can be assigned to a species. An adjustment by the expert can be made to correct deficiencies in the status of certain species. Depending on the score obtained, the species is classified according to the following sensitivity levels:

Table 23: Scale value used to assess the plant species sensitivity

Receptor sensitivity	Scale value
Negligible	**0 - 2**
Low	**2 – 4**
Medium	**4 – 6**
High	**6- 8**
Major	**8 – 10**

A total of 2 species were assessed to a high level of sensitivity inside the area of influence of the project (both Endangered): the bat *Pteropus rodricensis* and the gastropoda *Tropidophora articulata*.
However, as only some individuals were seen punctually flying over the area of influence, *Pteropus rodricensis* is considered as of low sensitivity. Similary, as only empty shells of *Tropidophora articulate* were found over the area, this species is considered of memdium-high sensitivity.
A third species has been assessed to a low level of sensitivity: the gastropoda *Tropidophora eugeniae.*

Table 24: Native fauna recorded at the area of influence and sensitivity assessment

Class	Order	Family	Taxa	Status	Local protection	IUCN	note statut	note protection	note IUCN	note total	Receptor sensitivity
Gastropoda	Littorinimorpha	Pomatiidae	*Tropidophora desmazuresi*	**Endemic**	**x**	**CR** *(EX)*	3	1	4	8	**Major**
Mammalia	Chiroptera	Pteropodidae	*Pteropus rodricensis*	**Endemic**	**x**	**EN**	3	1	3	7	**High**
Gastropoda	Littorinimorpha	Pomatiidae	*Tropidophora articulata*	**Sub-endémique**	**x**	**EN**	2	1	3	6	**High**
Gastropoda	Stylommatophora	Assimineidae	*Omphalotropis littorinula*	**Endemic**	**x**	**LC**	3	1	1	5	**medium**
Arachnida	Araneae	Araneidae	*Cyrtophora citricola*	**Native**	**x**	NA	1	1	0	2	**low**
Arachnida	Araneae	Araneidae	*Neoscona moreli*	**Native**	**x**	NA	1	1	0	2	**low**
Arachnida	Araneae	Nephilidae	*Trichonephila inaurata*	**Native**	**x**	LC	1	1	0	2	**low**
Arachnida	Araneae	Pholcidae	*Smeringopus pallidus*	**Native**	**x**	NA	1	1	0	2	**low**
Arachnida	Araneae	Salticidae	*Hasarius adansoni*	**Native**	**x**	LC	1	1	0	2	**low**
Arachnida	Araneae	Sparassidae	*Heteropoda venatoria*	**Native**	**x**	NA	1	1	0	2	**low**
Arachnida	Araneae	Sparassidae	*Olios lamarcki*	**Native**	**x**	NA	1	1	0	2	**low**
Arachnida	Araneae	Tetragnathidae	*Leucauge*	**Native**	**x**	NA	1	1	0	2	**low**
Aves	Charadriiformes	Charadriidae	*Pluvialis squatarola*	**Native**	**x**	LC	1	1	0	2	**low**
Aves	Charadriiformes	Scolopacidae	*Arenaria interpres*	**Native**	**x**	LC	1	1	0	2	**low**
Aves	Charadriiformes	Scolopacidae	*Numenius phaeopus*	**Native**	**x**	LC	1	1	0	2	**low**
Aves	Pelecaniformes	Ardeidae	*Butorides striata*	**Native**	**x**	LC	1	1	0	2	**low**
Aves	Phaethontiformes	Phaethontidae	*Phaethon lepturus*	**Native**	**x**	LC	1	1	0	2	**low**
Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra subspinipes*	**Native**	**x**	NA	1	1	0	2	**low**
Gastropoda	Caenogastropoda	Thiaridae	*Melanoides tuberculata*	**Native**	**x**	LC	1	1	0	2	**low**
Hexapoda	Blattodea	Blaberidae	*Pycnoscelus surinamensis*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Hemiptera	Pyrrhocoridae	*Dysdercus fasciatus*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Hymenoptera	Vespidae	*Polistes olivaceus*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Crambidae	*Spoladea recurvalis*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Erebidae	*Hydrillodes uliginosalis*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Erebidae	*Remigia conveniens*	**Native**	**x**	NA	1	1	0	2	**low**

Class	Order	Family	Taxa	Status	Local protection	IUCN	note statut	note protection	note IUCN	note total	Receptor sensitivity
Hexapoda	Lepidoptera	Erebidae	*Trigonodes hyppasia*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Hesperiidae	*Borbo borbonica*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Lycaenidae	*Leptotes pirithous*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Lycaenidae	*Zizeeria knysna*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Lycaenidae	*Zizina antanossa*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nolidae	*Earias biplaga*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nymphalidae	*Danaus chrysippus*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nymphalidae	*Hypolimnas misippus*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nymphalidae	*Junonia rhadama*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nymphalidae	*Melanitis leda*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Nymphalidae	*Phalanta phalantha*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Pieridae	*Catopsilia florella*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Lepidoptera	Sphingidae	*Agrius convolvuli*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Odonata	Coenagrionidae	*Ischnura senegalensis*	**Native**	**x**	LC	1	1	0	2	**low**
Hexapoda	Odonata	Libellulidae	*Pantala flavescens*	**Native**	**x**	LC	1	1	0	2	**low**
Hexapoda	Orthoptera	Acrididae	*Locusta migratoria*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Orthoptera	Gryllidae	*Gryllodes sigillatus*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Orthoptera	Tettigoniidae	*Conocephalus iris*	**Native**	**x**	NA	1	1	0	2	**low**
Hexapoda	Orthoptera	Trigonidiidae	*Trigonidium cicindeloides*	**Native**	**x**	NA	1	1	0	2	**low**
Malacostraca	Decapoda	Coenobitidae	*Coenobita rugosus*	**Native**	**x**	NA	1	1	0	2	**low**
Malacostraca	Decapoda	Gecarcinidae	*Cardisoma carnifex*	**Native**	**x**	NA	1	1	0	2	**low**
Malacostraca	Decapoda	Ocypodidae	*Ocypode ceratophthalmus*	**Native**	**x**	NA	1	1	0	2	**low**
Malacostraca	Decapoda	Sesarmidae	*Neosarmatium meinerti*	**Native**	**x**	NA	1	1	0	2	**low**
Reptilia	Squamata	Gekkonidae	*Lepidodactylus lugubris*	**Native**	**x**	LC	1	1	0	2	**low**

Table 25: Fauna conservation issues inside the area of influence

ID	Type	Items	Sub items	Sensitivity	Area/number of specimens inside the area of influence
FA01	**Fauna**	Fauna species of major / high sensitivity	*Tropidophora articulata & T. desmazuresi (Gastropoda)*	**Major / High**	Few alive populations inside Anse Quitor Reserve only
FA02	**Fauna**	Fauna species of high sensitivity	*Pteropus rodricensis (Chiroptera)*	**high**	>10
FA03	**Fauna**	Fauna species of medium sensitivity	*Omphalotropis littorinula (Gastropoda)*	**Medium**	Few alive populations inside Anse Quitor Reserve only
FA04	**Fauna**	Fauna species of low sensitivity	*All other native species*	**Low**	Unknown

1.3.4 Ecological continuities

An ecological network must make it possible to maintain and restore a network of exchanges on the territory so that animal and plant species can communicate, circulate, feed, reproduce, rest, etc. by themselves to ensure their survival.

An ecological network is composed of different elements:

- Biodiversity reservoirs. These are areas where biodiversity is the richest, they generally include areas subject to protection and heritage environments outside protected areas.
- Ecological corridors that connect (or could connect) biological reservoirs to each other.
- Obstacles to continuity, in particular by locating the artificial network (urbanization, roads, various networks, etc.).

On the site, Anse Quitor (wooded banks) could be considered as a corridor and a biodiversity reservoir at the same time, given the indigenous biodiversity it shelters and the continuous forested corridor it constitutes. We associate the caves of François Leguat Reserve with this core with regard to the ecological restoration efforts made in this area directly linked to the reserve.

The restoration parcels and plantations bordering it form a buffer zone (including the official delimitation of the Anse Quitor nature reserve, the François Leguat Reserve and the downstream portion of the river).

The axis of the river from upstream to downstream is an ecological corridor.

Finally, it should be noted that the coastline (shore and grazing lands in-shore) itself forms a specific aerial and terrestrial corridor mainly used by three indigenous (or migratory) species as a foraging habitat: Butorides striata, Arenaria interpres, Numenius phaeopus. All species and groups of species concerned by local continuities are listed in Table 26.

Figure 34: Numenius phaeopus uses the coastal and open grazing lands corridor for feeding

Table 26: List of ecological continuities included within the area of influence

Ecological continuites	Function	Species concerned
Anse Quitor river	**Terrestrial corridor**	Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (L*ygodactylus lugubris*)
Anse Quitor river	**Aerial corridor**	Bats (*Pteropus rodricensis*), marine birds (*Phaeton lepturus*)
Anse Quitor Nature Reserve	**Biodiversity reservoir**	Native plant species, i.e.: *Camptocarpus sphenophyllus, Clerodendrum laciniatum, Diospyros diversifolia, Fernelia buxifolia, Foetidia rodriguesiana, Hyophorbe verschaffeltii, Latania verschaffeltii, Mathurina penduliflora, Pleurostylia putamen, Polyscias rodriguesiana, Sarcanthemum coronopus, Secamone rodriguesiana, Terminalia bentzoe subsp. rodriguesensis, Zanthoxylum paniculatum…* Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (*Lygodactylus lugubris*) Endemic molluscs (*Tropidophora ssp, Omphalotropis littorinula*)
Coast	**Terrestrial corridor**	Waterbirds (*Butorides striata*), waders (N*umenius phaeopus, Arenaria interpres, Pluvialis squatarola*…)
Grazing lands		
Coast	**Aerial corridor**	Waterbirds (*Butorides striata*), waders (*Numenius phaeopus, Arenaria interpres*…), marine birds (*Phaeton lepturus, Anous ssp., Onychoprion ssp., Sterna dougallii, Ardenna pacifica, Gygis alba, e*tc)
Grazing lands		

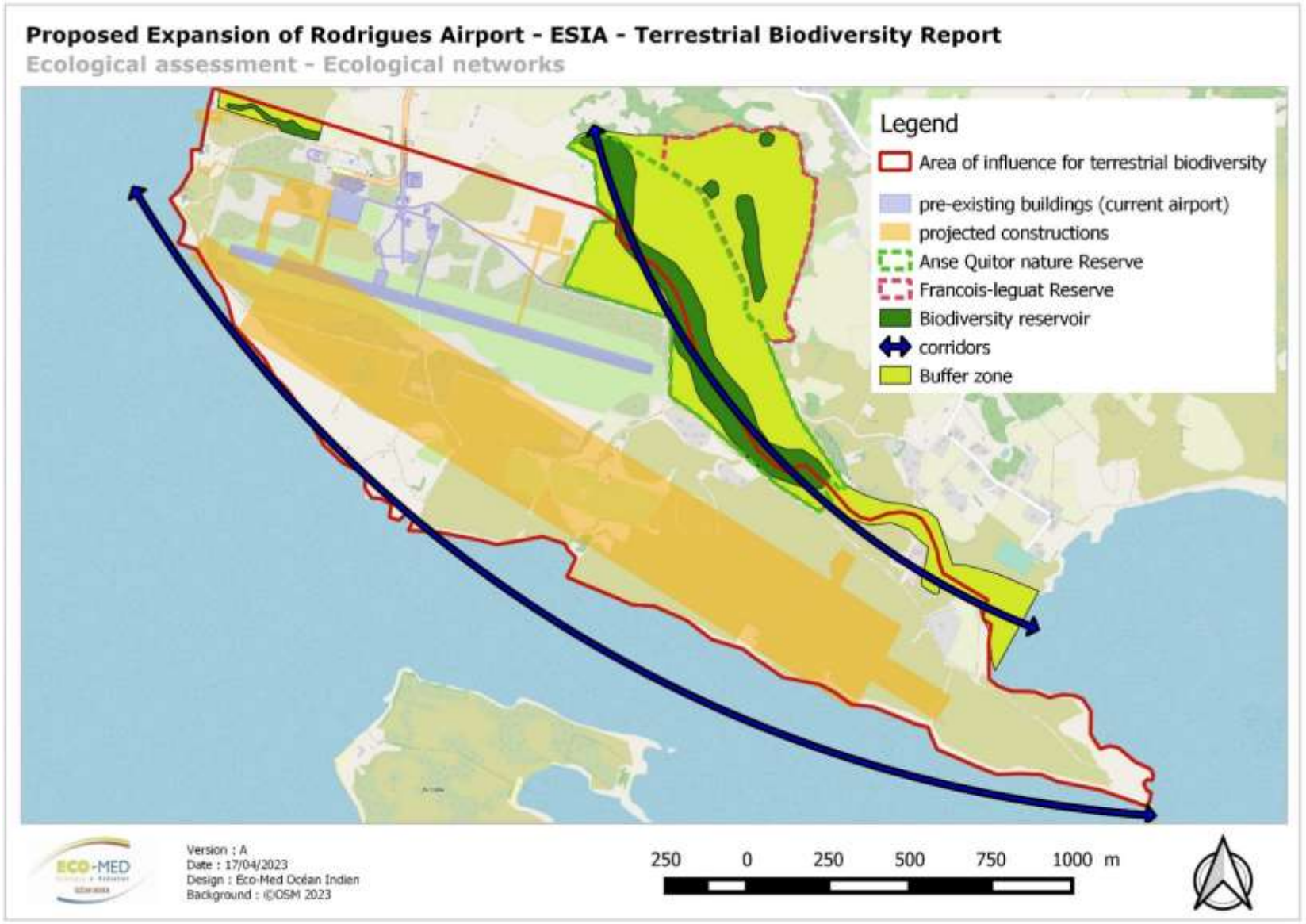


Figure 35: Ecological network mapping

1.3.5 Terrestrial biological environment issues

1.3.5.1 Terrestrial protected area

The protected area network in Rodrigues includes 4 protected sites, mentioned in the Forest and Reserves Act (1983), covering less than 1% of the total area of the island, namely: Great Mountain (30 ha fenced and 25.5 ha declared reserve), Anse Quitor (35 ha fenced and 10.3 ha declared reserve), Ile aux Sables (8 ha) and Ile aux Cocos (14.4 ha).

As shown in the previous map (Figure 109), the Anse Quitor Reserve adjoins the airport area.

This reserve has also been identified as "Key Areas for Biodiversity" by the Critical Ecosystems Partnership Fund.

Any impact on the core of the Reserve will be prohibited. Impacts on the buffer zone will be avoided as much as possible.

The extension of the airport area to Anse Quitor Reserve could weaken the acceptability of the project.

1.3.5.2 Protected species

Forestry Act 1983

All plants in forest land and reserves are prohibited from being destroyed by the **Forestry Act 1983**. Outside Anse Quitor, the project area does not seem to be affected. The text also lists the protected plants:

- All indigenous orchids
- *Ochna mauritiana*
- *Hornea mauritiana*
- All *Diospyros* species
- *Sideroxylon grandiflorum*
- *Cordyline mauritiana*
- All *Tambourissa* species
- All *Trochetia* species
- *Erythroxylon laurifolium*
- All indigenous ferns

The following plants are concerned within the limits of the area of influence:

- *Adiantum rhizophorum Sw.*
- *Nephrolepis acutifolia (Desv.) Christ*
- *Phymatosorus scolopendria (Burm. f.) Pic. Serm.*
- *Diospyros diversifolia*

Wildlife and National Parks Act 2016

Any person who plans to destroy native wildlife shall make a written application to the Director for a permit.

Many species, both animal and plant, are present on the site, as mentioned in the above tables.

The text mentions species of wildlife where more severe penalties are provided. Based on the field observations, the following could be impacted by this project:

- *Pteropus rodricensis*
- *Phaethon lepturus.*

Local protection of flora species (source: Rodrigues Regional Assembly, 16/04/2019)

A list of protected fauna and flora species has been sent by the Rodrigues Regional Council in April 2019. The list includes 3 species of fauna and 48 species of flora, as shown below.

Table 27: List of protected plant species in Rodrigues (Source: Rodrigues Regional Assembly, 2019): (in red, species recorded inside the area of influence; in yellow background: species recorded inside the project footprint)

Scientific name	Family	Local name	French name
Antirhea bifurcata (Desr.) Hook. f.	Rubiaceae	Bois goudron	
Badula balfouriana (Kuntze) Mez	Primulaceae	Bois papaye	
Carissa spinarum L.	Apocynaceae	Bois amer	
Clerodendrum laciniatum	Lamiaceae	Bois cabri	
Dictyosperma album (Bory) H. Wendl. et Drude ex Scheff.	Arecaceae	Palmiste blanc	Dictyosperme blanc
Diospyros diversifolia Hiern	Ebenaceae	Bois d'ébène / Ebénier	
Dodonaea viscosa Jacq.	Sapindaceae	Bois d'arnette	Dodonée visqueuse
Dombeya acutangula Cav.	Malvaceae	Mahot tantan	Mahot acutangulé
Dombeya rodriguesiana F. Friedmann	Malvaceae	Mahot / Bois Julien	
Doricera trilocularis	Rubiaceae	Bois chauve-souris	
Dracaena reflexa Lam.	Asparagaceae	Bois de chandelle	
Elaeodendron orientale Jacq.	Celastraceae	Bois rouge	Olivetier d'Orient
Eugenia rodriguesensis J. Guého & A.J. Scott	Myrtaceae	Bois fer	
Fernelia buxifolia Lam.	Rubiaceae	Bois bouteille	Fernel à feuilles de buis
Ficus reflexa Thunb.	Moraceae	Ti l'affouche	
Ficus rubra Vahl	Moraceae	Affouche rouge	Figuier rouge
Foetidia rodriguesiana F. Friedmann	Lecythidaceae	Bois puant	
Hibiscus liliiflorus Cav.	Malvaceae	Augerine	Ketmie à fleurs de lys
Hyophorbe verschaffeltii H. Wendl.	Arecaceae	Palmiste marron	
Latania verschaffeltii Lem.	Arecaceae	Latanier jaune	
Lomatophyllum lomatophylloides	Asphodelaceae	Ananas marron	
Mathurina penduliflora Balf. f.	Passifloraceae	Bois gandine	
Myoporum mauritianum A. DC.	Scrophulariaceae		
Obetia ficifolia (Poir.) Gaudich.	Urticaceae	Bois d'ortie	Obétie à feuilles de figuier
Olea lancea Lam.	Oleaceae	Bois malaya	
Pandanus heterocarpus Balf. f.	Pandanaceae	Vacoa parasol	
Phyllanthus casticum Soy.-Will.	Phyllanthaceae	Bois de demoiselle	
Phyllanthus dumentosus Poir.	Phyllanthaceae		
Pittosporum balfourii Cuf.	Pittosporaceae	Bois bécasse	
Pleurostylia putamen Marais	Celastraceae	Bois d'olive blanc	
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Araliaceae	Bois blanc	

Scientific name	Family	Local name	French name
Poupartia castanea (Baker) Engl.	Anacardiaceae	Bois lubine / figue marron	
Premna serratifolia L.	Lamiaceae	Bois sureau	Premme à feuilles dentelées
Psiadia rodriguesiana Balf. f.	Asteraceae		
Psychotria balfouriana Verdc.	Rubiaceae		
Ramosmania rodriguesii Tirveng.	Rubiaceae		
Sarcanthemum coronopus Cass.	Asteraceae		
Scolopia heterophylla (Lam.) Sleumer	Salicaceae	Goyave marron	Scolopie héterophylle
Senecio boutonii Baker	Asteraceae		
Sideroxylon galeatum (A.W. Hill) Baehni	Sapotaceae		
Sophora tomentosa L.	Fabaceae		Sophore tomenteux
Syzygium balforii (Baker) J. Guého & A.J. Scott	Myrtaceae		
Terminalia bentzoë (L.) L. f.	Combretaceae	Benjoin	
Terminalia bentzoe rodriguesensis	Combretaceae	Bois benjoin	
Thespesia populnea (L.) Sol. ex Corrêa	Malvaceae	Sainte Marie	
Turraea lacinata (Balf. f.) Harms	Meliaceae	Bois balai	
Vepris lanceolata (Lam.) G. Don	Rutaceae	Patte poule	Vépride lancéolé

1.3.5.3 Critical habitats

As per the World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, “Habitat” is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. This ESS addresses all habitats, categorized as ‘modified habitat’, ‘natural habitat’, and ‘critical habitat’, along with ‘legally protected and internationally and regionally recognized areas of biodiversity value’ which may encompass habitat in any or all of these categories.

AQNR is defined as a ‘critical habitat’ as per ESS6 in as such as it meets the definition below.
Critical habitat is defined as areas with high biodiversity importance or value, including:

(a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;

(b) Habitat of significant importance to endemic or restricted-range species;

(c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;

(d) Highly threatened or unique ecosystems

(e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

In the preliminary designed, the ATC tower was located in Anse Quitor critical habitat. It was recommended that, since the reserve is very well delineated by its property line, shifting the control tower a few meters to the south or west would put the project out of the critical habitat limits and avoid the destruction of the critical habitat by the project.

2022 update: the ATC tower and RFFSD have been relocated outside the critical habitat, hence reducing the impact rating.

1.3.6 Summary: Terrestrial biological environment sensitivity

Table 28: Terrestrial Biological environment sensitivity

Theme	Sub-theme	Receptor	Sensitivity
Biological environment	Terrestrial habitats	Grazing lands on basaltic resurgences	Medium
		Grazing lands on calcarenic substratum	Medium
		Coastal vegetation dominated by Ipomoea pes caprae (shore-line community)	Medium
		Dry forest	Major
		Riparian vegetation	Medium
		Estuarine habitat	Medium
		Calcarenic dry lawns of anthropogenic origin	Medium
		Coastal grasslands dominated by secondarized thickets (Lantana camara)	Low
	Terrestrial flora	*Foetidia rodriguesiana, Hyophorbe verschaffeltii, Latania verschaffeltii, Polyscias rodriguesiana*	Major
		Zanthoxylum paniculatum, Antirhea bifurcata, Clerodendrum laciniatum, Diospyros diversifolia, Fernelia buxifolia, Mathurina penduliflora, Pandanus heterocarpus, Pleurostylia putamen, Terminalia bentzoe subsp. rodriguesensis, Adiantum rhizophorum, Sarcanthemum coronopus	High
		Phyllanthus dumentosus, Camptocarpus sphenophyllus, Secamone rodriguesiana, Nephrolepis biserrata, Phymatosorus scolopendria	Medium
		Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Premna serratifolia, Thespesia populnea, Cynanchum viminale	Low
	Terrestrial fauna	*Tropidophora articulata & T. desmazuresi (Gastropoda)*	Major / High
		Pteropus rodricensis (Chiroptera)	High
		Omphalotropis littorinula (Gastropoda)	Medium
		All other native species	Low

1.4 Conclusion: main issues of the baseline

The main issues identified in the baseline assessment are many protected species, especially floristic ones such as *Foetidia Rodriguesiana*, and the vicinity of the Anse Quitor reserve and the François Leguat reserve, and of dry forest habitat,

The particularly important risks that must be considered in this inventory is the presence of a critical habitat inside of which was located the control tower in the preliminary design. However, the control tower has been moved as part of the detailed design, thus avoiding any impact on the habitat.

As is the case for any project, other predictable impacts can already be numbered; (impact on fauna and flora, etc.). These shall be mitigated by avoiding or compensating measures.

2 Preliminary terrestrial biodiversity impacts and mitigation measures

2.1 Definitions and methodology

2.1.1 Project's phase considered in this study

This study is based on the preliminary design stage. During this first design phase, there is still a possibility to study several options. Therefore, the project is not confirmed, and some elements can be modified. However, all required field investigations have been carried out at this time and confirm that the project is feasible.

The next design step will be the detailed design, which consists of the final production detailed architectural and engineering drawings of the project's physical components. The detailed design also aims to ensure of the financial viability.

In order to consider all the potential consequences of the project, the impacts were studied with a broad vision. So, it is necessary to note that certain of these impacts will be avoided when the project is finalized.

For example, an impact of the project has been studied on the caves 'Grotte Fougère' and 'Grotte Petit Lac' which are in proximity of the new runway, even if the detailled design will avoid them.

2.1.2 Methodology for impact assessment and rating

In previous aspects of this study, receptors were defined and evaluated.

The chapter below aims to evaluate the consequences of the project (impacts), on all the receptors identified in the baseline.

For each theme, the impacts are defined and classified according to whether they are:

Temporary work impacts. These impacts are intended to appear during the project implementation phase, but to disappear once the works phase is completed (e.g. noise caused by the work equipment);

- Definitive work impacts. These impacts are intended to appear during the works phase, and to continue once the work is completed (e.g. destruction of habitat located in the project footprint);
- Operational impacts. These impacts are linked to the very existence and operation of the project (e.g. noise caused by the planes landing and taking off).

Each identified impact was numbered, then the following protocol was carried out:

For each of these three types of large impacts, an assessment of the intensity was first conducted and rated on the basis of their severity (impact severity) as : 1 - not significant, 2 - low, 3 - medium, 4 - high, 5 - major.

Table 29: Impact severity

Impact severity	Not significant	Low	Medium	High	Major

The severity impacts were confronted with the sensitivity of the issues they affect. The evaluation of impact severity and receptors sensitivity is done regarding the previously described social impact assessment process and according to the various consultations and meetings with stakeholders during the field study. This provides the level of impact (impact magnitude). The severity of the social impacts and sensitivity of the receptors are then combined through a matrix to obtain the magnitude of the impact. This matrix applies both to adverse and positive impacts. The specific criteria used to assess the magnitude of each type of social impact are those defined in the assessment of impacts. The table below illustrates the magnitude matrix of social impacts:

Table 30: Magnitude matrix of social impacts

Impact severity	Not significant	Low	Medium	High	Major
Receptor sensitivity					
Low	Negligible	Low	Low	Low	Medium
Medium	Negligible	Low	Low	Medium	High
High	Negligible	Low	Medium	High	Major
Major	Low	Medium	High	Major	Major

Following the identification and assessment of impacts, avoidance, reduction and impact compensation measures have been defined and numbered. The same measure can correspond to avoiding or mitigating several impacts.
Finally, to correct previously identified impacts, these measures made it possible to carry out a new assessment of the impacts intensity. This is the mitigated impact or residual impact.

2.2 Temporary Impacts during Construction

2.2.1 Terrestrial habitats and flora

None.

2.2.2 Terrestrial fauna

2.2.2.1 Impact BioT-Fau-W-Temp-1: Impacts on the native bat Pteropus rodricensis

The following potential effects of the construction and operation of the project on the native bat *Pteropus rodricensis* are identified as:

- Loss of foraging habitat.
- Impact of construction noise, dust, vibration, light disturbance during night works, and operational lighting.
- Mortality or injury on roads through vehicle strike.

The species has been seen flying high enough to avoid most of the risks coming from vehicle strike. Noise, vibration and dust are potential sources of nuisance but the species is not very present when flying over the project area. The species could feed from the many specimen

of *Eleodendron orientale* on the study site or from any other trees that provide fruits. However, the area is generally sparsely forested and the potential for the species to feed within the project footprint is very low.

Figure 36: Pteropus rodricensis flying over the Anse Quitor nature reserve near the project

The number of specimens inside the area of influence or inside the project footprint is used to determine the impact severity. For this species, the number of specimens inside the area of influence is higher than 10, and the number of specimens inside the project footprint is considered 0.

The impact severity is low. Considering the receptor sensitivity assessed as high, **the impact magnitude is low**.

2.2.2.1.1 Mitigation measure and impact after mitigation

No measure is necessary.

The proposed measures result in a low severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.2.2.1.2 Summary

Table: Temporary Impact during Construction – Terrestrial Biological Environment - Terrestrial Habitats & Fauna

Impact ID	Impact name	Direction	Impact magnitude mitigation	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
BioT-Fau-W-Temp-1	Impact on *Pteropus rodricensis (Chiroptera)*	Adverse	Low	None	None	Low

2.3 Permanent and irreversible impacts during Construction Phase

Human impacts on terrestrial biodiversity have escalated with the spread and development of agriculture, resulting in the replacement of forest and other natural habitats by simpler ecosystems of much higher human carrying capacity. These types of developments have had a cumulative impact on biodiversity and resulted in effects such as habitat loss and fragmentation, pollution (both chemical and biotic) and disturbance such as light, noise and pet predation.

The main effects of the proposed airstrip extension will be:

- Loss of semi-natural vegetation and some ecosystem functions.
- Loss of native gasteropoda individuals and their foraging habitat. These aspects are discussed in more detail below.
- Loss of native trees of a low, medium, high and major sensitivity for Rodrigues Island.

2.3.1 Terrestrial habitat

It is likely that the overall area of semi-natural habitats (grazing lawns, thickets and shrubs) within the project footprint contributes to the ecological corridor of the Anse Quitor nature reserve, for instance, as a corridor and feeding site for arthropods, bats and birds (*Numenius phaeopus*). At least, 77 hectares of grazing lands, Lantana's and Leucaena's thickets, or coastal vegetation will be destroyed, which represents more than a third of the total surface area of influence.

The overall impact magnitude on habitat loss is assessed at low. The impacts for each type of habitat are detailed below.

2.3.1.1 Impact BioT-Hab-W-Def-1: Impact on Grazing lands on basaltic resurgences

2.3.1.1.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Grazing lands on basaltic resurgences	5,9	1,5 (25%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as medium, **the impact magnitude is low**.

2.3.1.1.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.2 Impact BioT-Hab-W-Def-2: Impact on Grazing lands on calcarenic substratum

2.3.1.2.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Grazing lands on calcarenic substratum	67,1	35,3 (53%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as medium, **the impact magnitude is low**.

2.3.1.2.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.3 Impact BioT-Hab-W-Def-3: Impact on Coastal vegetation dominated by Ipomoea pes caprae

2.3.1.3.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Coastal vegetation dominated by Ipomoea pes caprae	10,9	1,5 (14%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as medium, **the impact magnitude is low**.

2.3.1.3.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.4 Impact BioT-Hab-W-Def-4: Impact on Anthropized areas

2.3.1.4.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Anthropized areas	73,2	11,9 (16%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is low. Considering the receptor sensitivity assessed as low, the residual impact is of **low magnitude**.

2.3.1.4.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a low severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.5 Impact BioT-Hab-W-Def-5: Impact on Dry forest

2.3.1.5.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Dry forest	16,7	0 (endemic species in the initial footprint)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as major, **the impact magnitude is high**.

2.3.1.5.2 Mitigation measure and impact after mitigation

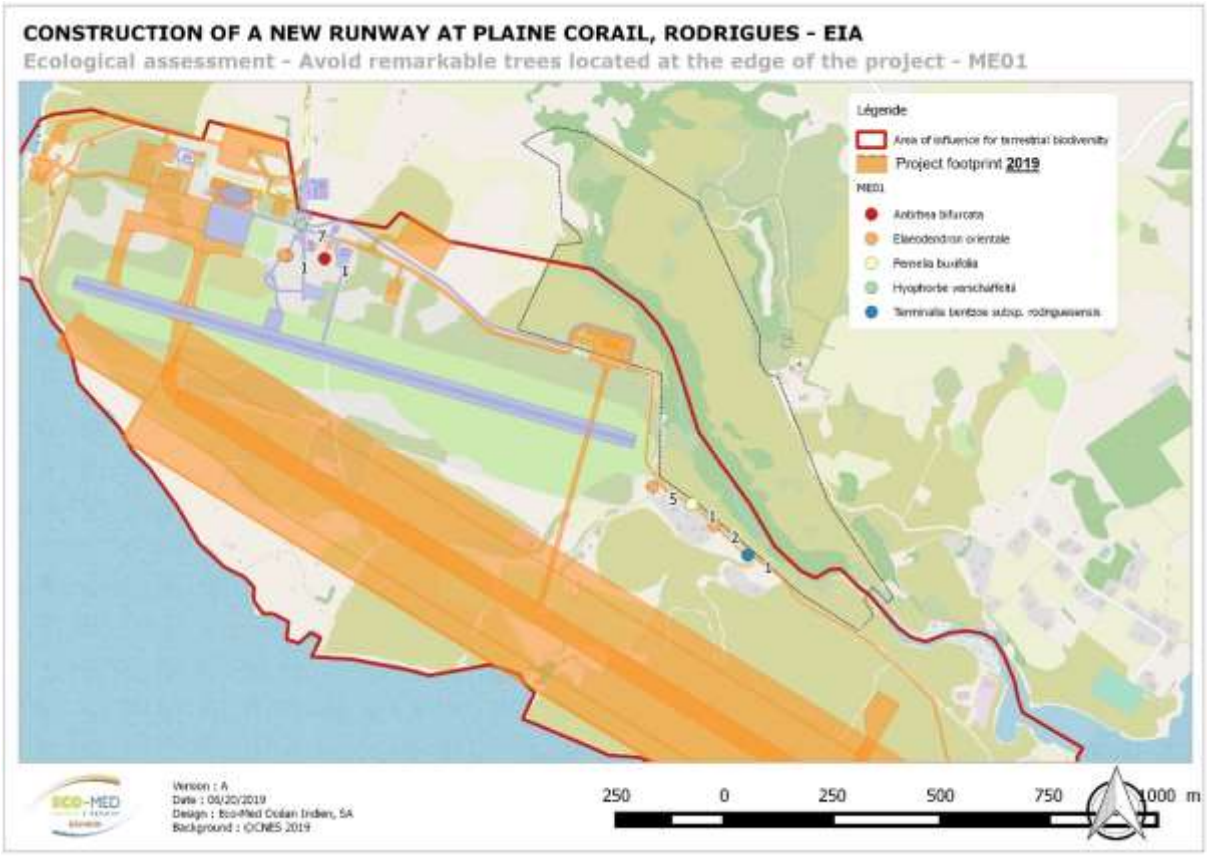
Avoidance measure (BioT-Av-1): Avoid remarkable trees located at the project edge

This measure consists in avoiding the destruction of remarkable trees located at the boundaries of the initial project footprint by locally adapting the project boundaries. A total of 19 trees have been easily avoided, as shown by the table and the map below.

Targeted species	Number of specimens avoided
Antirhea bifurcata	1
Elaeodendron orientale	9
Fernelia buxifolia	1
Hyophorbe verschaffeltii	7
Terminalia bentzoe subsp. rodriguesensis	1

Implementation conditions / Points of vigilance: these 19 trees must be marked prior to the works phase with permanent devices (fences, ribbons, paintings…) and tagged with an identification number (ID) in order to be properly followed during the works phase.

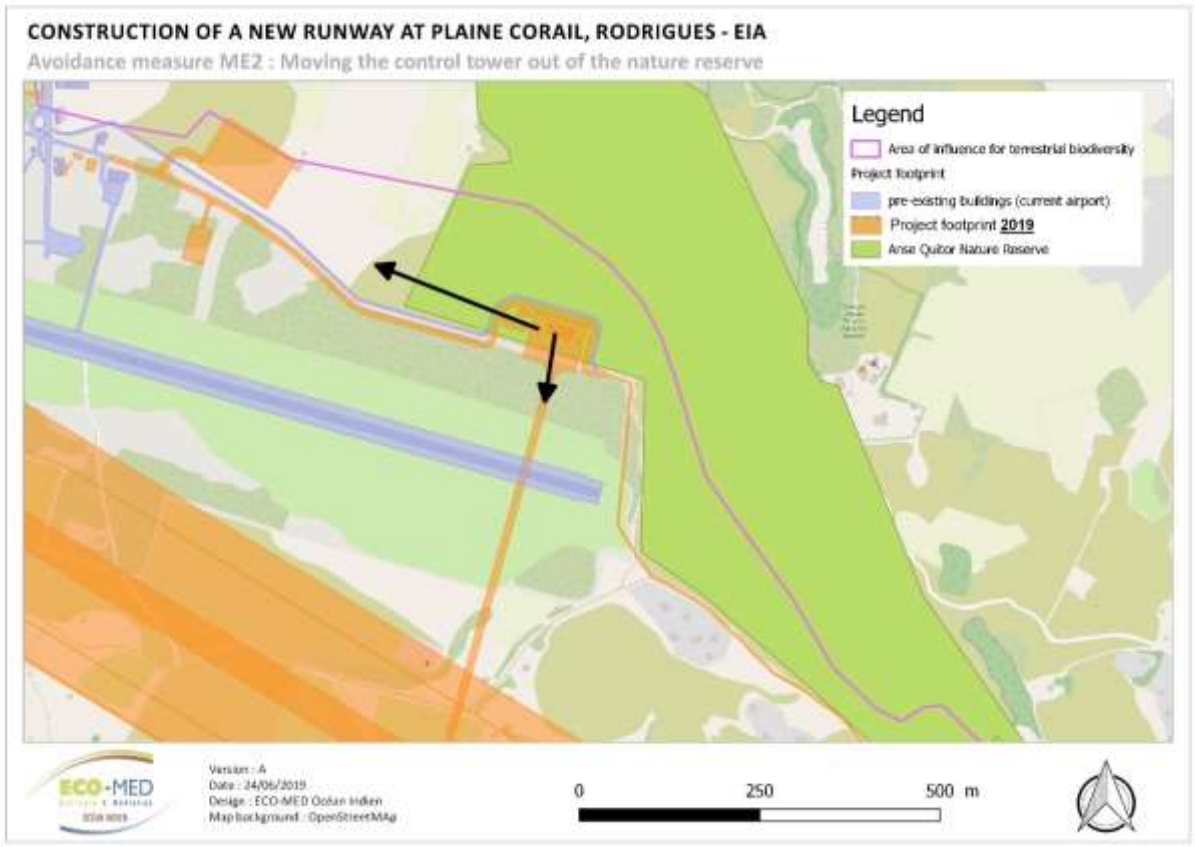
The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Mauritius Wildlife Foundation or Forestry Services.



<u>Avoidance measure (BioT-Av-2)</u>: Moving the control tower out of the nature reserve

This measure consists in avoiding the destruction of approximately 1 hectare of the buffer area of the Anse Quitor nature reserve, as mapped below. This measure allows to save 6 specimens of *Elaeodendron orientale (2), Sarcanthemum coronopus (3) and Terminalia bentzoe subsp. Rodriguesensis (1)*.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Wildlife Foundation and Forestry Services for the official limits of the nature reserve.



<u>Reduction measure (BioT-Mit-3)</u>: Creating an arboretum of endemic species inside the airport landscaping

This measure consists in planting 80 specimens of rare and endangered endemic species within the airport limits after the extension airstrip project. This aims to protect, preserve and create an arboretum of endemic seeds that will be used afterwards to produce endemic plants for the nature reserves in Rodrigues.

(An attempt to transplant all or part of the remarkable trees intended to be destroyed by the project is also proposed (in the least, *Diospyros, Terminalia, Foetidia, Antirhea*): reduction measure 2 and reduction measure 4).

A complementary list of species is proposed below, in regard of the impacts of the project on endemic flora.

Scientific name	French name	Family	Status	Type
Clerodendrum laciniatum Balf.f.	Bois cabri	Lamiaceae	Endemic	Bush
Fernelia buxifolia Lam.	Bois bouteille	Rubiaceae	Sub-endemic	Bush
Hyophorbe verschaffeltii H. Wendl.	Palmiste marron	Arecaceae	Endemic	Palm
Latania verschaffeltii Lem.	Latanier jaune	Arecaceae	Endemic	Palm
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Bois blanc	Araliaceae	Endemic	Tree
Ramosmania rodriguesii Tirveng.		Rubiaceae	Endemic	Tree

Implementation conditions / Points of vigilance: A partnership with the Forestry Services or the Mauritius Wildlife Fondation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the nature reserves of Rodrigues and/or Mauritius.

Collection of plant material will be authorized in advance by the reserve managers in any case.

A specific protocol will be designed for trees transplantation.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Mauritius Wildlife and Forestry Services.

Reduction measure (BioT-Mit-4): Transplant remarkable trees and ferns intended to be cut down during the works phase

This measure consisting in transplanting all or part of the remarkable trees and ferns intended to be destroyed by the project is also proposed (in priority, Diospyros, Terminalia, Foetidia, Antirhea, Nephrolepis).

Targeted species	Number of specimen targeted for transplantation
Adiantum rhizophorum	1
Diospyros diversifolia	1*
Elaeodendron orientale	155
Foetidia rodriguesiana	2
Nephrolepis biserrata	3
Pandanus heterocarpus	39
Phyllanthus dumentosus	1
Terminalia bentzoe subsp. rodriguesensis	1*

**: not directly within the project footprint but close enough to compromise its in situ survival over time*

Transplantating operations (Source: Guidelines on Tree Transplanting, Greening, Landscape and Tree Management Section Development Bureau - The Government of the Hong Kong Special Administrative Region - September 2014):

1 - Tools and equipment:

All tools and equipment should be appropriate to the operations and prepared in advance. Digging and root pruning tools shall be sharp and clean in order to cut without breaking, crushing or tearing roots;
Lifting cables, chains, straps, and/or slings can be used to lift the tree and its roots out of the ground;

2- Timing of transplantation:

In general, summer is not a common transplanting season as evapo-transpiration rate is high and the transplanted trees will be under stress when transplanting work is taking place during that time.

Before the rainy season seems like an optimal time (October to December)

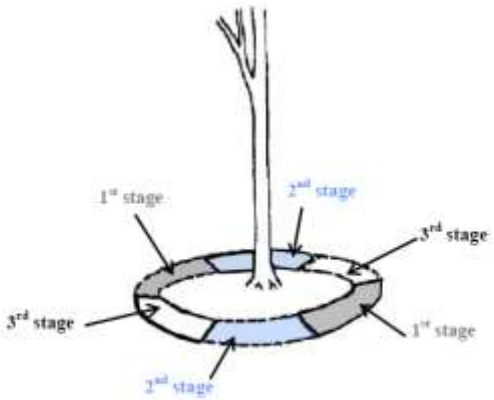
3 – Preparation of rootball:

Root pruning is sometimes required before transplanting a tree. Sufficient time should be allowed between preparation and final lifting for development of new roots capable of sustaining and continuing the growth of the transplanted tree;
The root system of a woodland or open-grown tree will normally be widespread. Lifting such trees without initial preparation of a root ball will result in much of the root system being left in the soil. After transplanting, the tree crown may then die back, or the tree may not be able to recover and will die eventually;
In general, the root ball diameter to tree diameter ranges from 8:1 to 10:1 according to international standards (except for a palm which may require a smaller root ball). The root ball sizes should be of a diameter and depth encompassing enough of the root system as necessary for establishment.

4 - Stage digging:

Root pruning to form a reasonable size of root ball is required and may be adjusted to suit specific tree species and/or imposed project constraints. For mature trees, root pruning is usually required to be carried out at different stages with a minimum of 1 month allowed for root regeneration between cuts. Stage digging can be carried out in the following stages in situations if the locations and work program are considered suitable. The four stages are:

- 1st stage – Dig a trench on the outside of the marked circumference in only two opposing segments;
- 2nd stage – After a period of no less than 1 month since the 1st root pruning, dig a trench on the outside of the marked circumference in the adjacent two opposing segments;
- 3rd stage – After another period of no less than 1 month since the 2nd root pruning, dig a trench on the outside of the marked circumference, in the remaining two opposing segments; and
- 4th stage – After a further period of not less than 1 month since the 3rd root pruning, prepare the root ball and cut the underside of the root ball, followed by uplifting and transplanting
- Cuts must be clean to avoid tearing or breaking the roots.



The 4th stage in preparing the root ball by cutting its underside

5 – Crown pruning

Pruning of tree crown during transplanting may not be necessarily beneficial to the trees as thinning the crown can reduce the tree's capability in making food and building up reserves. Excessive pruning can ruin the natural form of a tree and reduce photosynthesis.
Crown cleaning however can be carried out to remove unhealthy, damaged, diseased, dead and crossed branches so as to minimize susceptibility to pests and diseases.

6 – Tree lifting operations

Tree lifting operations shall be carefully timed so as to enable direct delivery to the receptor site. No transplanting operation should commence until either the receptor site or the holding nursery is fully prepared.

Damp hessian is placed on the sides and across the tip of the ball and pinned. The hessian should cover the full circumference of the root ball with bottom skirt hanging out.
The root ball should be properly wrapped before lifting. Lifting should be done by direct lift, with padded protection for the tree, using a machine of appropriate capacity connected to the support around the root ball, not to any other part of the tree. The tree should not be lifted by the trunk as this can cause serious trunk injury but by its root ball which should be properly prepared and wrapped. Root balls that are not properly protected would easily collapse during transplanting due to their own weight.

7 - Protection during transportation

Trees are often too tall to be transplanted in the upright position and are tipped to a horizontal position. Root balls may be flattened during transportation. When trees are being loaded on a lorry or trailer bed, care must be taken to avoid injuring the tree or breaking the soil ball. The crown of the tree should be carefully wrapped to minimize the risk of drying, branch damage due to excessive movements, and wind damage.

8 - Preparation of receptor site

Trees will not tolerate highly compacted soil, which should be broken up over as large an area of the site as possible. Planting pits should be provided with drainage to allow effective percolation of water.
During pit preparation, the existing topsoil ploughed from digging should be stripped and put aside for reuse as much as possible and to avoid a distinct interface between the planting pit and the surrounding soil.
In general, the depth of the planting hole shall not exceed the depth of the root ball and the sides of the planting hole should be scarified.

9 – Planting

Trees should preferably be placed in the same orientation from which they originated.
All root ball supporting materials should be removed from the planting hole prior to final back filling
When finally set, the top surface of the root ball should not be below the surrounding soil;
The backfill soil should be tamped firmly around the base to stabilise a tree, but the rest of the soil should be tamped only lightly, or left to settle on its own;
Mulch can be used to conserve soil moisture, to buffer soil temperature extremes, to control weeds and other competing vegetation, and to replenish organic matters and nutrients in the soil.
Sufficient and appropriate watering is important for proper root growth. Provision should be made for watering, allowing for total wetting of the rooting volume to minimize susceptibility to stress and assure survival.

Implementation conditions / Points of vigilance: A competent and trained external coordinator of the transplantation protocol will be mobilized.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Mauritius Wildlife and Forestry Services.

Implementation


Mauritian Wildlife Foundation, Rodrigues

Strategy and Action Plan for the protection and preservation of native and endemic plants that will be affected by the Airport Development Project at Plaine Corail, Rodrigues, Republic of Mauritius

The implementation of this transplant measure has started since 2021 following the recommendations of the previous report (2019).

Mauritian Wildlife Foundation has been commissioned to implement a Strategy and Action Plan for the protection and preservation of native and endemic plants that will be affected by the Airport Development Project at Plaine Corail.

With regards to the two specimens of *Foetidia rodriguesiana*, one of *Diospyros diversifolia*, one of *Polyscias rodriguesiana* and one of *Terminalia bentzoe ssp. rodriguesensis*, a 3-tier strategy has been proposed to protect these individuals, involving:

1) Propagation of these species in the MWF Rodrigues Solitude Nursery by MWF personnel, via:

a. the germination of seeds collected from the plants scheduled for removal and

b. the pricking out of collected seedlings collected under the same trees

2) Cloning and growing out of the individuals scheduled for removal, in the MWF Rodrigues Solitude Nursery by MWF personnel with advice from MWF botanists and horticulturists in Mauritius and the Conservatoire Botanique National de Brest (CBNB) in France to save the DNA of these individuals, by:

a. Collecting branch or root cuttings from the trees scheduled for removal, that will be placed in closed cases for growing out, and

b. Carrying out aerial layering in the field on the trees themselves

3) Transplanting the individuals scheduled for removal out of harm's way, to the most suitable and best protected locations using:

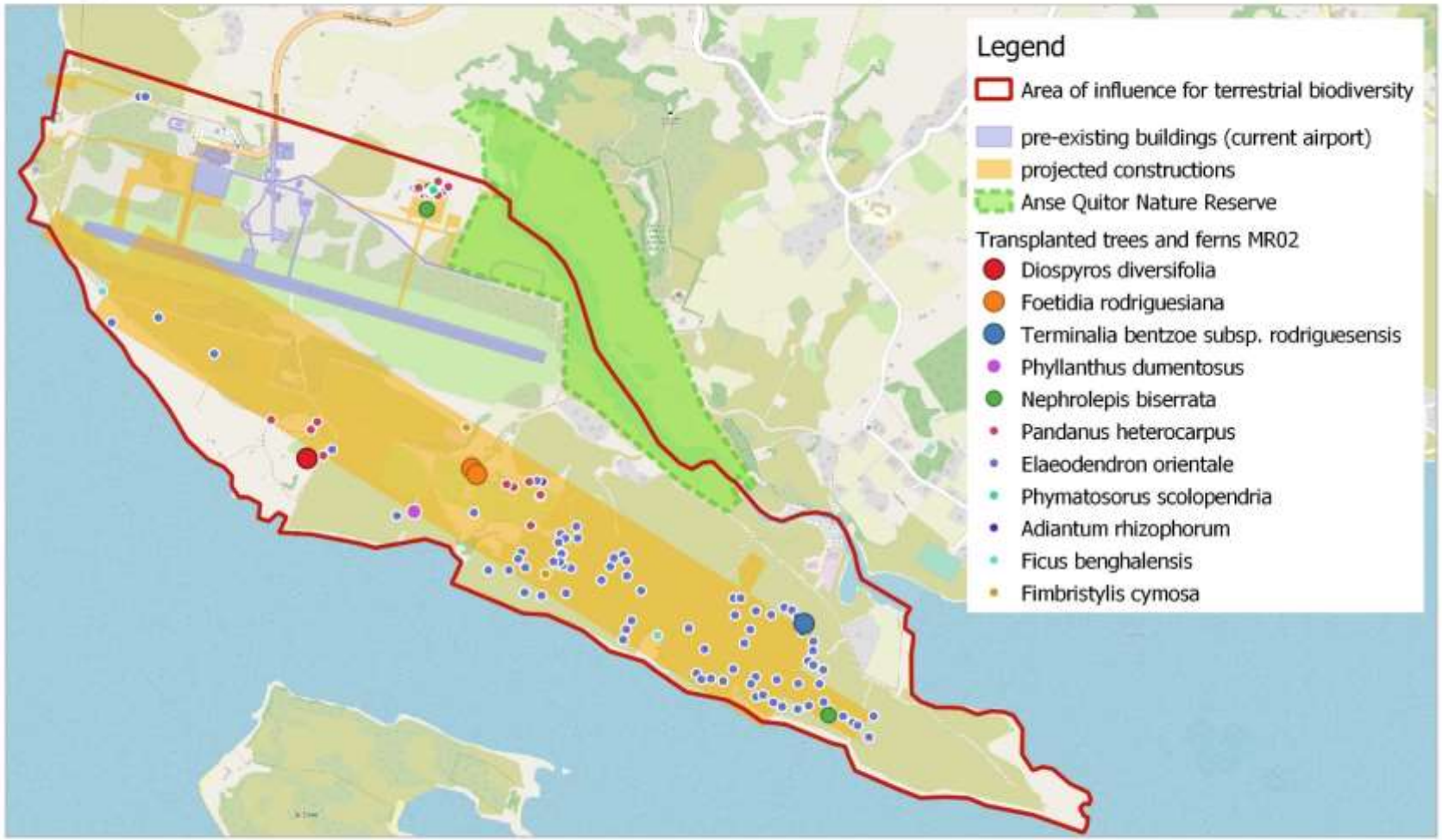
a. Expert advice of two Botanists currently working at the Naples Botanical Gardens in Florida, USA

b. Following detailed methods developed specifically for the flora subjects in collaboration with the above 2 experts.

c. Under the supervision of one expert who will travel to Rodrigues for said transplants

Proposed Expansion of Rodrigues Airport - ESIA - Terrestrial Biodiversity Report

Ecological assessment - Remarkable trees intended to be transplanted - MR02



<u>Reduction measure (BioT-Mit-5)</u>: Genetic conservation of populations of impacted rare species

In response to the destruction of several rare species specimens, this measure consists in ensuring the production and reintroduction of clones and genetic ancestors of these species in order to preserve their genetic lineage in the long term. A total of 14 to 35 specimens will be produced, depending on the results obtained by vegetative and sexual propagation.

The entire project is conditional on the success of this measure.

<u>1 - Targeted species</u>

The targeted species are those that will be threatened by the project after avoidance measures. One exception is Zanthoxylum paniculatum as the species is of major sensitivity in the area of influence and is in a very bad situation in Rodrigues - 3 plants left. Another exception is Antirhea bifurcata, one specimen will be left alive inside the airport limits: this species has become very rare in Rodrigues and requires conservation efforts.

Targeted species	French name	Family	Status	IUCN (status retained)	Number of specimens destroyed by the project	Comment	Proposed number of plants to be produced
Antirhea bifurcata (Desr.) Hook.f.	Bois goudron	Rubiaceae	Sub-endemic	**CR**	0	*See avoidance measure BioT-Av-1*	2 to 5
Diospyros diversifolia Hiern	Bois d'ébène / Ebénier	Ebenaceae	Endemic	**EN**	1		2 to 5
Foetidia rodriguesiana F. Friedmann	Bois puant	Lecythidaceae	Endemic	**CR**	2		2 to 5
Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens	Bois benjoin	Combretaceae	Endemic	**VU**	1	*See avoidance measure BioT-Av-2*	2 to 5
Zanthoxylum paniculatum Balf. f.	Bois pasner	Rutaceae	Endemic	**CR**	0	*Very rare species located inside the nature reserve*	2 to 5
Elaeodendron orientale Jacq.	Bois rouge	Celastraceae	Sub-endemic	**LC**	155		2 to 5
Pandanus heterocarpus Balf. f.	Vacoa parasol	Pandanaceae	Endemic	**NT**	39		2 to 5

<u>2 - Harvesting of plant material</u>

Two methods can be used at the same time to ensure the effectiveness of the measure:

a. By collecting seeds: Several campaigns have to be scheduled in order to target the right periods of fruiting. It requires to have someone locally implanted who can watch the different specimen on a regular basis (1 time every month for a year). As an indication, here are the flowering periods for the following genera in Reunion Island:
Foetidia = February; Eleodendron = from July to January; Zanthoxylum = June/July; Pandanus = from January to March; Terminalia bentzoë = from August to November; Diospyros = December; Antirhea = rainy season

Seeds have already been collected for *Foetidia rodriguesiana* by the Forestry services in July 2019 (Payandee, com. Pers.).

Species of high sensitivity impacted by the project	Cuttings	Layering	Grafting	Sowing	Germination rate?
Diospyros diversifolia	?	?	?	No dormancy reported for its sister species *D. borbonica* *An adult tree can produce 1500 fruits, each containing 10 to 12 seeds*	Germination rate is very good and can get to 60% but transplanting them then can get down to 50% on the total transplanted. The plantation success is very low as it is very sensitive to drought or heavy rainfall. The survival rate is around 30 to 40% and even less in some years. Germination rate of 60 to 80% for its sister species *D. borbonica*
Foetidia rodriguesiana	Seems to work according to (Dupont et al. 1989) but some tests ran by WWF do not confirm this data	Seems to work (Debize et al. 2007) as it works for F. mauritiana	?	Fruit has to be prepared to eliminate dormancy	Highly variable and around 30% for its sister species *F. mauritiana*
Terminalia bentzoë	?	?	?	Fruit has to be prepared to eliminate dormancy	< 50%

Figure 37: Fruit of Foetidia rodriguesiana

b. By collecting cuttings: to produce clones of the specimens destroyed by the project.
Period of collection: rainy season, from November to March

Take cuttings from the wild specimens: select young straight shoots about the diameter of a pencil (except trailing snowberry, which can be thinner). Collect long branches– they will be divided into individual cuttings later. Cut just above a leaf node. Put the cuttings in a plastic bag or the ends in a bucket of water, and keep them cool, moist, and out of direct sunlight.

Prepare individual cuttings: cut the branches into pieces long enough to have at least three or four leaf nodes (for most species, cuttings will be about 15 cm long). The end of the cutting closest to the roots (the “bottom”) should be cut at a 45° angle just below a node. To not confuse the bottom with the top of the cutting (essential), cut the top at a right angle (straight across) slightly above a node.

Production: while not essential, for some species success is improved by dipping the bottom (angled) end of the cutting in rooting hormone. Fill a pot with an unfertilized fast-draining soil mix (and in many cases perlite, sharp sand or vermiculite alone will work but cuttings need soil after rooting). Poke holes in the soil with a stick a bit larger than the cutting diameter, insert cuttings with at least 2 nodes in soil and 1 or 2 nodes above soil level, tamp soil and water it. Wait until leaf growth unfurls and gently check for substantial root development (it can take a few months). If there are leaves or roots but not the other reinsert the cutting and wait. Cuttings can be transplanted into a soil mix in a larger container, or transplanted into native soil. During a dry spring keep the rooting medium moist. During the following summer, supplemental water will improve survival and development.

3 - Plant production

The plants will be kept at the nursery until the receptor site is ready to receive the plant.

4 - In situ plantation: see BioT-Mit-3

Focus on Foetidia spp.
A sister species of F. rodriguesiana is present in Mauritius and La Réunion. We report here some informations about seeds harvesting, conservation and germination rates for this closely related species of F. rodriguesiana and some informal clarifications for F. rodriguesiana obtained from WWF and the Commission for Forestry from Rodrigues (Alfred Bègue, Richard Payandee).

***Collection**: F. mauritiana: Although the fruit ripens from October to January, it can be picked from the ground all year round because it keeps well.*

***Seeds**: F. mauritiana: The fruit is indestructible and waterproof. In nature, it takes several years to deteriorate. This dormancy can be eliminated by breaking the fruit as specified below. It is a delicate operation, which can sometimes destroy seeds. The fruits must be broken into four pieces, by tapping with the short side of a hammer on their diagonal. They are then left to soak for 1 hour in a 5% bleach solution (10 teaspoons of bleach for 1 litre of water) to destroy all the fungi that could harm the young seedling. Out of this bath, they should be rinsed thoroughly.*

***Storage**: F. mauritiana: The seed can be kept for more than one year in the fruit at room temperature and more than 5 years in a cold room.*

***Sowing**: F. mauritiana: The sowing must be done in boxes on a substrate relatively low in raw organic matter (half earth sieved and half sand). The fruit pieces are then deposited on the surface without covering them. The water from each watering shall contain a fungicide and from time to time an insecticide against ants. The first lifts take place after 15 days at best and may be extended over more than 6 months to 1 year.*

***Germination rate:** F. mauritiana: very variable, generally > 30%.*
F. rodriguesiana: i) Less than 1% success with no human help for cracking the seeds (10 young plants in 10,000 seeds), ii) 60 -70 % success when using a technique of cracking the seed with a hammer or with a vice to allow water to get inside the seed (imitating the effect of digestion by turtles), iii) One tree produces thousands of seeds.

***Cuttings**: F. rodriguesiana: does not work well according to the few trials carried out by MWF, but might work if carried out by a specialist. Recommended: horticulturists from Kew Garden (Martin Stanyford, Carlos Magdalena) or Brest laboratory.*

***Plant breeding**: F. mauritiana: The young root being very fragile, the transplanting must be done as soon as the germ appears (at most 1 cm long). Fungicide treatment should continue as long as the seedling remains at the cotyledon stage. It is advisable to provide containers deep enough for transplanting because the pivot of this relatively long species, has quite a fast development. F. rodriguesiana: Almost 100% success when planted excluding invasive species intrusion.*

Implementation conditions / Points of vigilance: A partnership with the Forestry Services or the Mauritius Wildlife Fondation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the specimen located within the project footprint.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Mauritius Wildlife and Forestry Services.

<u>Offset measure (BioT-Comp-6):</u> Action plan towards more sustainable agricultural practices for native biodiversity.

This measure consists in initiating a new approach for the management of extensive agriculture on the island of Rodrigues by proposing a turnkey operational action plan.

Grazing land management is the manipulation of the soil-plant-animal complex in pursuit of a desired result. Rodrigues's native shrubs and trees are sometimes desirable plant species for the livestock of which the wandering grazing is almost everywhere. These shrubs and trees not only provide an important food source at certain times throughout the year, but also provide numerous habitat values for a wide array of wildlife species. This includes browsing opportunities for ungulates and feeding and nesting sites for birds and small mammals. However, overuse by livestock leads to the destruction of native species or prevents spontaneous sexual and vegetative reproduction which causes the native flora disappearance.

Here, we propose to set up an action plan to provide concrete elements for the management of grazed areas with regard to biodiversity issues on the island of Rodrigues. Several steps will be necessary for its establishment, including consultation phases with all local stakeholders throughout the process in order to obtain a consensus document for all the Rodriguans.

The grazing management plan should have the following components:

- A definition of goals including livestock production and pasture and range sustainability;
- A definition of biodiversity areas, including isolated trees with high heritage value and riparian health;
- A list of native species that can be or are impacted by livestock grazing;
- A map of grazing areas including all developments such as fences, gates, water sources, etc…
- Type and number of livestock grazing in the pastures;
- Approximate period of use for pastures.

This action plan can be approached by:

- The inventory and consultation of all agricultural and ecologist partners throughout the project;
- The establishment of the development challenges of livestock breeding in Rodrigues;
- Drawing up an inventory of actions that can improve the quality and productivity of livestock farming by promoting local biodiversity;
- Proposing a fine cartographic work accompanied by spatialized actions throughout the Rodrigues territory.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Wildlife Fondation, Agricultural and Forestry Services, Regional Assemblee.

Offset measure BioT-Comp-7: Ecological restauration within the limits of the Anse Quitor nature reserve

This measure consists in:

Rebuilding the fence around the Anse Quitor nature reserve, with one that would be similar to the fence around the airport in order to discourage grazing livestock from going inside the reserve. This measure is a short-term response to the grazing vs. biodiversity issue that has to be solved with the offset measure (BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity).
Reinforcing native species populations by planting 500 native plant specimens within the Anse Quitor nature reserve buffer area, located besides the future airport boundaries (see map below).

Methods:
Harvesting**:**
The geographical origin of the seeds is an important criterion. The producer must be able to provide this information for each plant produced. Labelling (aluminium plate) of individuals may be considered. In addition, if harvests are required, four methods are proposed that are concerned with ecological conservation concepts:
The objective is to harvest primarily in the area of influence or in the immediate vicinity in order to offer the best guarantees of adaptation and to save the genetic heritage of the site;
Harvesting within the Anse Quitor nature reserve in priority;
Harvesting within existing arboretums;
To harvest in a natural environment requires the intervention of a qualified botanist. In order not to deprive the natural environment of the seeds necessary for its renewal, only one third of the fruits of a tree specimen must be harvested.
Production of plants:
Harvesting (seeds, cuttings) and production must take place well before the works phase in order to obtain plants of sufficient size for planting and to set up the restoration during the works phase of the project. The aims are:
To obtain medium-sized plants, for optimal recovery and easy transport;
To "wean" the plants, i.e. gradually reduce watering to accustom the young trees to the lack of water;
To promote good root development, for a good nutrition of the plant;
To limit the use of fertilizers and insecticides.

Planting:
Planting should take place in the wet season. Planting plots of 25 m² (5 m x 5 m) of native species with a density of 1 plant/m2 will be implemented. A total of 500 individuals will be distributed in 20 25 m² plots.

Planting young plants in dense masses would allow an optimal success rate: better protection of the plants against the sun, limiting competition with weed species... The very high density of indigenous species with rapid growth is a major element for the success of the measure. The plots will be supplied with topsoil to a depth of 1 to 2 metres to stimulate root development.

Several planting techniques can be carried out (mechanical, manual, etc.). We remind you that the young plants must be planted relatively close to each other (1 plant/m2), in order to stimulate their growth and avoid the return of invasive species.

Considering the taking into account of these measures, the magnitude of the mitigated impact is negligible.

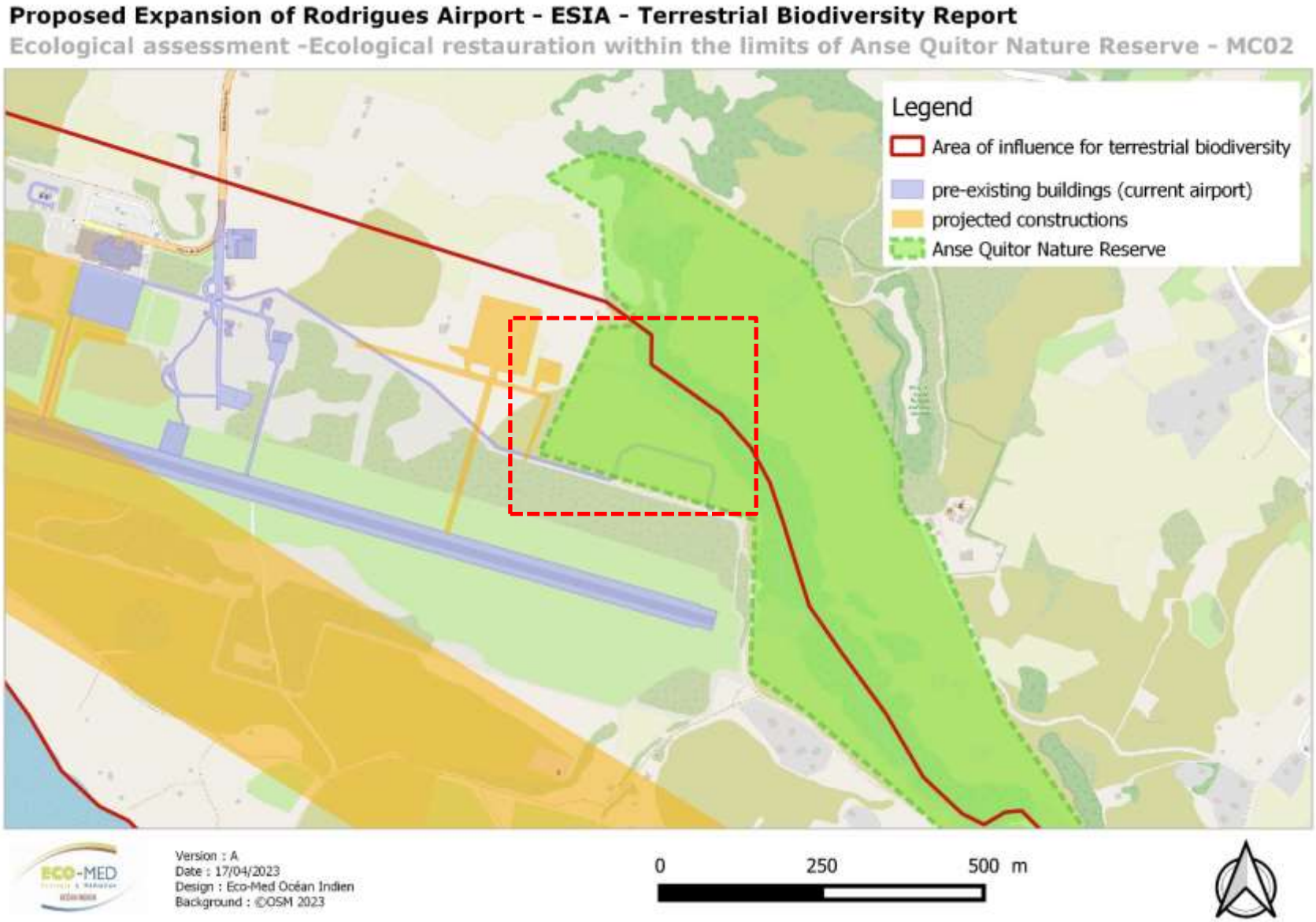
The proposed measures result in a low severity mitigated impact. Thus, The residual impact is of **negligible magnitude**.

Table 31: Targeted plant species

Scientific name	French name	Family	Status	Type
Adiantum rhizophorum Sw.		Pteridaceae	Sub-endemic	Herbaceous
Allophylus borbonicus (J.F. Gmel.) F. Friedmann	Bois de merle	Sapindaceae	Sub-endemic	Tree
Aloe lomatophylloides Balf. f.	Ananas marron	Asphodelaceae	Endemic	Herbaceous
Antirhea bifurcata (Desr.) Hook.f.	Bois goudron	Rubiaceae	Endemic Macarenes	Tree
Camptocarpus sphenophyllus (Balf. F.)		Asclepiadaceae	Endemic	Liane
Canavalia rosea (Sw.) DC.	Liane cocorico	Fabaceae	Indigenous	Herbaceous
Carissa spinarum L.	Bois amer	Apocynaceae	Native	Bush
Carissa xylopicron	Bois de ronde	Apocynaceae	Indigenous	Bush
Cassytha filiformis L.	Liane foutafout	Lauraceae	Indigenous	Liane
Clerodendrum laciniatum Balf.f.	Bois cabri	Lamiaceae	Endemic	Bush
Cynodon dactylon (L.) Pers.	Petit-chiendent	Poaceae	Indigenous	Herbaceous
Dactyloctenium ctenioides (Steud.) Lorch ex Bosser		Poaceae	Indigenous	Herbaceous
Dictyosperma album (Bory) H. Wendl. et Drude ex Scheff.	Palmiste blanc	Arecaceae	Endemic	Palm
Diospyros diversifolia Hiern	Bois d'ébène / Ebénier	Ebenaceae	Endemic	Tree
Dodonaea viscosa Jacq.	Bois d'arnette	Sapindaceae	Native	Bush
Dombeya acutangula Cav.	Mahot tantan	Malvaceae	Endemic	Bush
Dombeya rodriguesiana F. Friedmann	Mahot / Bois Julien	Malvaceae	Endemic	Bush
Doricera trilocularis	Bois chauve-souris	Rubiaceae	Endemic ROD	Bush
Dracaena reflexa Lam.	Bois de chandelle	Asparagaceae	Native	Tree
Elaeodendron orientale Jacq.	Bois rouge	Celastraceae	Sub-endemic	Tree
Eugenia rodriguesensis J. Guého & A.J. Scott	Bois fer	Myrtaceae	Endemic	Tree
Fernelia buxifolia Lam.	Bois bouteille	Rubiaceae	Endemic Macarenes	Bush
Ficus reflexa Thunb.	Ti l'affouche	Moraceae	Native	Tree
Ficus rubra Vahl	Affouche rouge	Moraceae	Native	Tree

Scientific name	French name	Family	Status	Type
Foetidia rodriguesiana F. Friedmann	Bois puant	Lecythidaceae	Endemic	Tree
Heteropogon contortus (L.) P. Beauv. ex Roem. et Schult.	Herbe polisson	Poaceae	Indigenous	Herbaceous
Hibiscus liliiflorus Cav.	Augerine	Malvaceae	Endemic	Tree
Hibiscus tiliaceus L.	Var	Malvaceae	Indigenous	Tree
Hyophorbe verschaffeltii H. Wendl.	Palmiste marron	Arecaceae	Endemic	Palm
Ipomoea pes-caprae (L.) R. Br.	Liane batatran	Convolvulaceae	Indigenous	Herbaceous
Ipomoea pes-caprae (L.) R. Br. subsp. brasiliensis (L.) Ooststr.	Patate à Durand	Convolvulaceae	Indigenous	Herbaceous
Latania loddigesii Mart.	Latanier bleu	Arecaceae	Endemic MAU	Palm
Latania verschaffeltii Lem.	Latanier jaune	Arecaceae	Endemic	Palm
Lycium mascarenense A.M. Venter et A.J. Scott	Souveraine de mer	Solanaceae	Indigenous	Bush
Mathurina penduliflora Balf. f.	Bois gandine	Passifloraceae	Endemic	Bush
Mucuna gigantea (Willd.) DC.		Fabaceae	Indigenous	Liane
Nephrolepis acutifolia (Desv.) Christ		Nephrolepidaceae	Indigenous	Herbaceous
Nephrolepis biserrata (Sw.) Schott	Fougère rivière	Nephrolepidaceae	Indigenous	Herbaceous
Obetia ficifolia (Poir.) Gaudich.	Bois d'ortie	Urticaceae	Endemic Macarenes	Tree
Pandanus heterocarpus Balf. f.	Vacoa parasol	Pandanaceae	Endemic	Tree
Pemphis acidula J.R. Forst. et G. Forst.	Bois matelot	Lythraceae	Indigenous	Bush
Phyllanthus casticum Soy.-Will.	Bois de demoiselle	Phyllanthaceae	Native	Bush
Phyllanthus dumentosus Poir.		Phyllanthaceae	Endemic	Bush
Pisonia grandis R. Br.	Bois mapou	Nyctaginaceae	Indigenous	Tree
Pittosporum balfourii Cuf.	Bois bécasse	Pittosporaceae	Endemic	Bush
Pleurostylia putamen Marais	Bois d'olive blanc	Celastraceae	Endemic	Bush
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Bois blanc	Araliaceae	Endemic	Tree
Poupartia castanea (Baker) Engl.	Bois lubine / figue marron	Anacardiaceae	Endemic	Tree
Premna serratifolia L.	Bois sureau	Lamiaceae	Native	Tree
Ramosmania rodriguesii Tirveng.		Rubiaceae	Endemic	Tree
Sarcanthemum coronopus Cass.		Asteraceae	Endemic	Bush
Cynanchum viminale (L.) R. Br.	Liane calé	Apocynaceae	Indigenous	Bush
Scolopia heterophylla (Lam.) Sleumer	Goyave marron	Salicaceae	Endemic	Tree

Scientific name	French name	Family	Status	Type
			Macarenes	
Scutia myrtina (Burm. f.) Kurz	Bois de sinte	Rhamnaceae	Indigenous	Bush
Secamone rodriguesiana F.Friedmann		Apocynaceae	Endemic	Liane
Securinega durissima J.F. Gmel.	Bois dur	Phyllanthaceae	Indigenous	Tree
Tephrosia purpurea (L.) Pers.	Lentille marronne	Fabaceae	Indigenous	Herbaceous
Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens	Bois benjoin	Combretaceae	Endemic	Tree
Thespesia populnea (L.) Sol. ex Corrêa	Sainte Marie	Malvaceae	Native	Tree
Thespesia populneoides (Roxb.) Kostel.	Porché	Malvaceae	Indigenous	Tree
Tournefortia argentea L.f.	Veloutier argenté	Boraginaceae	Indigenous	Tree
Turraea lacinata (Balf. f.) Harms	Bois balai	Meliaceae	Endemic	Tree
Vepris lanceolata (Lam.) G. Don	Patte poule	Rutaceae	Endemic Macarenes	Tree
Zanthoxylum heterophyllum (Lam.) Sm.	Bois de poivre	Rutaceae	Sub-endemic	Tree
Zanthoxylum paniculatum Balf. f.	Bois pasner	Rutaceae	Endemic	Tree
Zoysia matrella (L.) Merr.	Herbe pique-fesses	Poaceae	Indigenous	Herbaceous


Proposed Expansion of Rodrigues Airport - ESIA - Terrestrial Biodiversity Report
Ecological assessment -Ecological restauration within the limits of Anse Quitor Nature Reserve - MC02
Legend
Area of influence for terrestrial biodiversity
pre-existing buildings (current airport)
projected constructions
Anse Quitor Nature Reserve
Version : A
Date : 17/04/2023
Design : Eco-Med Océan Indien
Background : ©OSM 2023
0
250
500 m

2.3.1.6 Impact BioT-Hab-W-Def-6: Impact on riparian vegetation

2.3.1.6.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Riparian vegetation	1,1	0

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is not significant. Considering the receptor sensitivity assessed as medium, **the impact magnitude is negligible**.

2.3.1.6.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a not significant severity mitigated impact. Thus, the residual impact is of **negligible magnitude**.

2.3.1.7 Impact BioT-Hab-W-Def-7: Impact on estuarine habitat

2.3.1.7.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Estuarine habitat	8,2	0

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is not significant. Considering the receptor sensitivity assessed as medium, **the impact magnitude is negligible**.

2.3.1.7.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a not significant severity mitigated impact. Thus, the residual impact is of **negligible magnitude**.

2.3.1.8 Impact BioT-Hab-W-Def-8: Impact on calcarenic dry lawns of anthropogenic origin

2.3.1.8.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Calcarenic dry lawns of anthropogenic origin	2,2	1,5 (70%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as medium, **the impact magnitude is low.**

2.3.1.8.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.9 Impact BioT-Hab-W-Def-9: Impact on coastal grasslands dominated by secondarized thickets (Lantana camara)

2.3.1.9.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Coastal grasslands dominated by secondarized thickets (Lantana camara)	24,6	13,9 (56%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as low, **the impact magnitude is low**.

2.3.1.9.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.10 Impact BioT-Hab-W-Def-10: Impact on secondarized thickets (Leucaena leucocephala)

2.3.1.10.1 Impact before mitigation

The different areas which are concerned by the project are detailed in the table below.

Items	Area/number of specimens inside the area of influence (ha)	Area/number of specimens inside the project footprint (ha)
Secondarized thickets (Leucaena leucocephala)	23,7	11,4 (48%)

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is medium. Considering the receptor sensitivity assessed as low, **the impact magnitude is low**.

2.3.1.10.2 Mitigation measure and impact after mitigation

No measure is recommended.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.1.11 Summary

Table 32: Permanent impact during Construction – Terrestrial Biological Environment – Terrestrial Habitat

Impact ID	Impact name	Direction	Impact magnitude	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
BioT-Hab-W-Def-1	Impact on grazing lands on basaltic resurgences	Adverse	Low	None	None	Low
BioT-Hab-W-Def-2	Impact on grazing lands on calcarenic substratum	Adverse	Low	None	None	Low
BioT-Hab-W-Def-3	Impact on coastal vegetation dominated by Ipomoea pes caprae	Adverse	Low	None	None	Low
BioT-Hab-W-Def-4	Impact on anthropized areas	Adverse	Low	None	None	Low
BioT-Hab-W-Def-5	Impact on dry forest	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Negligible
				BioT-Av-2	Moving the control tower out of the nature reserve	
				BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
				BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
				BioT-Mit-5	Genetic conservation of populations of impacted rare species	
				BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity.	
				BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
BioT-Hab-W-Def-6	Impact on riparian vegetation	Adverse	Negligible	None	None	Negligible

Impact ID	Impact name	Direction	Impact magnitude	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
BioT-Hab-W-Def-7	Impact on estuarine habitat	Adverse	Negligible	None	None	Negligible
BioT-Hab-W-Def-8	Impact on calcarenic dry lawns of anthropogenic origin	Adverse	Low	None	None	Low
BioT-Hab-W-Def-9	Impact on coastal grasslands dominated by secondarized thickets (Lantana camara)	Adverse	Low	None	None	Low
BioT-Hab-W-Def-10	Impact on secondarized thickets (Leucaena leucocephala)	Adverse	Low	None	None	Low

2.3.2 Terrestrial flora

A total of 2 specimens of major sensitivity, 42 specimens of high sensitivity and 4 specimens of medium sensitivity are expected to be destroyed by the project: see table below.

Amongst low sensitivity species, one require special attention:

Eleodendron orientale: subendemic and LC (least concerned), the local population of this species in Plaine Corail is quite large and will be largely destroyed by the project (155 individuals out of 293 censored in total within the area of influence). The total population in Rodrigues is estimated at between 500 and 1000 individuals and the species is present in almost all valleys of the island along the coast.

Table 33. Number of native flora specimens destroyed by the project

Flora species	Sensitivity				Total
	Major	High	Medium	Low	
Foetidia rodriguesiana	2				2
Diospyros diversifolia		1			1
Adiantum rhizophorum		1			1
Terminalia bentzoe subsp. rodriguesensis		1			1
Pandanus heterocarpus		39			39
Nephrolepis biserrata			3		3
Phyllanthus dumentosus			1		1
Elaeodendron orientale				155	155
Total	**2**	**42**	**4**	**155**	**203**

Direct destruction of these species implies an overall impact magnitude assessed to high level.

Detailed impact sensitivity and magnitude are exposed below.

2.3.2.1 Impact BioT-Flo-W-Def-1: Impact on native species with a major sensitivity

2.3.2.1.1 Impact before mitigation

The number of specimens inside the project is detailed in the table below.

Sub items	Area/number of specimens inside the area of influence	Area/number of specimens inside the initial / final project footprint	Comments
Foetidia rodriguesiana	3	**2 / 2**	50 to 100 specimens in the wild or ex-situ collections
Hyophorbe verschaffeltii	43	**7 / 0**	Impacted specimens are known to be of domestic origin
Latania verschaffeltii	10	0 / 0	/
Polyscias rodriguesiana	7	0 / 0	/

The impact is the loss of native trees from a major sensitivity for the island of Rodrigues.

The impact severity is medium. Considering the receptor sensitivity assessed as major, **the impact magnitude is high**.

2.3.2.1.2 Mitigation measure and impact after mitigation

Avoidance measure BioT-Av-1: Avoid remarkable trees located at the edge of the project

Reduction measure BioT-Mit-3: Creating an arboretum of endemic species inside the airport landscaping

Reduction measure BioT-Mit-4: Transplant remarkable trees and ferns intended to be cut down during the works phase

Reduction measure BioT-Mit-5: Genetic conservation of populations of impacted rare species

Offset measure BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity

Offset measure BioT-Comp-7: Ecological restauration within the limits of the Anse Quitor nature reserve

All these measures are presented in the chapter 2.3.1 Terrestrial habitat.

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.2.2 Impact BioT-Flo-W-Def-2: Impact on native species with a high sensitivity

2.3.2.2.1 Impact before mitigation

The number of specimens inside the project is detailed in the table below.

Sub items	Area/number of specimens inside the area of influence	Area/number of specimens inside the initial / final project footprint	Comments
Diospyros diversifolia	1	**1 / (1)**	Has become very rare in Rodrigues. The information obtained from wildlife indicates that the number of plants remaining in Rodrigues is about 300 to 500. The main threats to them are development, grazing, low regeneration.
Terminalia bentzoe subsp. Rodriguesensis	28	**1 / (1)**	Reported to be very rare (Mauritius herbarium) but many specimens seem to have been planted around Anse Quitor. The information obtained from wildlife indicates that the number of plants remaining in Rodrigues is about less than fifty.

			The main threats to them are development, grazing, hybridization with T.b. bentzoe from Mauritius.
Antirhea bifurcata	1	**1 / 0**	Has become very rare in Rodrigues
Adiantum rhizophorum	1	**1 / 1**	Ferns locally protected
Sarcanthemum coronopus	37	**1 / 0**	/
Phyllanthus dumentosus	2	**1 / 1**	It has become very rare. The information obtained from wildlife indicates that the species is locally common (> 1000 plants). The main threat to them is the development of Port Mathurin.
Mathurina penduliflora	5	**0 / 0**	/
Pleurostylia putamen	17	**0 / 0**	/
Pandanus heterocarpus	69	**25 / 39**	/
Zanthoxylum paniculatum	1	0	/
Clerodendrum laciniatum	3	0	/
Fernelia buxifolia	2	**1 / 0**	/

The impact is the loss of native trees of a high sensitivity for the island of Rodrigues.

The impact severity is high. Considering the receptor sensitivity assessed as high, **the impact magnitude is high**.

2.3.2.2.2 Mitigation measure and impact after mitigation

Avoidance measure BioT-Av-1: Avoid remarkable trees located at the edge of the project

Avoidance measure BioT-Av-2: Moving the control tower out of the nature reserve

Reduction measure BioT-Mit-3: Creating an arboretum of endemic species inside the airport landscaping

Reduction measure BioT-Mit-4: Transplant remarkable trees and ferns intended to be cut down during the works phase

Reduction measure BioT-Mit-5: Genetic conservation of populations of impacted rare species

Offset measure BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity

Offset measure BioT-Comp-7: Ecological restauration within the limits of the Anse Quitor nature reserve

All these measures are presented in the chapter 2.3.1 Terrestrial habitat.

The proposed measures result in a high severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.2.3 Impact BioT-Flo-W-Def-3: Impact on native species with a medium sensitivity

2.3.2.3.1 Impact before mitigation

The species and the number of specimens inside the project are detailed in the table below.

Sub items	Area/number of specimens inside the area of influence	Area/number of specimens inside the initial / final project footprint	Comments
Phyllanthus dumentosus	2	1 / 1	It has become very rare. The information obtained from wildlife indicates that the species is locally common (> 1000 plants). The main threat to them is the development of Port Mathurin
Camptocarpus sphenophyllus	-	-	/
Secamone rodriguesiana	2	-	/
Nephrolepis biserrata	5*	1 / 3*	Ferns locally protected
Phymatosorus scolopendria	2*	1 / 1*	Ferns locally protected

*refers to non-exhaustive counts

The impact is the loss of native trees of a medium sensitivity for the island of Rodrigues.

The impact severity is high. Considering the receptor sensitivity assessed as medium, **the impact magnitude is medium**.

2.3.2.3.2 Mitigation measure and impact after mitigation

Avoidance measure BioT-Av-1: Avoid remarkable trees located at the edge of the project

Avoidance measure BioT-Av-2: Moving the control tower out of the nature reserve

Reduction measure BioT-Mit-3: Creating an arboretum of endemic species inside the airport landscaping

Reduction measure BioT-Mit-4: Transplant remarkable trees and ferns intended to be cut down during the works phase

Reduction measure BioT-Mit-5: Genetic conservation of populations of impacted rare species

Offset measure BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity

Offset measure BioT-Comp-7: Ecological restauration within the limits of the Anse Quitor nature reserve

All these measures are presented in the chapter 2.3.1 Terrestrial habitat.

The proposed measures result in a high severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.2.4 Impact BioT-Flo-W-Def-4: Impact on native species with a low sensitivity

2.3.2.4.1 Impact before mitigation

The species and the number of specimens inside the project are detailed in the table below.

Items	Sub items	Area/number of specimens inside the area of influence	Area/number of specimens inside the project footprint	Comments
Plant species of low sensitivity: 8 species (in red, species expected to be impacted by the project)	*Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Premna serratifolia, Thespesia populnea, Cynanchum viminale*	293*	155*	Some of these species will be massively destroyed by the project and are locally protected (Eleodendron orientale). For Elaeodendron orientale, the information obtained from wildlife indicates that the number of plants remaining in Rodrigues is about 500 to 1000. They are present in almost all valleys of the island along the coast. The main threat to them is development.

*refers to non-exhaustive counts

The impact is the loss of native trees of a low sensitivity for the island of Rodrigues.

The impact severity is high. Considering the receptor sensitivity assessed as low, **the impact magnitude is low**.

2.3.2.4.2 Mitigation measure and impact after mitigation

Avoidance measure BioT-Av-1: Avoid remarkable trees located at the edge of the project

Avoidance measure BioT-Av-2: Moving the control tower out of the nature reserve

Reduction measure BioT-Mit-3: Creating an arboretum of endemic species inside the airport landscaping

Reduction measure BioT-Mit-4: Transplant remarkable trees and ferns intended to be cut down during the works phase

Reduction measure BioT-Mit-5: Genetic conservation of populations of impacted rare species

Offset measure BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity

Offset measure BioT-Comp-7: Ecological restauration within the limits of the Anse Quitor nature reserve

All these measures are presented in the chapter 2.3.1 Terrestrial habitat.

The proposed measures result in a high severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.2.5 Summary

Table 34: Permanent impact during Construction – Terrestrial Biological Environment - Terrestrial Flora

Impact ID	Impact name	Direction	Impact magnitude mitigation	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
BioT-Flo-W-Def-1	Impact on native species with a major sensitivity	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
				BioT-Av-2	Moving the control tower out of the nature reserve	
				BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
				BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
				BioT-Mit-5	Genetic conservation of populations of impacted rare species	
				BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
				BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
BioT-Flo-W-Def-2	Impact on native species with a high sensitivity	Adverse	High	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
				BioT-Av-2	Moving the control tower out of the nature reserve	
				BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
				BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
				BioT-Mit-5	Genetic conservation of populations of impacted rare species	
				BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
				BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
BioT-Flo-W-Def-3	Impact on native species with a medium sensitivity	Adverse	Medium	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
				BioT-Av-2	Moving the control tower out of the nature reserve	
				BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	

Impact ID	Impact name	Direction	Impact magnitude mitigation	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
				BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
				BioT-Mit-5	Genetic conservation of populations of impacted rare species	
				BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
				BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	
BioT-Flo-W-Def-4	Impact on native species with a low sensitivity	Adverse	Low	BioT-Av-1	Avoid remarkable trees located at the edge of the project	Low
				BioT-Av-2	Moving the control tower out of the nature reserve	
				BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	
				BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	
				BioT-Mit-5	Genetic conservation of populations of impacted rare species	
				BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	
				BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	

2.3.3 Terrestrial fauna

Loss of the vegetation cover from the site will result in the loss of habitat for a range of species and will reduce the ecosystem services provided. Ecosystem services particularly affected will be retention of soil, sediment control, water retention and gradual release.

Based on qualitative field observations completed during the field campaigns, the area within the proposed airstrip extension appears unlikely to support ecologically significant Rodrigues bird and reptile species. It is likely that isolated indigenous faunal species (e.g. *Lygodactylus lugubris*) do exist within the limits of the project footprint; however, the presence of these individuals in numbers that would be considered a viable community is considered unlikely. Species such as *Tropidophora ssp*. are widely present in the area of influence and the "endangered" status of *Tropidophora articulata* makes it a particularly sensitive point here. The impacts of the destruction of individuals of these 2 species could be important without mitigation measures.

The impact sensitivity and magnitude are exposed below.

The overall impact magnitude on native fauna loss is assessed at medium level.

2.3.3.1 Impact BioT-Fau-W-Def-1: Impact on *Pteropus rodricensis (Chiroptera)*

2.3.3.1.1 Impact before mitigation

For this species, the number of specimens inside the area of influence is higher than 10, and the number of specimens inside the project footprint is considered 0.

The dry forest sectors favourable to *Pteropus rodricensis* around the area of influence cover an area of about 17 ha but will not be challenged by the project.

The impact is the loss of semi-natural vegetation and some ecosystem functions.

Regarding the risk of collision with aircraft, moving the runway further south takes it away from the reserve and reduces the risk.

The impact severity is low. Considering the receptor sensitivity assessed as high, **the impact magnitude is low**.

2.3.3.1.2 Mitigation measure and impact after mitigation

No measure is necessary.

The proposed measures result in a low severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.3.2 Impact BioT-Fau-W-Def-2: Impact on Tropidophora ssp & Omphalotropis ssp (Gastropoda)

2.3.3.2.1 Impact before mitigation

For this species, the number of specimens inside the area of influence is relatively small and subservient to the Reserve (considered as null inside the project footprint). The impact could be the loss of native gasteropoda individuals and their foraging habitat. However, only empty shellswere found on the project footprint.

The impact severity is low. Considering the receptor sensitivity assessed as major, **the impact magnitude is medium**.

2.3.3.2.2 Mitigation measure and impact after mitigation

Reduction measure BioT-Mit-8: Collect molluscs from the T*ropiphodora* & *Omphalotropis* genus before and during earthwork

This measure consists in collecting living individuals of *Tropiphodora & Omphalotropis* within the project footprint boundaries.

As a precaution, given the issue, several campaigns will be conducted before the works phase and during earthwork. Sampling planning will allow the entire project area to be visited in an equivalent manner. If species are more abundant in some areas, these areas will be collected more thoroughly.

Implementation conditions / Points of vigilance: Learn how to distinguish the different species recorded on site.

The responsible person or structure for this measure could be the contractor or ARL, and the potential partners: Vincent Florens (Department of Biosciences, University of Mauritius, Réduit, Mauritius).

The proposed measures result in a medium severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.3.3 Impact BioT-Fau-W-Def-3: Impact on *Lygodactylus lugubris (Reptilia)*

2.3.3.3.1 Impact before mitigation

For this species, the number of specimens inside the area of influence or inside the project footprint is unknown (at least 3).

Figure 38: Isolated Lygodactylus lugubris on a Latania vershaffeltii near the airport

The impact is the loss of semi-natural vegetation and some ecosystem functions.

The impact severity is low. Considering the receptor sensitivity assessed as low, **the impact magnitude is low**.

2.3.3.3.2 Mitigation measure and impact after mitigation

No measure is necessary.

The proposed measures result in a low severity mitigated impact. Thus, the residual impact is of **low magnitude**.

2.3.3.4 Summary

Table 35: Permanent impact during Construction – Terrestrial Biological Environment - Terrestrial Fauna

Impact ID	Impact name	Direction	Impact magnitude mitigation	Measure ID	Avoidance / Mitigation / Compensation / Improvement Measures	Residual / improved impact magnitude
BioT-Fau-W-Def-1	Impact on *Pteropus rodricensis (Chiroptera)*	Adverse	Low	None	None	Low
BioT-Fau-W-Def-2	Impact on Tropidophora ssp & Omphalotropis ssp (Gastropoda)	Adverse	Medium	BioT-Mit-8	Collect molluscs from the Tropiphodora & Omphalotropis genus before and during earthwork	Low
BioT-Fau-W-Def-3	Impact on *Lygodactylus lugubris (Reptilia)*	Adverse	Low	None	None	Low

2.4 Impacts during operation phase

The project aims to enable Rodrigues Island to develop tourism and aerial cargo. Tourism development might have significant impacts on th environment.

However, this ESIA only aims to address the impacts of the infrastructure. Thus, the sio-cio-economic development and changes that could be expected due to te air access improvement are not part of this ESIA scope.

Impacts of the airport extension on tourism and socio-economics on an island scale are addressed in other studies carried out under RRA's control.

2.4.1 Terrestrial biodiversity

None.

3 Preliminary Terrestrial Biodiversity Management Plan for the construction phase

The following chapters (3.1, 3.2) aim to summarize and guide to implement the terrestrial biologic environmental measures associated to the construction phase. Some measures don't directly address the works nor the operation phase but must be implemented as soon as possible, upstream of the works: these are the compensation measures and the more global measures accompanying the project, and they are also covered in this part.

The measures' descriptions should be read in section 2 as this chapter doesn't provide an exhaustive description of all measures.

The first paragraph is a table listing all the commitment and measures and indicating for each one:

- when and by whom it should be initiated and carried out,
- how it should be monitored,
- and which are the indicators of success, as well as the corrective measures to be taken if the performance objectives are not met.

The second paragraph is intended to guide stakeholders in the implementation of these measures monitoring, indicating which operational plans and procedures should be established to implement and monitor the measures, and the guidelines for the preparation of these plans.

The first paragraph refers to the plan that ensures each measure implementation. The second paragraph recalls for each plan which measures it addresses.

As part of the final ESIA, an Environmental and Social Management Plan will be developed in accordance with the World Bank ESS1. An ESMP is an instrument that details (a) the measures to be taken during the implementation and operation of a project (in this case closure) to eliminate or offset adverse environmental and social impacts, or to reduce them to acceptable levels; and (b) the actions needed to implement these measures. The ESMP will include requirements for mitigation, monitoring, capacity development and training, implementation schedule and cost estimates, as well as integration with the Project.

3.1 Terrestrial Biodiversity Management Plan for the construction phase

Table 36: Terrestrial Biodiversity Management Plan for the construction phase

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
Biodiversity	BioT-Av-1	Avoid remarkable trees located at the edge of the project Targeted species*: Antirhea bifurcata , Elaeodendron orientale, Fernelia buxifolia, Hyophorbe verschaffeltii, Terminalia bentzoe subsp. rodriguesensis*	This measure consists in avoiding the destruction of remarkable trees located at the boundaries of the project footprint by locally adapting the project boundaries. A total of 19 trees could be easily avoided.	Works phase Before the work begins. **Biodiversity management and monitoring plan**	These 19 trees must be marked prior to the works phase with permanent devices (fences, ribbons, paintings..) and tagged with an identification number (ID) in order to be properly followed during the works phase	Number of trees left after the works phase (out of the 19)	Reinforcing measure BioT-Mit-3	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Fondation, Forestry Services
	BioT-Av-2	Moving the control tower out of the nature reserve	This measure consists in avoiding the destruction of approximately 1 hectare of the buffer area of the Anse Quitor nature reserve. This measure allows to save 6 specimens of the following species: Elaeodendron orientale, Sarcanthemum coronopus, Terminalia bentzoe subsp. rodriguesensis	This measure must be anticipated in the project design **Biodiversity management and monitoring plan**	The official boundaries of the nature reserve will be provided by the forestry services	- Surface area left inside the Anse Quitor nature reserve (objective: 0) - Project design with a repositioning of the control tower	Reinforcing measure BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Fondation, Forestry Services for the official limits of the nature reserve
	BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	This measure consists in planting 80 specimens of rare and endangered endemic species within the airport limits after the extension airstrip project. This aims to protect, preserve and create an arboretum of endemic seeds that will be used afterwards to produce endemic plants for nature reserves in Rodrigues.	Works phase This measure must be implemented way before the works phase, in particular as regards with the collection of plant material from specimens outside the project area. **Biodiversity management and monitoring plan**	A partnership with the Forestry Services or the Mauritius Wildlife Foundation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the nature reserves of Rodrigues and/or Mauritius. Collection of plant material will be authorized in advance by the reserve managers in any case. A specific protocol will be designed for tree transplantation.	- number of plants produced (objective : 100) - number of species planted	Reinforcing measure BioT-Comp-7	External biodiversity specialists / Contractor Under ARL's control Potential partners : Wildlife Fondation, Forestry Services
	BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	This measure consists in transplanting all or part of the remarkable trees and ferns intended to be destroyed by the project: in priority, Diospyros, Terminalia, Foetidia, Antirhea, Nephrolepis	Works phase Before and or during works phase (machines will be available during the works phase which optimizes costs) **Biodiversity management and monitoring plan**	A competent and trained external coordinator on the transplantation protocol will be mobilized	- number of trees transplanted - number of trees transplanted which survive the 1st, 2nd, 3rd, 4th and 5th year after transplantation	Reinforcing measures BioT-Mit-3, BioT-Mit-5, BioT-Comp-6	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Fondation, Forestry Services

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
	BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	In response to the destruction of several rare species specimens, this measure consists in ensuring the production and reintroduction of clones and genetic ancestors of these species in order to preserve their genetic lineage in the long term. A total of 14 to 35 specimens will be produced, depending on the results obtained by vegetative and sexual propagation.	This measure must be implemented way before the works phase, in particular as regards with the collection of plant material from specimens intended for destruction inside the project footprint. Several campaigns have to be scheduled in order to target the right periods of fruiting **Biodiversity management and monitoring plan**	A partnership with the Forestry Services or the Mauritius Wildlife Foundation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the specimens located within the project footprint.	- number of plants produced (objective : 35) - number of species planted	Reinforcing measures BioT-Mit-3, BioT-Mit-4	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners : Wildlife Fondation, Forestry Services
	BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity	This measure consists in initiating a new approach for the management of extensive agriculture on the island of Rodrigues by proposing a turnkey operational action plan.	Planning over 24 months will allow satisfactory consultation times for the implementation of the action plan in the short term **Biodiversity management and monitoring plan**	This action plan can be approached by: 1- the inventory and consultation of all agricultural and ecologist partners throughout the project; 2- the establishment of the development challenges of livestock breeding in Rodrigues; 3- drawing up an inventory of actions that can improve the quality and productivity of livestock farming by promoting local biodiversity; 4- proposing a fine cartographic work accompanied by spatialized actions throughout the territory of Rodrigues.	- Obtaining an action plan validated by the regional assembly in 2022	Reinforcing measure BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners: Wildlife Fondation, Agricultural and Forestry Services, Regional Assemblee…

Theme / Issue	Title and ID of the measure		Complementary description	Period of performance / Corresponding plan	Performance monitoring system	Performance indicators	Corrective measures	Responsible managers for implementation
	BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	This measure consists in: • Rebuilding the fence around the Anse Quitor nature reserve, with one that would be similar to the fence around the airport in order to discourage grazing livestock inside the reserve. This measure is a short-term response to the grazing vs. biodiversity issue that has to be solved with the offset measure (BioT-Comp-6: Action plan towards more sustainable agricultural practices for native biodiversity). • Reinforcing native species populations by planting 500 native plant specimens within the Anse Quitor nature reserve buffer area, located besides the future airport boundaries (see map below).	Harvesting (seeds, cuttings) and production must take place well before the works phase as well as the fencing work **Biodiversity management and monitoring plan**	- Check the watering quality of the plants; - Identify, locate and count exotic species and define appropriate control methods against invasive and potentially invasive exotic species; - Quantify the mortality rate and health status of native species. - Establish corrective measures if necessary, in order to always orientate this rehabilitation project in an ecologically correct direction.	- Number of plants planted - Mortality rate (total/species) - Number of placettes - Number of linear metres of fence	Reinforcing measures BioT-Mit-3, BioT-Mit-4	External biodiversity specialists / RRA services Under RRA and ARL's control Potential partners: Wildlife Fondation, Forestry Services
	BioT-Mit-8	Collect arthropods from the Tropiphodora & Omphalotropis genus before and during earthwork	This measure consists in collecting living individuals of Tropiphodora within the project footprint boundaries. Several campaigns will be conducted before the works phase and during earthwork. Sampling planning will allow the entire project area to be visited in an equivalent manner. If species are more abundant in some areas, these areas will be collected more thoroughly.	Works phase This measure must be implemented before and during the earthwork phase. Several campaigns have to be scheduled. **Biodiversity management and monitoring plan**	Learn how to distinguish the two different species recorded on site	- number of living specimens collected - number of species collected - number of survey campaigns	None	External biodiversity specialists / Contractor Under ARL's control Potential partners: Vincent Florens (Department of Biosciences, University of Mauritius, Réduit, Mauritius)

3.2 Terrestrial Biodiversity Management Plans to be implemented for the construction phase

3.2.1 Avoidance and Offset measures

“BioT-Av-1” and “BioT-Av-2” are avoidance measures and must be implemented from the detailed design under ARL’s control.

“BioT-Mit-4 and 5” are referred to as a mitigation measure because of its low chance of success. However they should be managed as offset measures: from prior to the works under biodiversity specialists management, within the context of specific contracts and under ARL and RRA’s control.

“BioT-Comp-6” is an offset measure to be carried out by the Rodrigues authorities throughout the island.

“BioT-Comp-7” is an offset measure to be carried out by biodiversity specialists under ARL and RRA’s control.

Details of these measures are provided in section 2. Implementation managers, performance indicators and monitoring systems are described in the previous paragraph (3.1) and should be implemented under the control of ARL and RRA.

ARL should provide and implement:

- ✓ a management plan to follow the implementation of measures to be implemented before the works phase (BioT-Av-1 and 2 / BioT-Mit-4 and 5),
- ✓ a management plan to follow the measures to be carried out by RRA on an island scale (BioT-Comp-6 / BioT-Comp-7).

3.2.2 Mitigation measures

“BioT-Mit-3 and 8” are mitigation measures to be carried out from the beginning of works, under biodiversity specialist management, within the context of specific contracts and under ARL and RRA’s control.

The measures’ descriptions should be read in section 2 as this chapter doesn’t provide an exhaustive description of all measures.

ARL should provide and implement a management plan to manage and follow the implementation of these measures BioT-Mit-3 and 8.

3.3 Summary of plans to be drawn up for terrestrial biodiversity management during the construction phase

Table 37: Summary of Required ESMP– Terrestrial Biodiversity Plans - Construction Phase

Plan	Measures that the plan must allow to implement and monitor	Person in charge of implementation and control	Activity / Procedures to include
Biodiversity management and monitoring plan	BioT-Av-1 and 2 BioT-Mit-4 and 5 BioT-Comp-6 BioT-Comp-7	External biodiversity specialists / RRA services Under RRA and ARL's control	- A management plan to follow the implementation of measures to be implemented before the works phase (BioT-Av-1 and 2 / BioT-Mit-4 and 5) - A management plan to follow the measures to be carried out by RRA on an island scale (BioT-Comp-6 / BioT-Comp-7)
	BioT-Mit-3 and 8	External biodiversity specialists / Contractor Under ARL's control	- A management plan to manage and follow the implementation of measures BioT-Mit-3 and 8.

4 Estimated costs of the Terrestrial Biodiversity management

4.1 Terrestrial Biodiversity measures costs

The following table presents a cost estimate of the various terrestrial biodiversity measures and management and monitoring plans previously presented.

Those costs are not to be considered as a project commitment, they are just indicative and will have to be revised afterwards.

Geotechnical measures are not estimated here as they will have to be sized and included within the work cost.

4.1.1 Construction phase

Table 38: ESMP Cost Estimate Construction Phase – Terrestrial Biodiversity Aspects

Theme / Issue	Title and ID of the measure / Plan		Implementation	Responsible for management and implementation	Estimated costs (EUR)	Comments
Biodiversity	BioT-Av-1	Avoid remarkable trees located at the edge of the project Targeted species*: Antirhea bifurcata, Elaeodendron orientale, Fernelia buxifolia, Hyophorbe verschaffeltii, Terminalia bentzoe subsp. rodriguesensis*	These 19 trees must be marked prior to the works phase with permanent devices (fences, ribbons, paintings) and tagged with an identification number (ID) in order to be properly followed during the works phase	External biodiversity specialists / RRA services Under RRA and ARL's control	4 500 €	- Tree marking and identification 2500,00 - Monitoring for 5 years 2000,00
	BioT-Av-2	Moving the control tower out of the nature reserve	The official boundaries of the nature reserve will be provided by the forestry services	External biodiversity specialists / RRA services Under RRA and ARL's control	None	
	BioT-Mit-3	Creating an arboretum of endemic species inside the airport landscaping	A partnership with the Forestry Services or the Mauritius Wildlife Fondation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the nature reserves of Rodrigues and/or Mauritius. Collection of plant material will be authorized in advance by the reserve managers in any case. A specific protocol will be designed for tree transplantation.	External biodiversity specialists / Contractor Under ARL's control	12 500€	- Collection of plant material (seeds, cuttings..) 2500,00 - Nursing (production of plants) 4000,00 - Planting 4000,00 - Monitoring for 5 years 2000,00

Theme / Issue	Title and ID of the measure / Plan		Implementation	Responsible for management and implementation	Estimated costs (EUR)	Comments
	BioT-Mit-4	Transplant remarkable trees and ferns intended to be cut down during the works phase	A competent and trained external coordinator on the transplantation protocol will be mobilized	External biodiversity specialists / RRA services Under RRA and ARL's control	25 000€	For 20 trees: 20 x 2,500€
	BioT-Mit-5	Genetic conservation of populations of impacted rare species : production and reintroduction of clones and genetic ancestors of these species	A partnership with the Forestry Services or the Mauritius Wildlife Fondation will be conducted in order to produce seedlings of native species from seeds, cuttings or juveniles collected from the specimen located within the project footprint.	External biodiversity specialists / RRA services Under RRA and ARL's control	11 000€	- Collection of plant material (seeds, cuttings..) 3 000,00 - Nursing (production of plants) 3 000,00 - Planting 2 000,00 - Monitoring for 5 years 3 000,00
	BioT-Comp-6	Action plan towards more sustainable agricultural practices for native biodiversity.	This action plan can be approached by: 1- the inventory and consultation of all agricultural and ecologist partners throughout the project; 2- the establishment of the development challenges of livestock breeding in Rodrigues; 3- drawing up an inventory of actions that can improve the quality and productivity of livestock farming by promoting local biodiversity; 4- proposing a fine cartographic work accompanied by spatialized actions throughout the Rodrigues territory	External biodiversity specialists / RRA services Under RRA and ARL's control	Approximately 35 000€	

Theme / Issue	Title and ID of the measure / Plan		Implementation	Responsible for management and implementation	Estimated costs (EUR)	Comments
	BioT-Comp-7	Ecological restauration within the limits of the Anse Quitor nature reserve	- Check the watering quality of the plants; - Identify, locate and count exotic species and define appropriate control methods against invasive and potentially invasive exotic species; - Quantify the mortality rate and health status of native species. - Establish corrective measures if necessary, in order to always orientate this rehabilitation project in an ecologically correct direction.	External biodiversity specialists / RRA services Under RRA and ARL's control	100 000€	- Harvesting from wild specimens and arboretums 3000,00 - Production of 500 individuals 10000,00 - Planting 4000,00 - New fence within the shared limits between the airport and the nature reserve (1,2 km approximately): 80 000,00
	BioT-Mit-8	Collect arthropods from the Tropiphodora & Omphalotropis genus before and during earthwork	Learn how to distinguish the two different species recorded on site	External biodiversity specialists / Contractor Under ARL's control	Approximately 10 days of sampling effort at 500€ per day 5 000€	
	Biodiversity management and monitoring plan		The only costs non included in the above lines is ARL's management	-	-	Included in conception costs

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Airport of Rodrigues Ltd

Proposed Expansion of Rodrigues Airport

Marine Biodiversity Factual Report for the purpose of the Environmental and Social Impact Assessment Report

Report Reference – 09053999

Prepared by

setec (Mauritius) Ltd

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MAREX
Expertise & conseil en environnement marin

18 May 2023

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0 Non-Technical Executive Summary

0.1 Introduction

Plaine Corail Airport in Rodrigues Island is managed by Airport of Rodrigues Ltd. (ARL), a subsidiary of the Airports of Mauritius Co. Ltd. (AML).

An Environmental and Social Impact Assessment for the New runway at Plaine Corail Airport in Rodrigues Island was prepared in 2019 to meet the requirements of the Government of Mauritius and those of the Agence Française de Développement (AFD) and the European Union (EU).

In this context a factual baseline study was undertaken in 2019.

Airport of Rodrigues Ltd is now proposing to seek financing support from the World Bank for the proposed expansion of the Rodrigues Airport, and is therefore required to update the ESIA to meet the requirements of the World Bank Environmental and Social Framework (ESF).

The present factual study report is the final report based on the one prepared in 2019 and updated with data acquired in April 2023.

0.2 Baseline conditions

Based on the latest biodiversity inventories and the assessment of the ecological sensitivity of the habitats, it appears that, among the habitats subject to the effects of the project, only the fringing reefs dominated by *Acropora muricata* present a significant overall ecological sensitivity. Sea turtles, which are not restricted to a specific habitat but which move according to their basic needs (food, rest, reproduction) seem to like a beach as a nesting site on Crabs Island, less than 500m from the future airstrip.

Fringing reefs and sea turtles will therefore have to be the subject of special precautions during the construction phase as well as during the operation of the airport, in particular against the turbid plume and the sound and light pollutions. In this sense, several avoidance and reduction measures are proposed in order to guide the project owner in his research of the project with the least environmental impact.

At the end of the environmental impact study and after the proposition of avoidance and reduction measures, compensation measures are proposed on the watersheds of Topaz Bay in order to limit the phenomena of erosion, at the origin of a progressive degradation of the quality of water (turbidity) and sediment (siltation) of the study site, causing chronic degradation of the fringing reefs, regardless of the airstrip project.

0.2.1 Marine Biodiversity

The biodiversity inventories were carried out in immersion (snorkeling or diving) during the investigation campaign of April 2023 (MAREX, 2023). A total of 261 species were identified, for an estimated total sampling time of 14 hours, carried out by 3 experts immersed simultaneously at 86 stations of which 78 (91%) were composed of soft substrates at more than 80% (muddy to coarse rubbles).

The species were distributed as follows within the different taxa:

- 149 species of fish (including 16 new records for Rodrigues)
- 50 species of hard corals (scleractinia and millepores)
- 34 species of macroinvertebrates (crustaceans, echinoderms, molluscs, flatworms)
- 26 species of macroalgae (including 1 new record for Rodrigues)
- 2 species of marine phanerogams.

Among all the species listed, only one species of fish and one species of coral have a protection status in local regulations:

- *Stegastes limbatus*: The Fisheries and Marine Resources Act, 2007
- *Acropora muricata* (formerly *Acropora Formosa*): The Fisheries and Marine Resources Act, 2007 and The environment protection Act, 2002

In addition, 15 species of coral (see appendix 1), 2 species of fish (*Carcharhinus amblyrhynchos* and *Taeniura meyeni*) and 1 species of sea cucumber (*Holothuria nobilis*) are classified NT, VU or EN on the IUCN Red list. All species of corals, *Holothuria nobilis* and *Tridacna maxima* are also listed in Appendix II of CITES.

0.2.2 Final ESIA

As part of the update of the ESIA and following the recommendations of the World Bank, this study provides an update of the study of marine fauna and flora, including turtles and marine mammals. It provides a detailed mapping of habitats, both in terms of area and associated biodiversity, covering an area of 51km^2 including Topaz Bay and the islands of Crabs, Frigates and Destiny.

The option of a coral transplant of the colonies of *Acropora muricata* from the fringing reef of Pointe Mapou, threatened by the project, was ruled out because:

- the degraded state of health of the colonies concerned,
- the absence of a potential host site with both available sublittoral rocky substrates and hydrological conditions favorable to coral development.

These prohibitive conditions directed the project team towards compensatory measures localized on the southern watersheds of Rodrigues Island (revegetation of riparian forests and the coasts of Topaz Bay), intended to mitigate the chronic effects of soil erosion, causing a gradual deterioration in the quality of water and sediments. These measures may be integrated into a marine biodiversity management plan during implementation.

1 Introduction

The Project refers to the New runway at Plaine Corail Airport in Rodrigues island, a dependency of the Republic of Mauritius.

With a runway length of 1200 m, the largest aircraft that it can accommodate currently is the ATR 72, which carries passengers only. The number of flights at PCA amounts to three per day during the low season and can rise to a maximum of twelve flights during the peak season which coincides with the Christmas and New Year holidays.

The airport is managed by Airport of Rodrigues Ltd. (ARL), a subsidiary of the Airports of Mauritius Co. Ltd. (AML).

Due to its remote location, 620 kilometres from Mauritius, air transport is vital to the island in every respect and particularly important from a social and economic perspective. Rodrigues Island, through the Rodrigues Regional Assembly, wishes to increase the capacity of its airport in order to accommodate the A321 Neo / B737 aircraft type, which carries up to a maximum of 244 passengers and is capable of transporting cargo.

The objectives of the construction of the new longer runway as well as the associated facilities and amenities, are to:

- provide Rodrigues with an efficient, reliable, safe and affordable air transport facility to improve the national, regional and international connectivity and accessibility of the island and;
- contribute to its social and economic development in key economic sectors such as tourism, agriculture, and fishery.

The initial Environmental and Social Impact Assessment report 2019 had two objectives:

- Compliance to the procedure for obtaining the EIA Licence from the Government of Mauritius
- Evaluation of the environmental and social impacts of the project in line with the requirements of the two Funding Agencies: Agence Française de Développement (AFD) and the European Union (EU).

Airport of Rodrigues Ltd is now proposing to seek financing support from the World Bank for the proposed expansion of the Rodrigues Airport, and is therefore required to update the ESIA 2019 to meet the requirements of the World Bank Environmental and Social Framework (ESF).

This factual report is based on the results acquired during a new sampling campaign, carried out in April 2023 in the study area in Rodrigues. This study completes, via a study of the impacts of the project on marine biocenoses, the previous version of the report.

2 Legal and institutional framework applicable to Marine Biodiversity

2.1 Marine biological context

2.1.1 Regulatory context

For the Republic of Mauritius, various regulatory texts define the modalities of protection and/or harvesting for marine fauna and flora. For marine environments, the fauna and flora are protected by the following texts:

- The Environment Protection Act 2002,
- The Fisheries and Marine Resources Act 2007,
- Maritime Zone Act 2005,
- For these texts, provisions specify the habitats or species protected or regulated.

2.1.2 Management responses and marine protected area

The Government of Mauritius and the Rodrigues Regional Assembly have implemented various measures in recognition of the need to protect coastal and marine biodiversity such as declaring Fishing Reserves where throwing net fishing is prohibited (Fisheries Act 75 of 1984). In Rodrigues, 5 areas were created: Pointe Venus to Pointe la Gueule, Pointe la Gueule to Pointe Manioc, Baie Topaze, Anse Quitor and Grande Passe.

There are also four Marine Reserves: Grand Bassin (14.1km²), Passe Demi (7.2km²), Passe Cabri (1.5km²) and Rivière Banane (1.5km²); and one multiple-use Marine Protected Area, the newest South-East Marine Protected Area (SEMPA). SEMPA is a multiple use MPA covering a total area of 43km² including Anse Quitor and Grande Passe.

The marine environment of Rodrigues is protected by the Fisheries and Marine Resources Act signed in 2007. Several marine areas are protected as fishing and marine reserves.

Six fishing reserves have been established in the lagoon:

- Pointe Vénus,
- Pointe la Gueule,
- Pointe Manioc,
- Baie Topaze,
- Anse Quitor,
- Grande Passe.

These areas cover an area of 6km². Their aim is to preserve the environment but also to perpetuate the artisanal fishing activity. These reserves regulate fisheries by controlling the size of fishing nets and the period of activity, and by prohibiting certain practices such as seining.

There are also five marine reserves in Rodrigues:

- Four little areas in the north of the island: Riviere Banane, Anse aux Anglais, Grand Bassin and Passe Demi,
- A large area in the south called South East Marine Protected Area (SEMPA).

SEMPA covers the entire southern coast of the island and the lagoon. It covers an area of 42.5km². Under the responsibility of the Rodrigues Regional Assembly, SEMPA is administered in a community way by a Management Committee that brings together the RRA administration, NGOs, partners (Shoals, MRC, Terre Mer Rodrigues), fishermen, tourism stakeholders and users.

The project is located between the Topaz Bay Fishing Reserve and the South East Marine Protected Area. It is not included in any marine protected area.

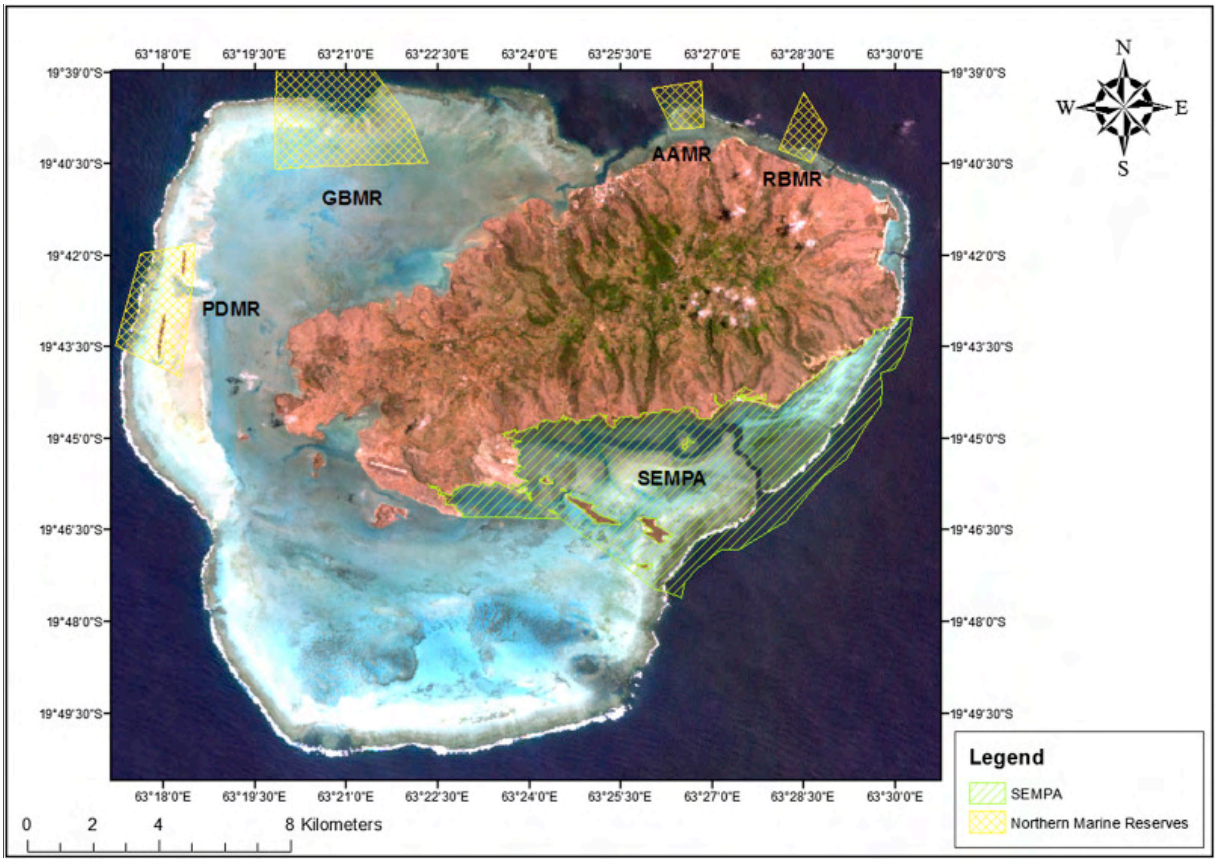


Figure 1: Marine reserves in Rodrigues (Pasnin et al., 2016)

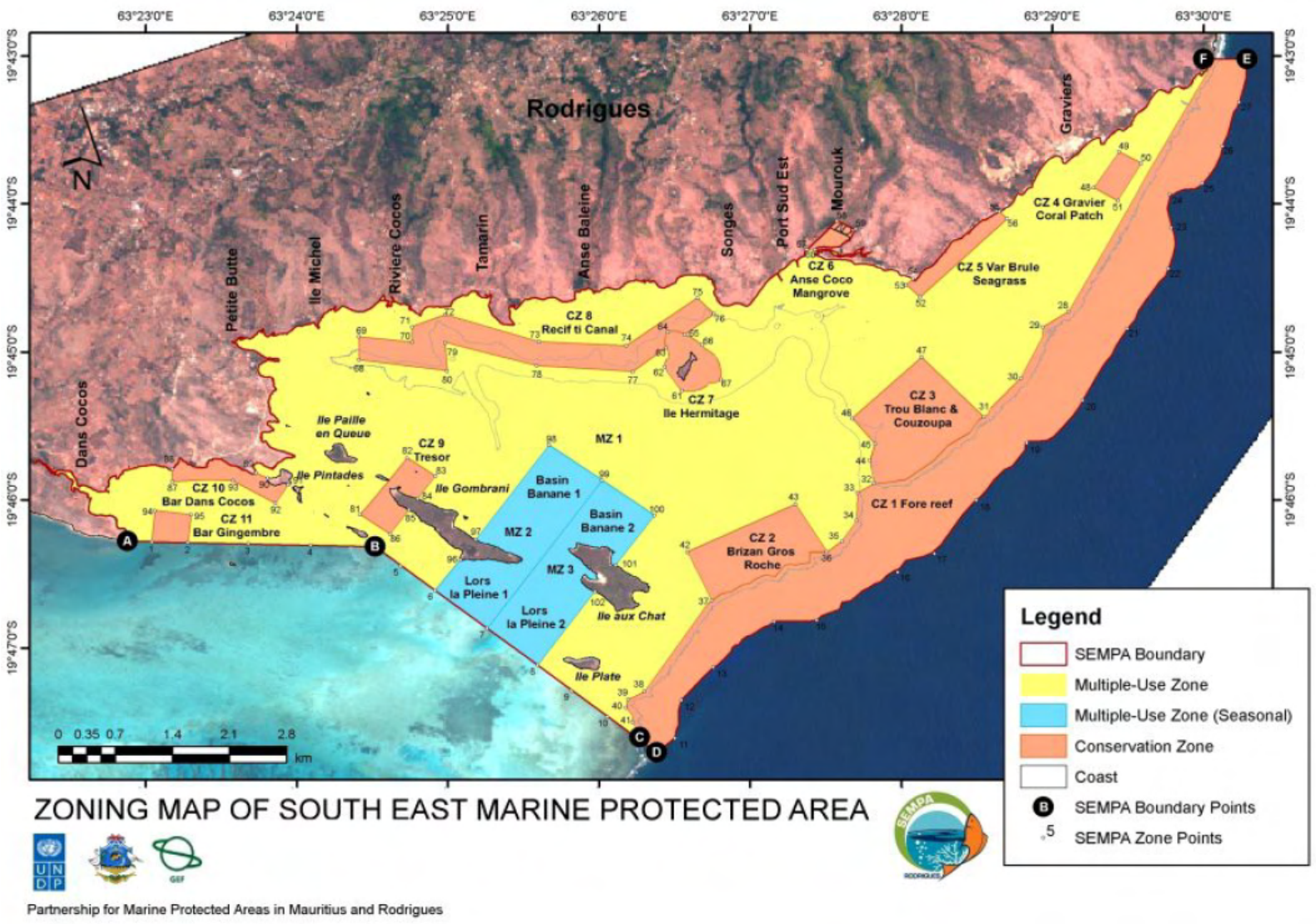


Figure 2: Perimeter of Southeast Marine Protected Area (Robert, 2014)

3 Baseline conditions

3.1 Marine ecological issues of Rodrigues Island

Rodrigues Island is surrounded by a fringing reef that encloses a shallow lagoon and extends up to 5 km offshore, it is described as the most developed reef in the Mascarene Islands (Klaus *et al.,* 2016). However, the island is isolated and located upstream of other major reefs in the Western Indian Ocean, making the coral reefs of Rodrigues Island vulnerable to disturbance (Klaus *et al.*, 2016).

According to Duvat (2015), the effects of climate change on the marine environment of the small islands of the southwest Indian Ocean are characterized by:

- An accentuation of beach erosion (retreat of the coastline).
- A silting up or a displacement of the mangroves.
- A reduction in phanerogam meadows.
- An increasing frequency and intensity of coral bleaching events.
- A decrease in the resilience of coral communities.
- A resurgence of pathogens.

The results of the BRIO program (Building Resilience in the Indian Ocean - Météo France, 2022), show a warming that could reach 6°C locally by 2100 compared to the period 1981-2010; resulting in an alternation of longer and more severe droughts, with denser rainy episodes and a higher proportion of intense cyclones.

In Reunion, Météo France observes an increase in the average temperature of 0.9°C over the last 53 years, as well as a warming of the surface waters of the ocean of 0.5°C to 0.6°C between 1968 and 2018, with an acceleration of warming over the past ten years. The level of the ocean rose by an average of 5mm per year over the period 1993-2017. These physicochemical changes associated with an increase in atmospheric CO_2 could also cause ocean acidification (Cao and Caldeira, 2008).

Rainfall data for the past 10 years, measured at the "Plaine Corail Airport" site by the Mauritius Meteorological Services (2023), provide results in line with BRIO program forecasts. Thus, despite very irregular rainfall from one year to the next, we globally observe:

- An increase in the number of days with more than 25 mm of precipitation (33 days during the period 2013-2017 Vs 54 days during 2018-2022, i.e. an increase of 64%).
- An increase in the number of months with more than 250 mm of precipitation (3 months during 2013-2017 Vs 6 months during 2018-2022, i.e. an increase of 100%).

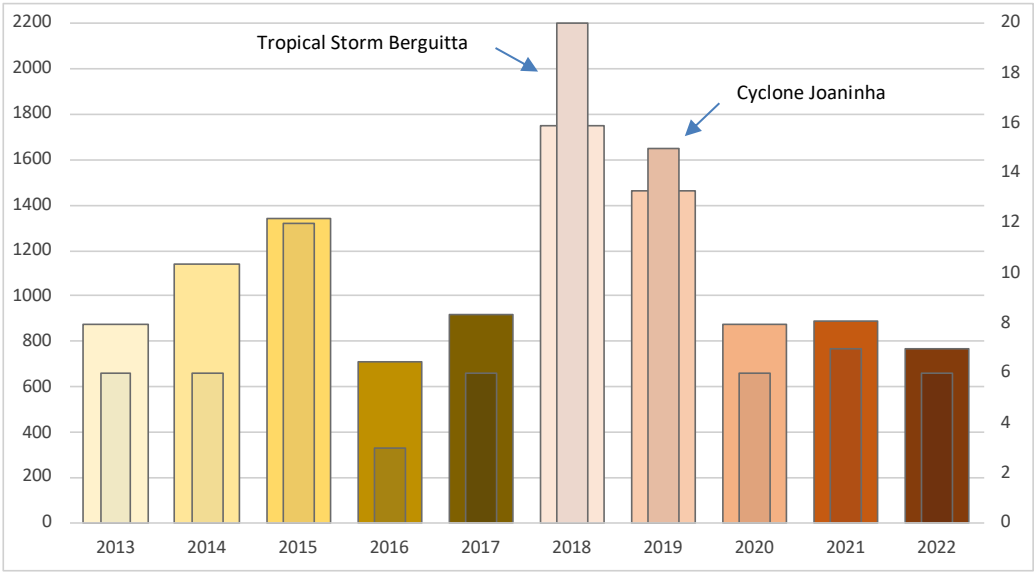


Figure 3 : Total annual precipitation (broad histogram, left axis); number of days with precipitation above 25 mm/day (narrow histogram, right axis) and main meteorological hazards from 2013 to 2022 (Mauritius Meteorological Services, 2023)

During the same period, corals have been severely impacted by human activities and climate change. In 2015 and 2016, a coral bleaching event occurred due to high sea surface temperatures, resulting in high coral mortality on Rodrigues Island (com pers Shoals Rodrigues, 2021). Indeed, seawater temperatures were above average for more than 12 months from March 2015 and exceeded the maximum summer average in 2016 (Klaus *et al*., 2016). This is the largest event recorded to date.

In July 2016, 23 sites were monitored for coral bleaching. Of these 23 sites, 17.4% (4 sites) suffered moderate mortality, 65.4% (15 sites) suffered high mortality, and 17.4% (4 sites) suffered extreme mortality. The impact of bleaching was greater in the north, northwest and southwest compared to the southeast and northeast.

In response to coral bleaching, a coral reef restoration and monitoring programme has been launched by Shoals Rodrigues. Activities started in June 2020, 17 stations were selected for coral transplantation of *Acropora muricata*, *Montipora* sp., *Pocillopora* sp. and *Millepora* sp. species in the north and south of the island. After 3 months of transplantation, the survival rate was 67% at 8 of the 17 sites (com pers Shoals Rodrigues, 2021).

More locally, all the anthropogenic pressures applied to the emerged lands of Rodrigues have an impact on the intertidal and infralittoral habitats. Although the population density of the island in 2014 (386 inhabitants/km^2) remained much lower than that of Mauritius (618 inhabitants/km^2), this density showed a growth three times greater than that of Mauritius over the period 2000-2011, with a natural increase rate of 12.9%, which is very high in the context of the Mascarenes. By way of comparison, the population density in Reunion was 342 inhabitants/km^2 in 2020 with a natural increase rate of 4.4% over the same period as Rodrigues. This strong demographic growth leads to rapid development issues, whether for domestic uses (housing, food, sanitation, etc.), community services (education, places of worship, collective structures, etc.) or exploitation of natural resources (agriculture, fishing, livestock, etc.), all of which have an impact on the environment.

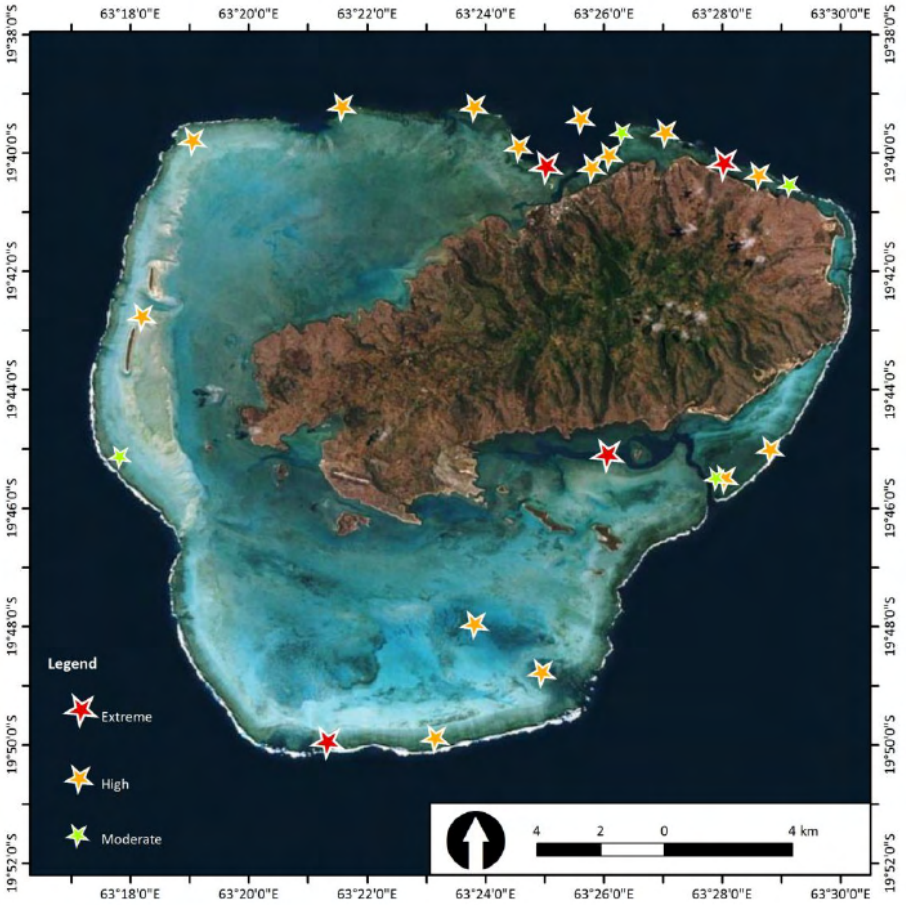


Figure 4 : Map showing coral bleaching mortality around Rodrigues Island in 2016 according to the Obura scale (moderate mortality = 10-50%, high mortality = 50-90%, extreme mortality =>90%) (source: Klaus and al., 2016)

The main pressures with a proven impact on coral reefs and associated ecosystems concern the runoff of terrigenous particles due to soil erosion (cultivation on slopes, soil sealing, etc.), the dumping of effluents of domestic, agricultural and industrial origin (wastewater, phytosanitary products, hydrocarbons, etc.) and the transport of various wastes (plastics, metals, organic matter, etc.) to the coastal zone and reef environments. Although a wastewater treatment master plan and the establishment of wastewater treatment units are planned in Rodrigues, water management remains a major challenge for the island.

Fishing is also one of the main sources of disturbance for coral reef ecosystems (Jhangeer-Khan *et al.*, 2013), as are seaside, local or tourist visits and the use of cosmetic products (sun creams). Fishing for octopus leads to trampling of corals by fishermen. In order to find their target more easily, fishermen use used machine oil to smooth the water surface. Foot and seine fishing are also practicing that damage coral reefs.

The cumulative effect of all the pressures of anthropogenic origin identified on Rodrigues Island represents the highest risk of direct impact of human activity on coastal marine ecosystems. This effect has probably largely contributed to the gradual degradation of lagoon coral formations and acts chronically on ecosystems, gradually affecting their regulation and resilience mechanisms in the face of paroxysmal natural impacts (cyclones, heavy rains, coral bleaching, etc.). These weakened ecosystems

then resist less well and regenerate more slowly than if they were not subjected to these chronic pressures. This degradation of coral populations (architect species) could eventually cause a lasting breakdown (phase shift) of coastal reef ecosystems towards environments with detrital spreading of low ecological interest, causing almost definitive chain reactions on all ecosystem services produced by the reef-lagoon system (fisheries resources, sanitation and public health, self-sanitation, CO_2 sequestration, etc.).

3.2 Technical characteristics of the project

Refer to chapter 1 of the ESIA report (pages 42 to 65)

The Rodrigues airport is currently equipped with a runway of 1,200m long, which can accommodate aircraft of type ATR 72. Operational and technical issues related to the length of the runway mean that the airport cannot operate at full capacity. This situation inexorably leads to some pressure on the carriers during peak periods, a higher cost rate application for airline tickets, and an inability to develop a viable air cargo sector.

In response to this situation, the government has expressed the wish for the construction of a new runway which will boost the economic and social development of the island. The new runway will be 2,100m long x 45m wide. This new infrastructure would support larger aircraft like the A321 Neo/B737, which carries up to a maximum of 244 passengers and is capable of transporting cargo. With this new configuration, the potential of operating new regional routes will be feasible, which may further enhance the economic growth of the island.

In addition to the actual infrastructure of the new track, the following will be built in particular:

- A power plant (electricity production),
- A solid waste management facility / Incinerator,
- A containerized wastewater treatment plant,
- A fresh water production unit (desalination plant),
- A surface water drainage system,
- Roads, car parks and taxiway.

A material extraction quarry will also be located at St Marie Hill, located within the perimeter of the airport. The current buildings and track will be demolished and the land reallocated to the new infrastructures.

It is important to specify that the fresh water production unit (desalination) and the containerized water treatment plant will be installed from the start of the works with the dual objective of:

- To have fresh water for the concrete and the various manufacturing processes without impacting the limited resources of the island,
- Ensure retention and settling of runoff rainwater on terraces exposed by earthworks.

These different stages of the project will generate effects on the marine environment which will be detailed in the following chapters. These estimates will then be compared with the hydrodynamic models of plume dispersion, with a view to best circumscribing the marine surfaces potentially impacted by the effects of the project, both in the construction and operational phases.

3.3 Area of influence

The marine ecology study area is located in the south-west of Rodrigues Island, around the infrastructure of the current airport, located on the Plaine Corail. The reef sector included in this area (excluding land, islands and offshore waters) extends over 51km^2, i.e. a sector of 11km from east to west and 6.6km from the North to South.

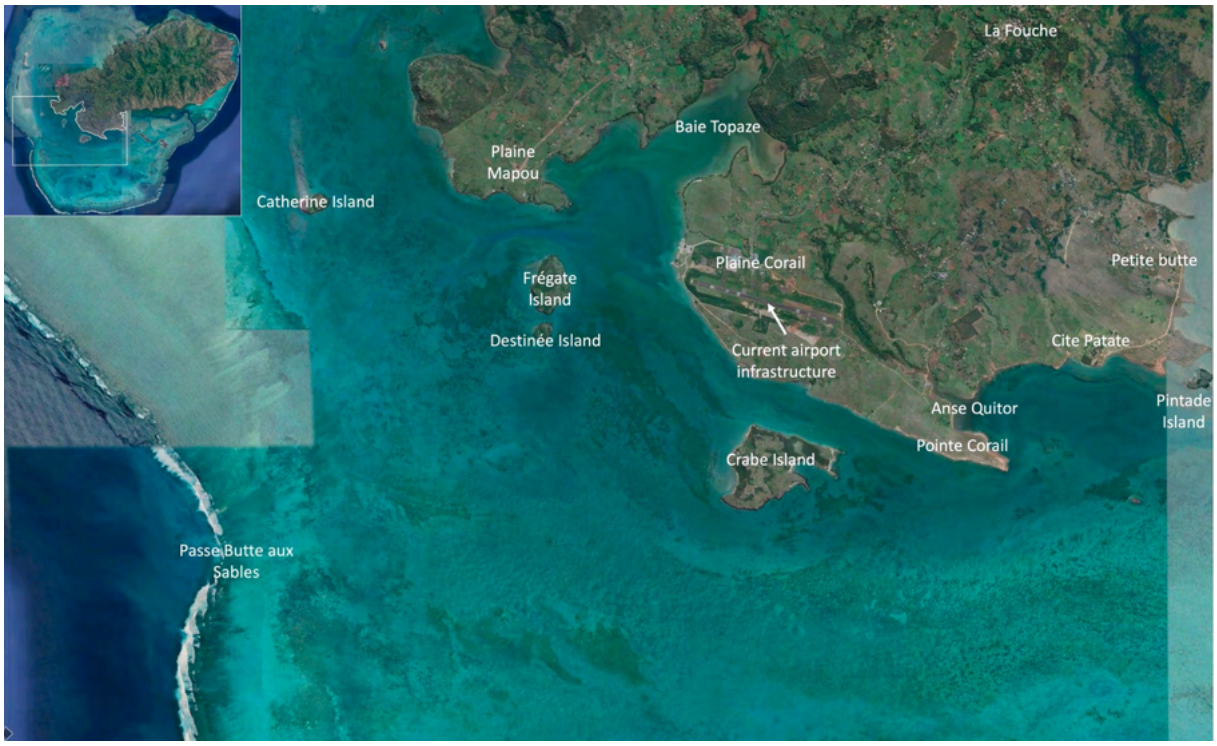


Figure 5 : Area of influence of the project on marine biocenoses (Google Earth, 2023)

This very shallow lagoon expanse (0.5 to 2.5m) is located completely downstream from the main coastal current of Rodrigues. It then flows out to sea through several passes, including Passe Butte aux Sables, located in the study area. It therefore drains large quantities of soft substrates, sometimes muddy, sometimes coarse sabo-sedimentary, of mixed bioclastic and volcanic erosive origins, exploited in a traditional way in the bay.

The first characterization studies of the Rodrigues lagoon and its coral reef were carried out in the 1970s (Faure, 1973, 1974, 1975, 1977; Montaggioni, 1974) and 1980s (Montaggioni, 1980; Montaggioni and Faure, 1980). These studies showed that Topaz Bay was characterized by a soft substrate, dominated by sand and silt.

The studies carried out since (Chapman, 2000; Chapman and Turner, 2004; Andréfouët et al., 2006, Pasnin et al., 2016) have made it possible to refine the level of knowledge of marine ecosystems, in particular of soft substrates, by describing environments dominated by algal assemblages and phanerogam beds, in variable proportions.

Small dense coral formations were also identified by Chapman (2000) in the study area, particularly at the level of the Plaine Mapou, but no information on the state of conservation of these formations has been found in the literature. The classification of this small rocky point as

being part of one of the richest habitats on the island, however, suggests that its state of health was satisfactory in 2000.

Finally, although the mangroves were not studied in the context of this study, several *Rhizophora mucronata* formations were observed at the bottom of Topaz bays, Anse Quitor and Île aux Crabs. The study of aerial photos available on Google Earth has made it possible to follow the ecological dynamics of this ecosystem, known for its role in purifying and stabilizing coastal soils, in a context of increasing erosion since 2005.

This area covered by mangroves gradually increased from 1.59ha in 2005, to 2.12ha in 2011, then 2.84ha in 2017 and finally 4.12ha in 2023, which represents an extension of the area covered nearly 160% in less than 20 years. In addition, the number of patches has multiplied, with mangroves only visible in the northern cove of Topaz Bay in 2005, then in the eastern cove of the same bay from 2011, in Anse Quitor, where a mangrove restoration program seems to have been carried out for about ten years and Crabs Island.

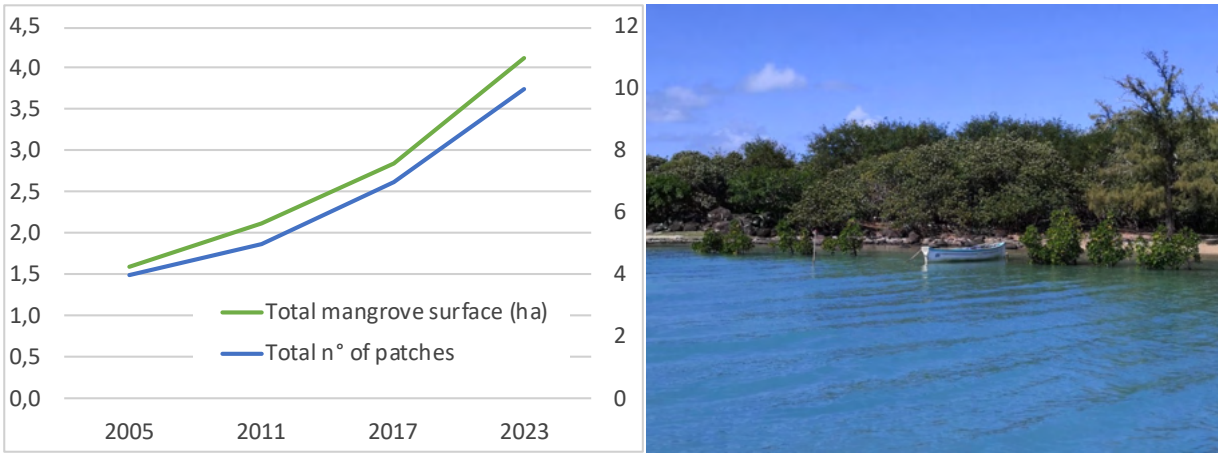


Figure 6 : Total area of mangroves in hectares (green curve, left axis) and number of mangrove patches (blue curve, right axis) identified within the study area between 2005 and 2023 (Google Earth, 2023) and picture of the mangrove patch of Rhizophora mucronata on Crabs Island (MAREX, 2023)

This significant development of mangroves, if it may seem to indicate an improvement in the preservation of the ecosystem in Rodrigue, could also indicate a gradual change in grain size towards the muddy sand of an increasingly large area around Topaz Bay, testifying to an increasingly significant erosion of arable land following the rapid development of the urban spot over the past 20 years.

3.4 Field data

3.4.1 Marine biodiversity inventory

3.4.1.1 Methodology

The biodiversity inventories were carried out in immersion (snorkeling or diving) on all of the 86 stations sampled during the investigation campaign of April 2023 (MAREX, 2023). The identifications were carried out partly in situ and partly on digital photos by the following experts:

- Fish: Julien WICKEL
- Corals: Jean Benoit NICET

- Macro-invertebrates: Mathieu PINAULT
- Algae: Mathieu PINAULT, Mayalen ZUBIA
- Marine phanerogams: Mathieu PINAULT

Were referenced at each new record:

- The type of habitat (mostly soft or hard substrates)
- The level of taxonomic confidence (species marked "cf" are considered doubtful)
- The degree of relative abundance (rare, occasional, frequent, dominant)

The lists thus produced were compared with the scientific work carried out in Rodrigues for the identification of certain taxa, in particular the work of Heemstra et al. (2004) for fish and the work of Coppejans et al. (2004) and De Clerck et al. (2004) for macroalgae. Western Indian Ocean marine fauna and flora guides (Poupin, 2008; Deuss et al., 2013; Conand et al., 2015) were also used when identification required confirmation.

New records for Rodrigues were referenced, as well as their level of threat (IUCN, CITES, CMS), their level of targeting by fishing and their level of protection (The environment protection Act, 2002 and The Fisheries and Marine Resources Act, 2007) in Rodrigues.

3.4.1.2 Results (2023)

A total of 261 species were identified during this study, for an estimated total sampling time of 14 hours, carried out by 3 experts immersed simultaneously at 86 stations of which 78 (91%) were composed of soft substrates at more than 80% (muddy to coarse rubbles).

The species were distributed as follows within the different taxa:

- 149 species of fish (including 16 new records for Rodrigues)
- 50 species of hard corals (scleractinia and millepores)
- 34 species of macroinvertebrates (crustaceans, echinoderms, molluscs, flatworms)
- 26 species of macroalgae (including 1 new record for Rodrigues)
- 2 species of marine phanerogams.

However, despite this significant imbalance in the sampling of soft and hard substrates (only 8 stations with a majority of hard substrates), 79% of all species were observed on rocky substrates, or fixed on limestone blocks (dead corals), illustrating the issue of conservation of these minority habitats. However, it should be noted that all species of phanerogams, as well as 54% of algae species, 32% of macroinvertebrate and 18% of fish were observed on soft substrates.

Among all the species listed, only one species of fish and one species of coral have a protection status in local regulations:

- *Stegastes limbatus*: The Fisheries and Marine Resources Act, 2007
- *Acropora muricata* (formerly *Acropora Formosa*): The Fisheries and Marine Resources Act, 2007 and The environment protection Act, 2002

In addition, 15 species of coral (see appendix 1), 2 species of fish (*Carcharhinus amblyrhynchos* and *Taeniura meyeni*) and 1 species of sea cucumber (*Holothuria nobilis*) are classified NT, VU or EN on the IUCN Red list. All species of corals, *Holothuria nobilis* and *Tridacna maxima* are also listed in Appendix II of CITES.

Concerning the uses by humans, 39 species of fish have an ancillary interest for fishing (subsistence exploitation) and 35 have a major interest (marketing). These are mainly groupers, spinefoots, red mullets, parrots and snappers. These species were observed in very low abundance and generally in juvenile stages, with the exception of the Passe Butte aux Sable station (ROD56) where the individuals observed were abundant and large.

Among the macro invertebrates, apart from ourite (*Octopus cyanea*), whose fishing is regulated in Rodrigues (closure of fishing from August 13 to October 12), lobster (*Panulirus versicolor*) and kono-kono (*Pleuroploca trapezium*), still relatively abundant, only a few individuals of *Holothuria leucospilota* and *Holothuria nobilis*, whose fishing has also been regulated in Mauritius and Rodrigue since 2006 (but whose effective control in the field seems difficult), as well as a specimen of giant clam (*Tridacna maxima*), the international trade of which is regulated by CITES, have been observed.

Certain species of algae are also used as seafood and in pharmacopoeia, in particular because of their richness in antioxidants, mineral salts and their antibiotic and vermifuge action. These are in particular species of the genus *Caulerpa*, which are very abundant in the study area, and to a lesser extent *Turbinaria, Acanthophora* and *Digenea*.

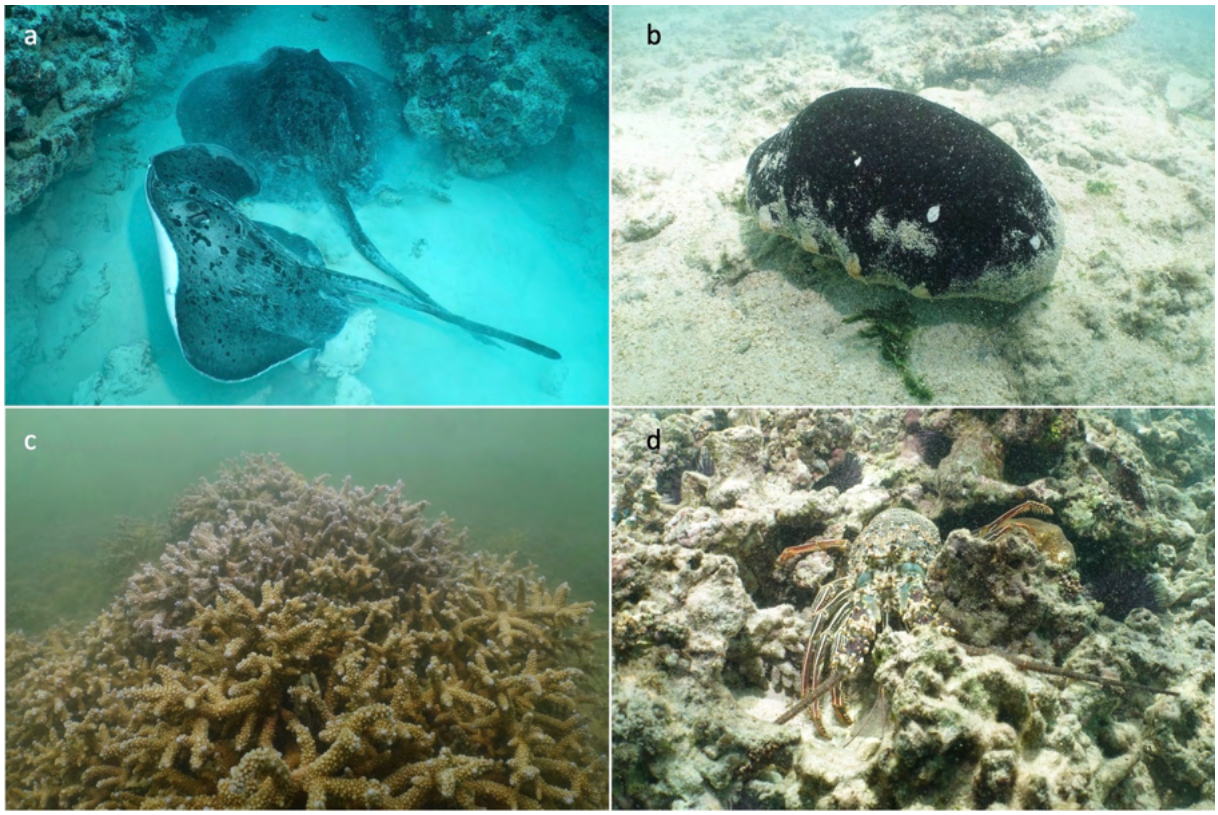


Figure 7: Examples of notable species observed during this study (a) Taeniura meyeni ROD56; (b) Holothuria nobilis ROD52; (c) Acropora muricata ROD03; (d) Panulirus versicolor ROD55 (MAREX, 2023)

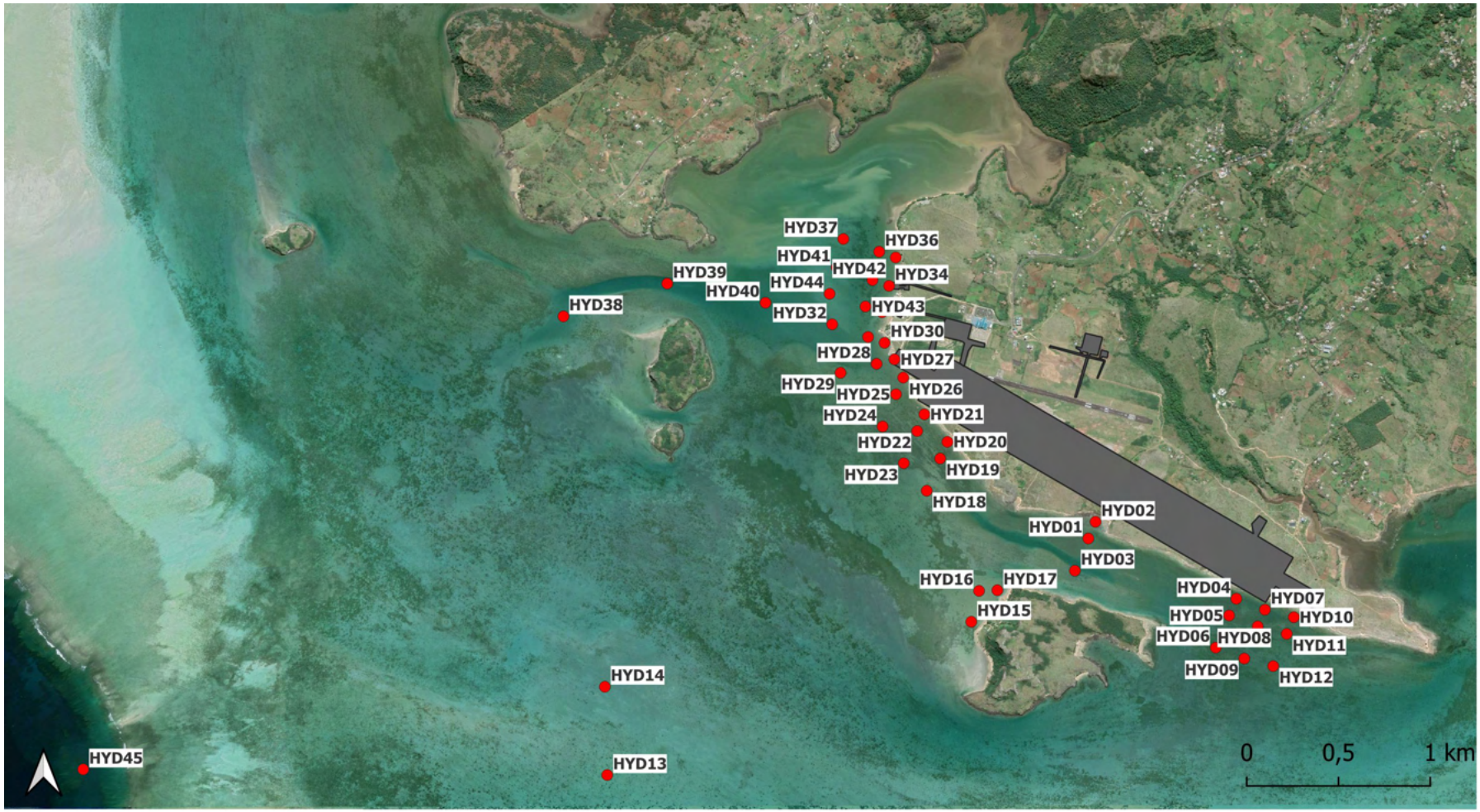


Figure 17: Water physicochemical sampling plan

3.4.2 Mapping of marine habitats

3.4.2.1 Methodology

Based on an updated bibliographic work (i.e. Chapman, 2000; Chapman and Turner, 2004; Andréfouët et al., 2006, Pasnin et al., 2016) the mapping work consisted, depending on the habitats considered: (1) in a visual outline of the different types of seabed by cutting out the different bodies with similar structures and colours, or (2) in a supervised processing of identification and automatic delimitation of the contours of seagrass beds and algae beds. This second method made it possible to provide a fine outline of the patches of seaweed and seagrass beds, the edges of which are very finely cut. The proposed typology considers the geomorphology (soft substrates, hard substrates), the dominant benthic populations (corals, algae, phanerogams) and their relative abundance (dense or sparse cover).

During the ground truth campaigns, the following were noted:

- Dominant communities and their relative abundance (coverage),
- The percentage of soft / hard substrates,
- The granulometry of the sediments (visual estimation),
- The density of burrows and burial mounds (bioturbation).

3.4.2.2 Results (2023)

A total of 13 habitats have been identified based on image analysis and ground truth from 2019 and 2023. They can be grouped according to the following typology:

Soft substrate habitats:

- Bare soft substrates:
  - Muddy bay
  - Sandy-muddy channel
  - Sandy-muddy lagoon with rubble
  - Sandy lagoon with rubble
- Algae and seagrass beds:
  - Algae bed dominated by Rhodophyta assemblage
  - Algae bed dominated by *Caulerpa spp*.
  - Seagrass bed dominated by *Halophila spp*.

Hard substrate habitats:

- Sublittoral rocks:
  - Sublittoral rock dominated by Ochrophyta assemblage
- Fringing coral reefs:
  - Fringing reef dominated by *Acropora muricata*
  - Detrital fringing reef dominated by Ochrophyta assemblage
- Barrier coral reefs:
  - Detrital reef flat with sparse corals and algae
  - Outer reef flat with sparse corals
  - Outer slope with corals, soft corals, gorgonians and crustose algae

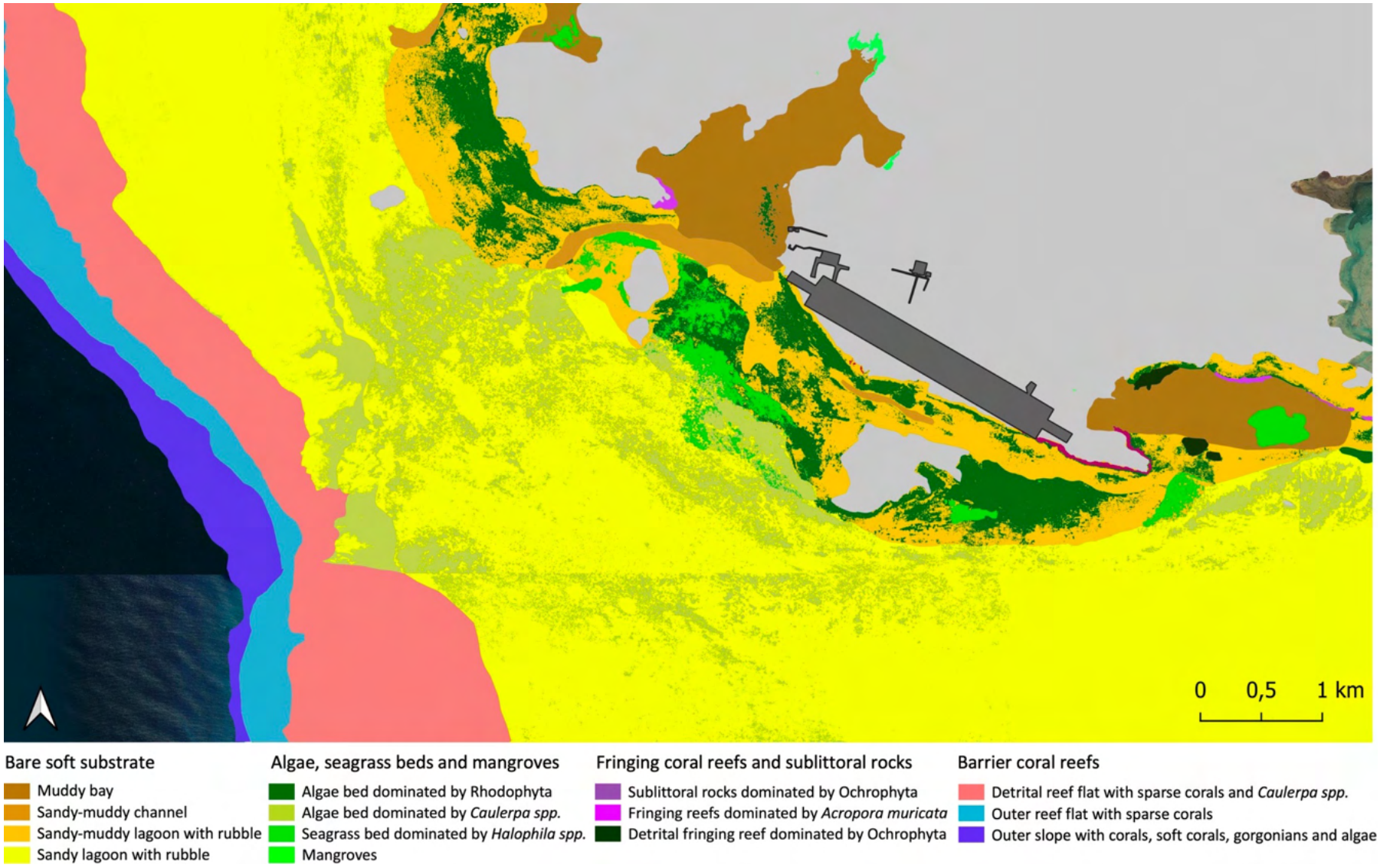


Figure 9: Marine habitats mapping

3.4.3 Ecological sensitivity assessment

3.4.3.1 Methodology

The "MERCI-Cor" assessment method (Method to Avoid, Reduce and Compensate for Impacts in Coral Environments), developed on behalf of IFRECOR (Pinault et al., 2017), offers a rapid approach to acquiring data from field, allowing a semi-quantitative evaluation of the main ecological indicators, adapted to each type of environment (coral reefs, seagrass beds, associated fauna), currently promoted by the International Coral Reef Initiative (ICRI).

On the same stations as the biodiversity inventories, 19 ecological indicators were measured in order to estimate ecological sensitivity according to three criteria:

- The richness and abundance of benthic populations of hard substrates (8 indicators),
- The richness and abundance of benthic populations of soft substrates (6 indicators),
- The richness and abundance of associated mobile fauna (fish and macro-invertebrates) (5 indicators).

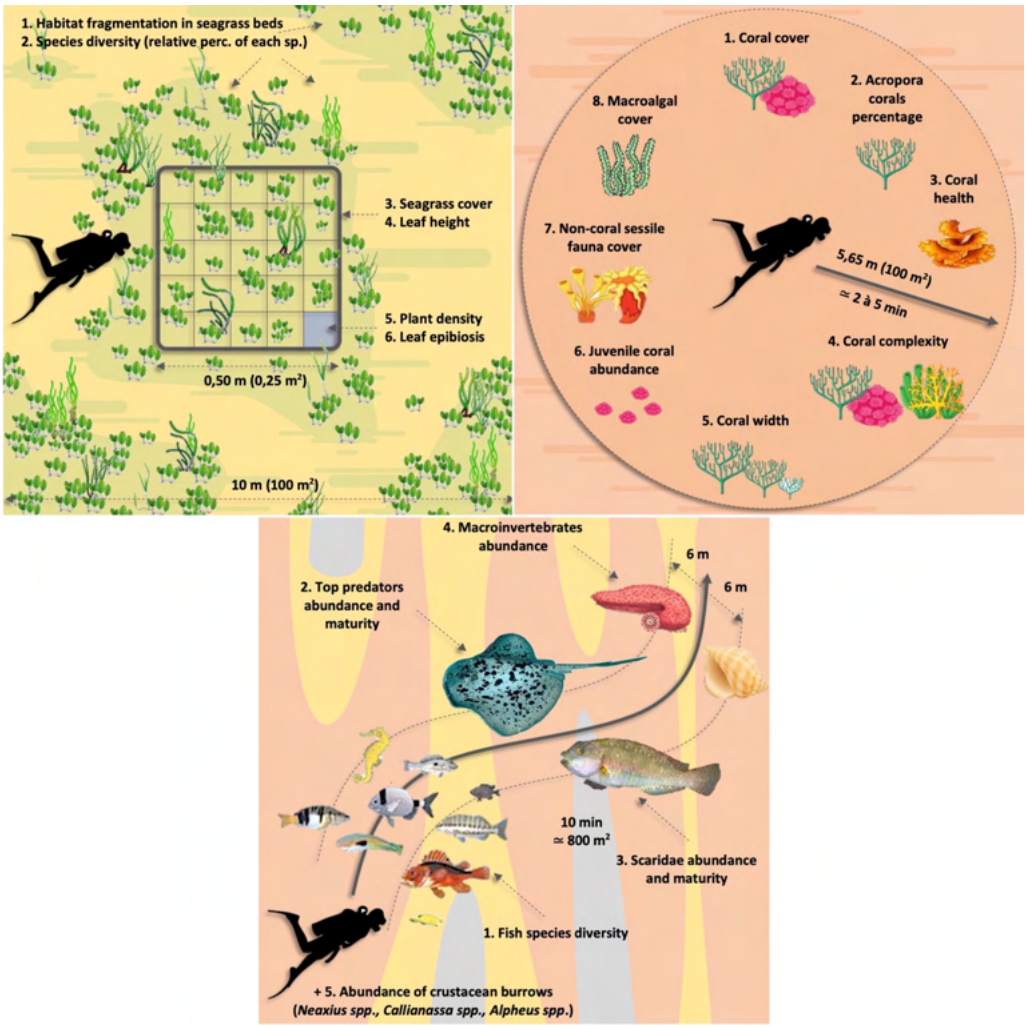


Figure 10: Indicators and associated field methods used to define the ecological sensitivity of habitats (MAREX, 2023)

In addition, a global indicator, composed from the 19 indicators from the three criteria above, also provided a synthetic vision of the sensitivity of the ecosystem as a whole.

3.4.3.2 Results (2023)

3.4.3.2.1 Bare soft substrate habitats

Bare soft substrate habitats cover a large majority of the study area (64%), as evidenced by the artisanal exploitation of lagoon sand, whose landing stage is located on the project footprint. There is a very clear grain size gradient between: (1) the muddy bays, covered with a silty sediment mainly of terrigenous origin (black color), fluid and smooth, (2) the sandy-muddy channel, with less cohesive but still very fine sediments, (3) the sandy-muddy lagoon with rubble, mainly composed of fine to medium sand, and (4) the sandy lagoon with rubble composed of coarse sand and shell and coral debris.

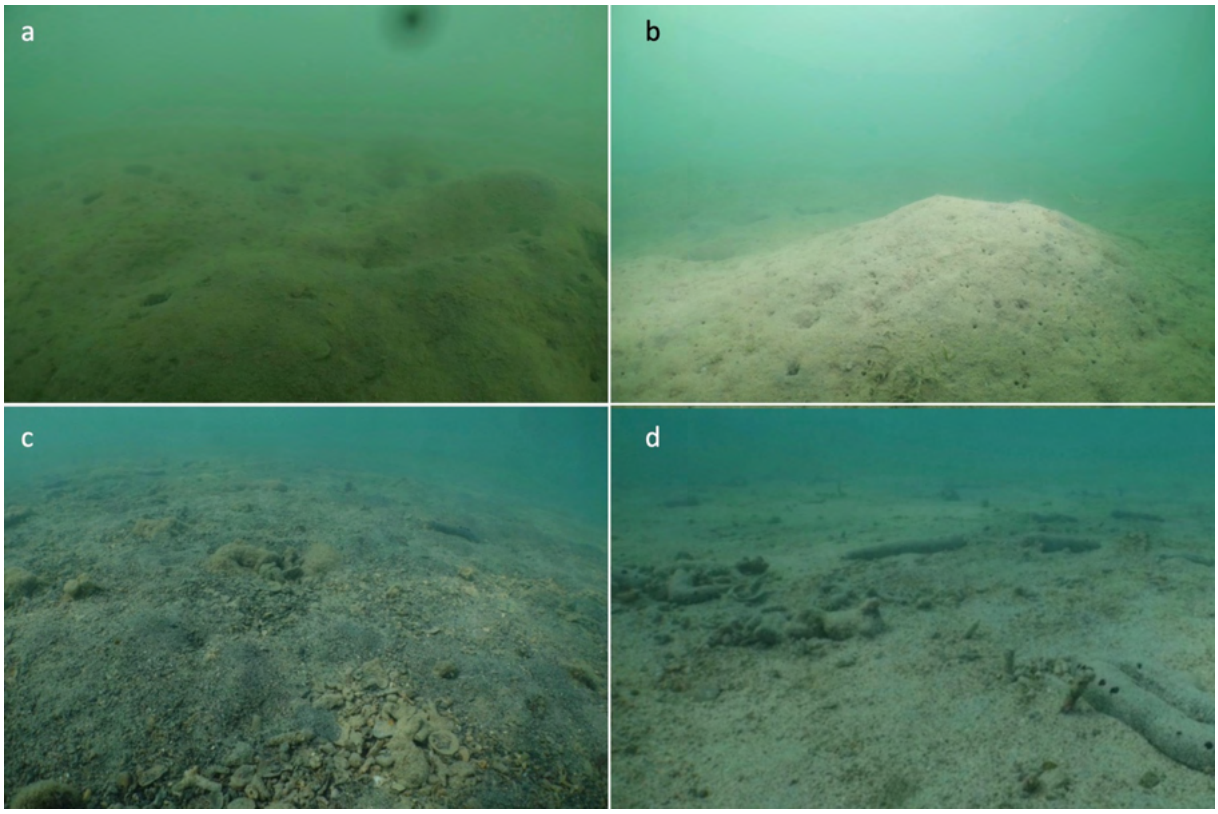


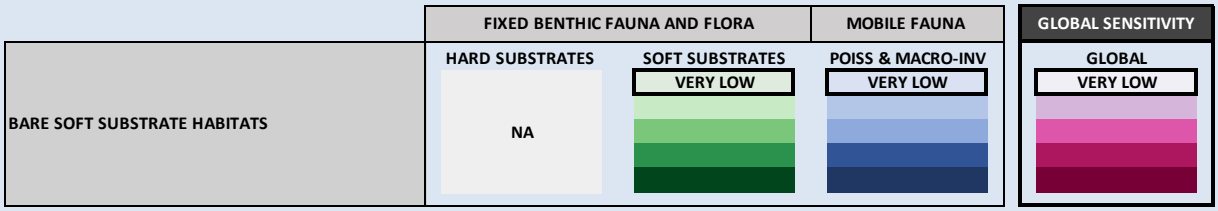
Figure 11: Bare soft substrate habitats (a) Muddy bay; (b) Sandy-muddy channel; (c) Sandy-muddy lagoon with rubble; (d) Sandy lagoon with rubble (MAREX, 2023)

From a biological perspective, almost no fish were observed on these habitats. They are characterized by their populations of epigeal (living on the surface of the sediment) and endogeic (living buried in the sediment) macroinvertebrates. Epigeal macro-invertebrates, mainly composed of echinoderms, in particular black sea cucumber (*Holothuria atra*), extremely abundant throughout the study area, and some gastropod molluscs (Tonna perdix, *Pleuroploca trapezium*, etc.), were identified in situ and showed increasing abundance from muddy bays (3 individuals/100m^2) to the sandy lagoon with rubble (86 individuals/100m^2).

The relative abundance and diversity of endogeic fauna were estimated from the number of burrows and tumuli observed per square meter, and by the diversity of shells and debris of dead organisms present on the surface of the sediment. Thus, burrows and tumuli dug by decapod crustaceans (Alpheidae, Callianassidae) and lugworms were very abundant at the

bottom of the bays (43 burrows/m^2) and increasingly rare going seaward, with minimum values on the sandy lagoon with rubble (7 burrows/m^2). Conversely, bivalve shells collected at the surface of *the substrate (e.g. Gafrarium pectinatum, Quidnipagus palatam, Trachycardium angulatum*) indicated greater abundance and diversity in the coarser sediments.

Despite an increasing gradient of biological richness from the muddy bays, very poor in biological settlements, towards the lagoonal coarser sediments, characterized by populations of moderately abundant and diversified macro-invertebrates, the bare soft substrates habitats can be considered as resistant to environmental disturbances, due in particular to the strong demographic flexibility and the food opportunism of their benthic communities. They are considered in this study of **very low sensitivity**



3.4.3.2.2 Algae and seagrass beds

Algae and seagrass meadows represent 17% of the study site. They develop on a grain size gradient ranging from fine, slightly silted sand to coarse sand and debris.

Algae assemblages, dominated by Rhodophyta (*Palisada perforata, Acanthophora spicifera, Hypnea cornuta*), resistant to desiccation and environmental variations (Vasconcelos et al., 2021), develop very close to the shore, sometimes up to the intertidal zone.

Then follow the phanerogam meadows, composed of pioneer species adapted to sedimentation (*Halophila ovalis, Halophila stipulacea*). Finally, *Caulerpa* beds (*Caulerpa brachypus, C. chemnitzia, C. cupressoides, C. racemosa, C. serrulata, C. taxifolia*) appear further from the shore (about 1km) on coarse detrital substrates and extend in patches to the barrier reef.

Fish populations were virtually absent from these habitats. The associated fauna was also mainly composed of macroinvertebrate species, overall very similar to those described on bare soft substrates. A very high abundance of black sea cucumbers (*Holothuria atra*) was notably observed in the *Caulerpa* beds and individuals of kono-kono (*Pleuroploca trapezium*), isolated or in small groups, were frequently observed on the Halophila seagrass stations.

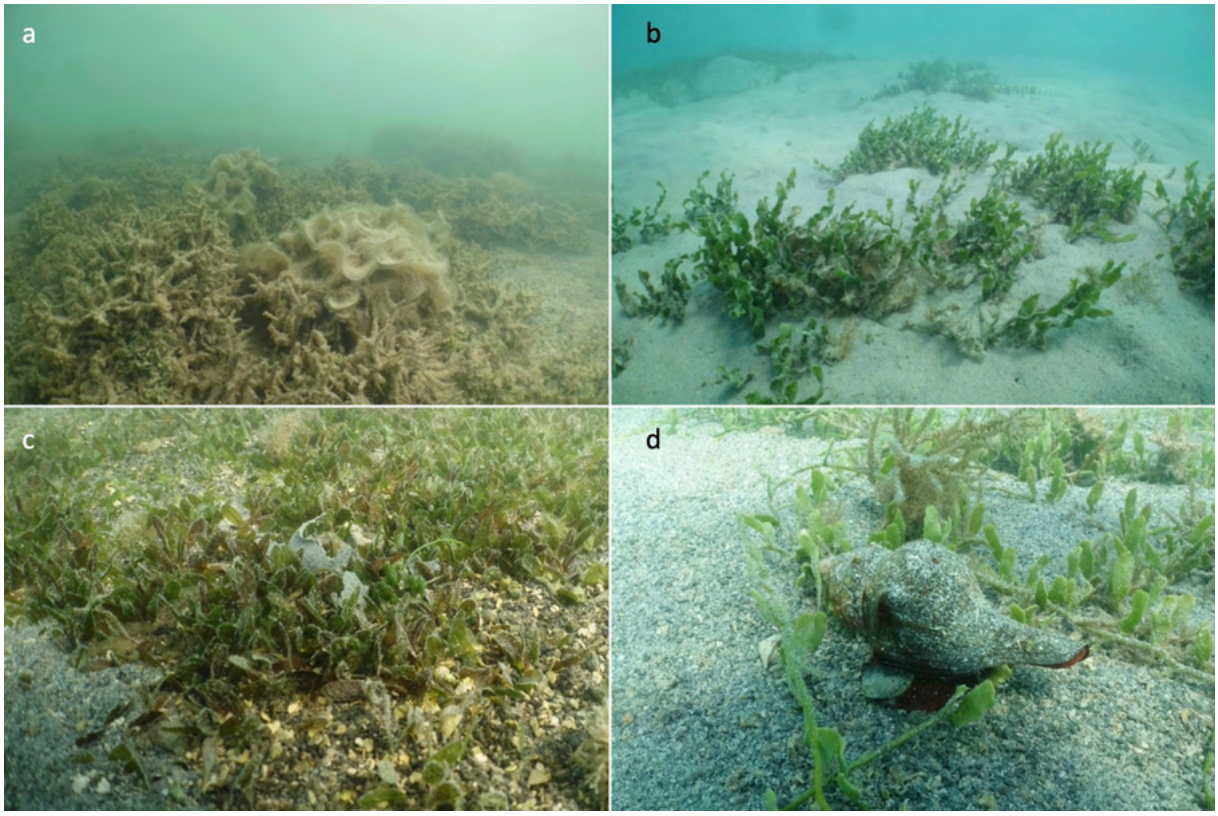


Figure 12: Algae and seagrass beds habitats (a) Mixed algae bed; (b) Caulerpa algae bed; (c) Halophila seagrass bed; (d) a kono-kono on Caulerpa bed (MAREX, 2023)

Although the ecological interest of *Caulerpa* beds is poorly documented, they seem to act on the associated fauna in a similar way to seagrass beds, by concentrating the associated mobile fauna (feeding, reproduction, concealment against predation), such as sea cucumbers and gastropod molluscs. On the other hand, their strong adaptability to environmental variations and the virtual absence of fish keep these habitats at a **low** level of sensitivity. Coastal algal beds, dominated by Rhodophyta assemblages, are classified as **very low sensitivity**.

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
ALGAE BED DOMINATED BY RHODOPHYTA ASSEMBLAGE	NA	VERY LOW	VERY LOW	VERY LOW
	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
ALGAE BED DOMINATED BY CAULERPA SPP.	NA	LOW	LOW	LOW
	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
SEAGRASS BED DOMINATED BY HALOPHILA SPP.	NA	MEDIUM	VERY LOW	LOW

3.4.3.2.1 Sublittoral rocks

In places (0,1% of the study site), the volcanic coastline of Pointe Corail continues into the lagoon as a rocky belt about 40m wide. This rocky incursion is then quickly silted up going seaward. It allows the installation of a brown algae assemblage (Phaeophyceae) characteristic of intertidal environments, beaten by the waves (*Sargassum ilicifolium, Padina boergesenii, Canistrocarpus cervicornis, Turbinaria ornata*).

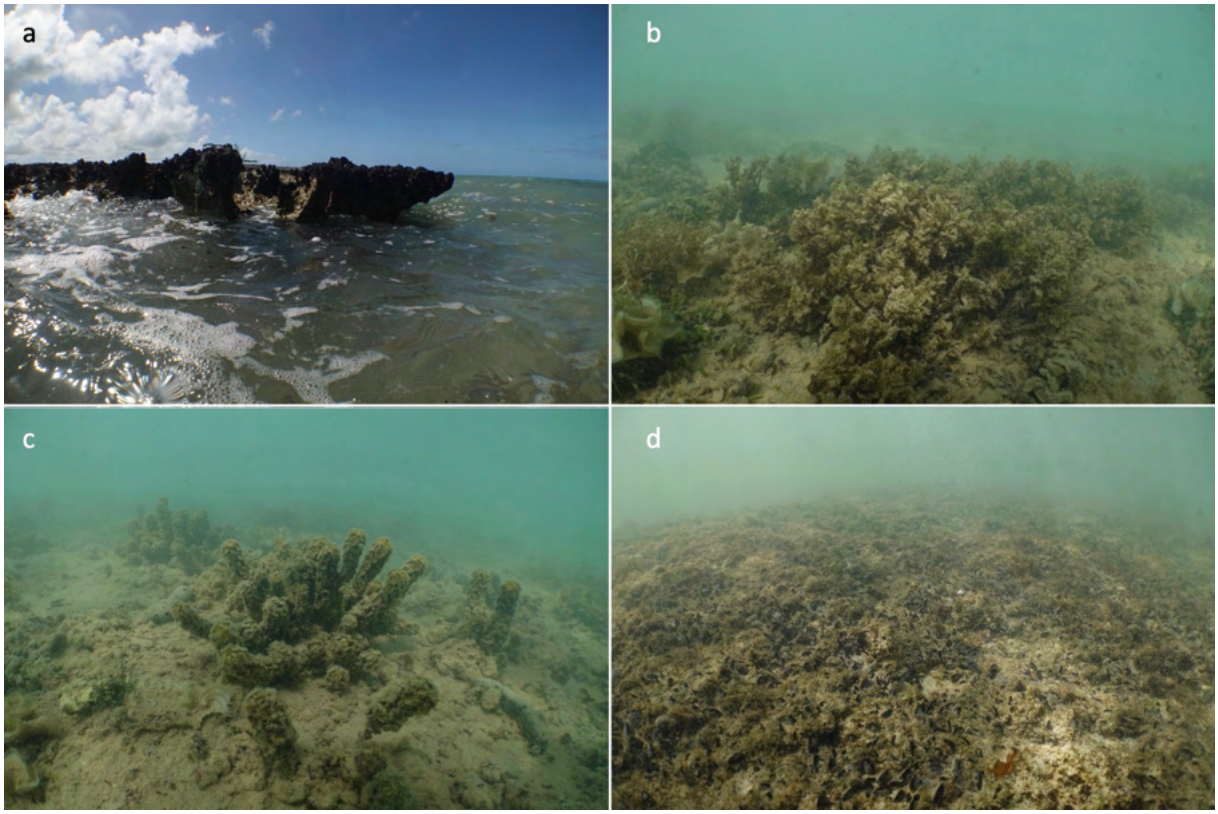


Figure 13: Sublittoral rocks habitats (a) Volcanic coastline incursion; (b) Assemblage of Sargassum spp.; (c) Turbinaria ornata; (d) Dense patch of Modiolus auriculatus (MAREX, 2023)

However, this transitional ecosystem does not present any specific issue in terms of conservation due, on the one hand, to the very ubiquitous and pioneering nature of the algal assemblage and, on the other hand, to the very low diversity and abundance of the associated fauna, with the exception of the species *Modiolus auriculatus* present in dense patches. This habitat is classified as **very low sensitivity.**

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
SUBLITTORAL ROCKS DOMINATED BY OCHROPHYTA ASSEMBLAGE	VERY LOW	NA	LOW	VERY LOW

3.4.3.2.2 Fringing coral reefs

Small scattered fringing reefs (0,2% of the study area), already described by Chapman in 2000, were sampled near certain coasts of the study site in 2019 and 2023. These habitats, of heritage interest despite their small size, in particular thanks to the architect species *Acropora muricata*, however, showed significant signs of degradation. If some reefs are already completely dead, probably for many years, it is different for reefs that are still alive, the signs of degradation of which seem to have appeared more recently (10 to 15 years). Their location near the coast, at the exits of bays, could indicate a gradual deterioration in water quality over the past twenty years, amplified by the coral bleaching events of 2015 and 2016.

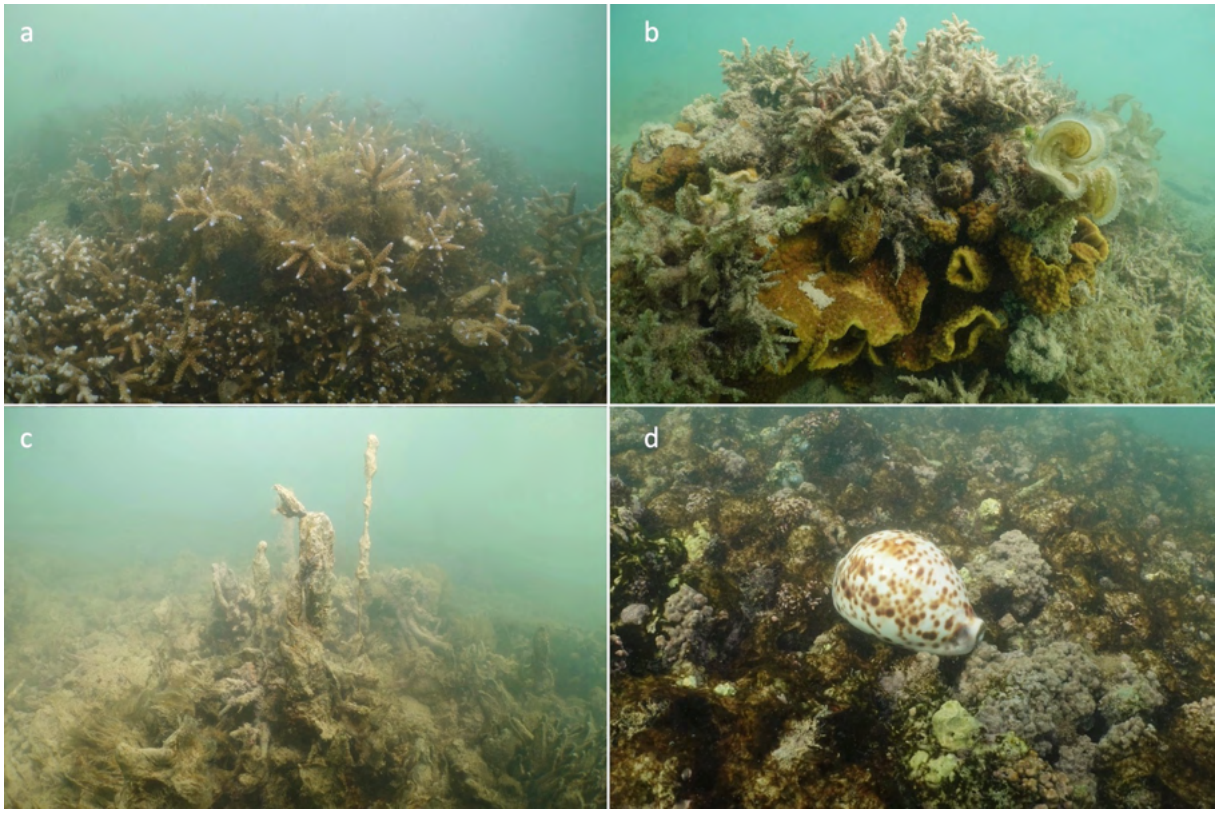


Figure 14: Fringing coral reef habitats (a) Branched Acropora muricata; (b) Coral colony constrained by algae; (c) Dead reef with cyanobacteria; (d) Tiger cowry (Cypraea tigris) on deads (MAREX, 2023)

Fish populations were moderately diverse (20 to 30 species per station on branched Acropora reef and less than 15 species on dead reefs) and composed of fairly common non-specialist species, typical of shallow rocky bottoms, with few top predators of small sizes (*Lutjanus fulviflamma, Lutjanus fulvus, Epinephelus merra*). Species characteristic of coral reefs (*Chaetodontidae, Sacridae, Holocentridae, Pomacentridae*) were almost absent, in favour of opportunistic herbivorous with a broad food spectrum (*Ctenochaetus striatus, Zebrasoma desjardinii, Acanthurus nigrofuscus, etc.*).

The macroinvertebrate populations were composed of a mixture of reef species of heritage interest (*Turbo argyrostomus, Cypraea tigris*) and black sea cucumbers (*Holothuria atra*) present throughout the study area in variable densities. The colonies of *Acropora muricata* were invaded by algal turfs and ascidians and grapes of bivalves of the *Pteria* genus were inserted between the partially necrotic branches.

The presence of the protected species *Acropora muricata* and associated populations moderately abundant and diversified, although fairly common, justify the classification of branching Acropora reefs as **medium sensitivity**. On the other hand, dead reefs, whose extinct coral species have left only rubbles where common fauna still lives, are classified as **low sensitivity**.

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
FRINGING REEF DOMINATED BY ACROPORA MURICATA	MEDIUM	NA	MEDIUM	MEDIUM

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
DETRITAL FRINGING REEF DOMINATED BY OCHROPHYTA ASSEMBLAGE	LOW	NA	LOW	LOW

3.4.3.2.1 Barrier coral reefs

The barrier reef (19% of the study site), located offshore (2 to 4km from the coast) is both the richest environment and the furthest from the supposed effects of the airport project. From the lagoon out to sea, it is composed of: (1) an inner detrital reef flat on mixt substrates, characterized by a virtual absence of coral colonies, scattered and unoriginal fish populations and a high abundance of sea urchins (*Echinometra mathaei*), (2) a compact outer reef flat with coral populations slightly more developed than on the inner reef flat and very high densities of sea urchins (*Echinometra mathaei, Echinothrix diadema, Stomopneustes variolaris*), (3) an outer slope with spurs and grooves, marked by partly dead coral populations and composed of species adapted to siltation, but a remarkable population of fish, in particular composed of threatened species (Carcharhinus amblyrhynchos, Taeniura meyeni) and of high interest for fishing (*Epinephelus coioides, Epinephelus tauvina, Plectropomus punctatus*).

Apart from the populations of sea urchins, the macroinvertebrates encountered on the barrier reef habitats were scarce, but were of heritage interest, such as the giant clam (Tridacna maxima), the turban (*Turbo argyrostomus*), the black teatfish (*Holothuria nobilis*) or the eyed cowry (*Arestorides argus*).

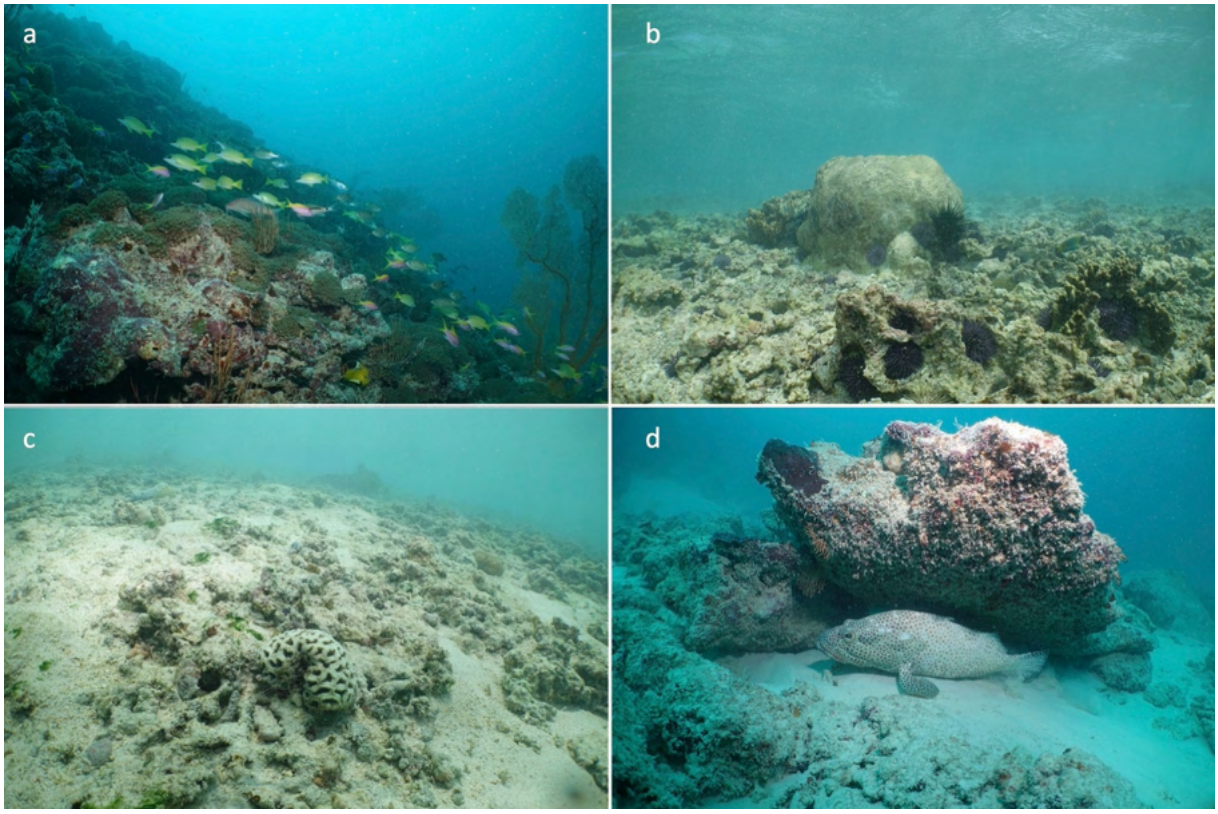


Figure 15: Barrier coral reef habitats (a) Outer slope with gorgonians; (b) Outer reef flat with many sea urchins; (c) Inner detrital reef flat; (d) Orange-spotted grouper (Epinephelus coioides) on outer slope (MAREX, 2023)

These habitats located on a hydrodynamic gradient also present a gradient of ecological sensitivity decreasing from the sea towards the lagoon, with an outer slope of **high sensitivity** (remarkable fish population), followed by a compact outer reef flat then a detrital inner reef flat of **low sensitivity**.

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
DETRITAL REEF FLAT WITH SPARSE CORALS AND ALGAE	VERY LOW	NA	LOW	LOW

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
OUTER REEF FLAT WITH SPARSE CORALS	MEDIUM	NA	LOW	LOW

	FIXED BENTHIC FAUNA AND FLORA		MOBILE FAUNA	GLOBAL SENSITIVITY
	HARD SUBSTRATES	SOFT SUBSTRATES	POISS & MACRO-INV	GLOBAL
OUTER SLOPE WITH CORALS, SOFT CORALS, GORGONIANS AND CRUSTOSE ALGAE ASSEMBLAGE	MEDIUM	NA	HIGH	HIGH

3.4.4 Physicochemical analyses

3.4.4.1 Methodology

In order to better understand the causal relationships between biotic and abiotic variables, 4 complementary physicochemical variables were measured in the sub-surface (50cm deep), on board the boat, using a multiparameter probe YSI Quatro +©:

- Water temperature (°C),
- Salinity (g/L),
- Dissolved O2,
- pH.

At the same stations, the turbidity (NTU) was measured on a water sample using a Hanna instruments TUB430© field turbidimeter.

Figure 16: YSI Quatro +© multiparameter probe (a), Hanna instruments TUB430© field turbidimeter (b), in situ deployment (c) (MAREX, 2023)

Sampling was carried out on April 21, 2023 between 11:35 a.m. and 3:36 p.m., at 45 stations located near the project footprint, at high tide, to allow access by boat to the habitats closest to the coast, also the shallowest, and to reflect the mechanisms of dilution and dispersion during the emptying of the reef complex at ebb tide (according to Praveena et al., 2013).

3.4.4.2 Results (2023)

The results of the physicochemical analyses (appendix 2) show a strong gradient of increasing quality of the coastal waters from the bottom of Topaz Bay, towards the reef barrier (HYD45). The water in the bay is characterized (1) by significantly higher temperature (27.9°C) and salinity (35.18) values (ocean values of 27.2°C and 34.75), indicators of a marked evaporation phenomenon, accompanied (2) by significantly lower dissolved oxygen (85.7%) and pH (7.88) values (ocean values of 101% and 8.14), indicators of highly confined waters, probably subject to a phenomenon of coastal eutrophication, and (3) very high turbidity values (8.44 NTU, for oceanic values of 0.45 NTU), also showing a chronic terrigenous influence on this highly sensitive water body.

These results are in line with the observations made previously on the tendency to progressive siltation of the coastal fringe, probably due to cumulative mechanisms of land destabilization (urbanization, unsuitable agricultural practices, deforestation) in a context of climate change (increase the number of days of heavy rain per year and the frequency and intensity of tropical depressions). This phenomenon is most likely the main cause of the signs of advanced degradation of lagoon coral reefs described in this study.

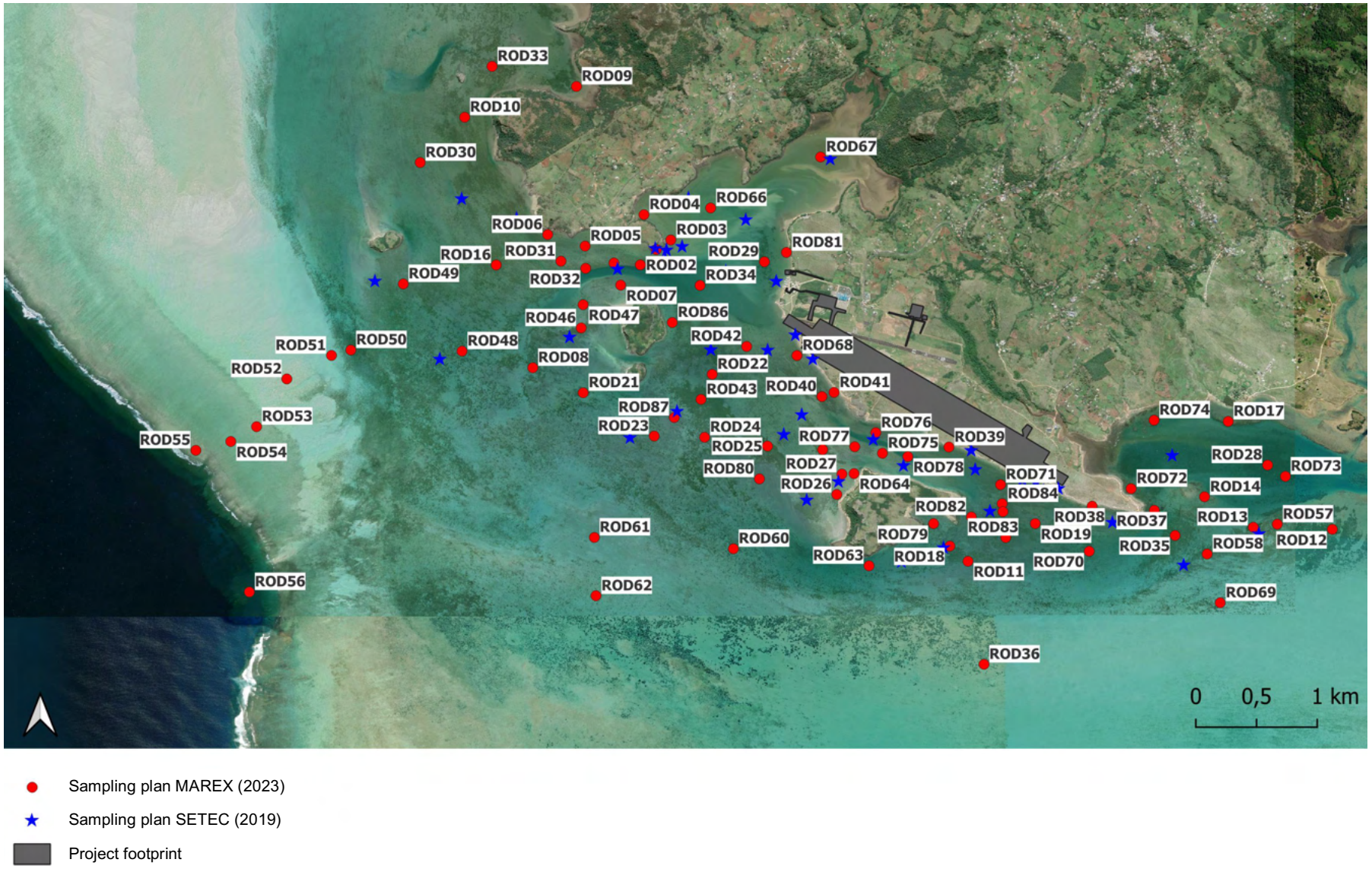


Figure 8: Marine biodiversity sampling plan

3.4.5 Main results of the field survey

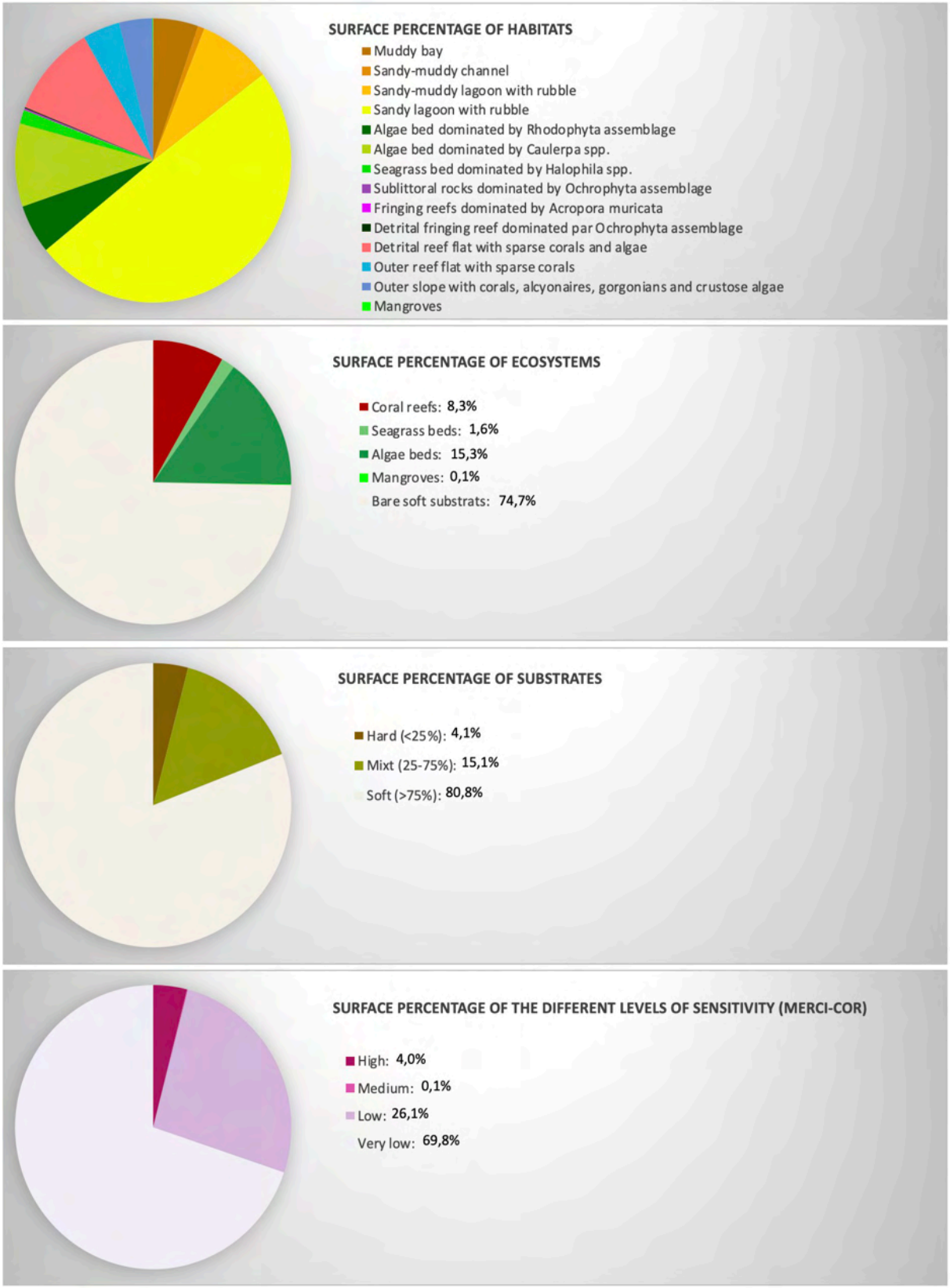


Figure 18: Reminder of the main indicators of ecological sensitivity, expressed as a percentage of the total study area (51 km²) (MAREX, 2023)

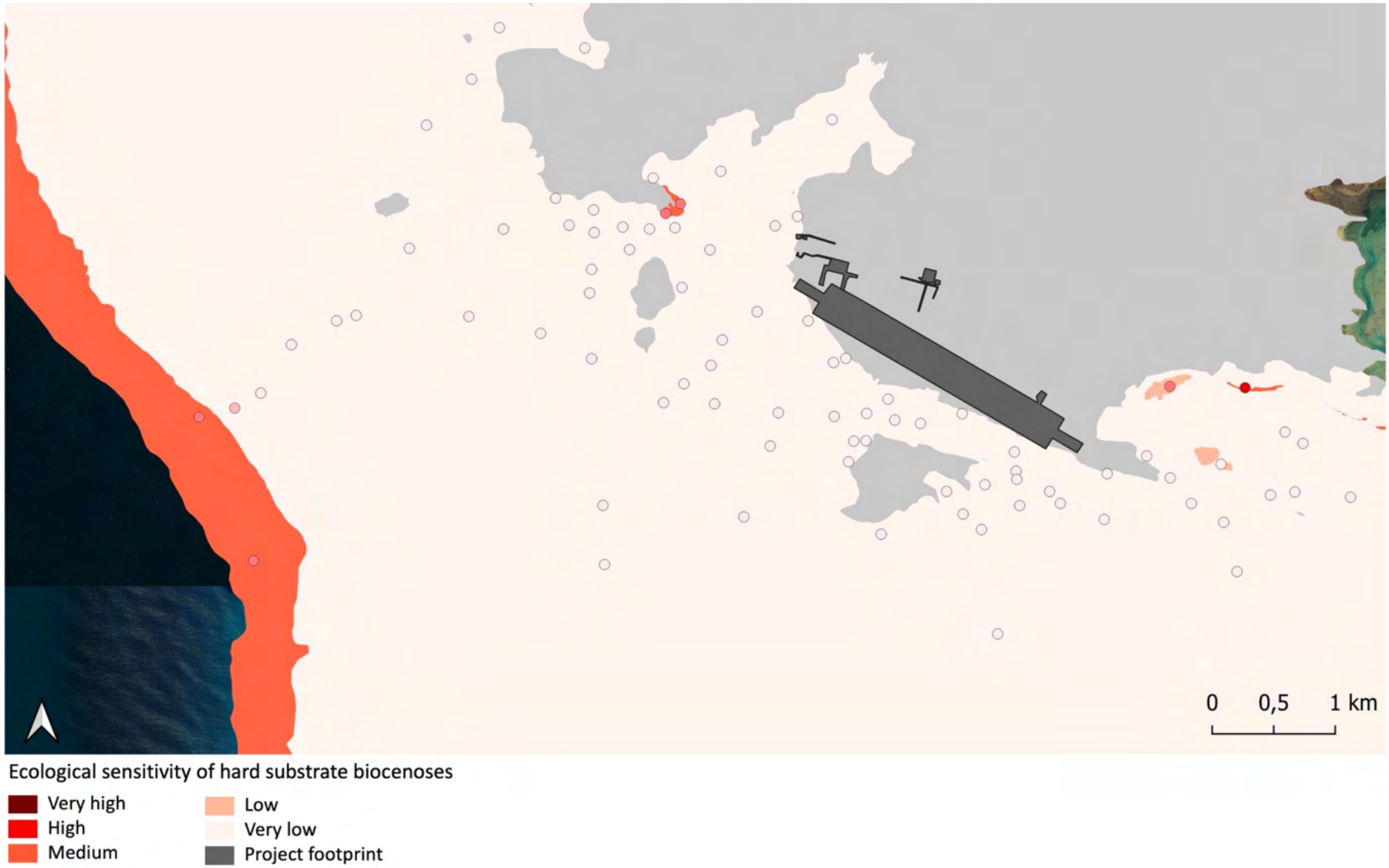


Figure 19: Ecological sensitivity of hard substrate biocenoses (MAREX, 2023)

Figure 20: Ecological sensitivity of soft substrate biocenoses (MAREX, 2023)

Figure 21: Ecological sensitivity of fish and macroinvertebrates (associated fauna) (MAREX, 2023)

Figure 22: Habitats overall sensitivity – MERCI-Cor indicator (MAREX, 2023)

Table 1: Habitats dimension and ecological sensitivity

SUBSTRATES	HABITATS (1)	HABITATS (2)	SURFACE (HA)	SURFACE (%)	HARD SUBSTRATE BENTHOS	SOFT SUBSTRATE BENTHOS	FISH AND INVERTEBRATES	GLOBAL SENSITIVITY
SOFT SUBSTRATES	BARE SOFT SUBSTRATES	MUDDY BAY	269,20	5,3%	/	VERY LOW	VERY LOW	VERY LOW
		SANDY-MUDDY CHANNEL	39,46	0,8%	/	VERY LOW	VERY LOW	VERY LOW
		SANDY-MUDDY LAGOON WITH RUBBLE	439,84	8,6%	/	VERY LOW	VERY LOW	VERY LOW
		SANDY LAGOON WITH RUBBLE	2532,39	49,6%	/	VERY LOW	VERY LOW	VERY LOW
	ALGAE AND SEAGRASS BEDS	ALGAE BED DOMINATED BY RHODOPHYTA ASSEMBLAGE	285,98	5,6%	/	VERY LOW	VERY LOW	VERY LOW
		ALGAE BED DOMINATED BY CAULERPA SPP.	484,60	9,5%	/	LOW	LOW	LOW
		SEAGRASS BED DOMINATED BY HALOPHILA SPP.	80,55	1,6%	/	MEDIUM	VERY LOW	LOW
HARD SUBSTRATES	SUBLITTORAL ROCKS	SUBLITTORAL ROCKS DOMINATED BY OCHROPHYTA ASSEMBLAGE	5,17	0,1%	VERY LOW	/	LOW	VERY LOW
	FRINGING CORAL REEFS	FRINGING REEF DOMINATED BY ACROPORA MURICATA	4,97	0,1%	MEDIUM	/	MEDIUM	MEDIUM
		DETRITAL FRINGING REEF DOMINATED BY OCHROPHYTA ASSEMBLAGE	6,95	0,1%	LOW	/	LOW	LOW
	BARRIER CORAL REEFS	DETRITAL REEF FLAT WITH SPARSE CORALS AND ALGAE	539,42	10,6%	VERY LOW	/	LOW	LOW
		OUTER REEF FLAT WITH SPARSE CORALS	223,78	4,4%	MEDIUM	/	LOW	LOW
		OUTER SLOPE WITH CORALS, SOFT CORALS, GORGONIANS AND CRUSTOSE ALGAE ASSEMBLAGE	198,14	3,9%	MEDIUM	/	HIGH	HIGH

3.5 Bibliographic study of marine mammals and sea turtles of Rodrigues

3.5.1 Sea turtles

Six species of marine turtles are present in the Indian Ocean. The green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*) were the two species initially found in Rodrigues. They were heavily exploited during the 18th century and became very uncommon from 1950 onwards in Rodrigues.

More recent studies have shown that both species still frequent the waters of Rodrigues. Individuals have been observed occasionally in the lagoon or on the reef slopes (Shoals Rodrigues pers. obs.). The beaches potentially favourable to marine turtles are mainly located in the eastern third of the island (figure below).

The data collected by Lartiges et al in 2003 have enabled us to highlight the presence of marine turtles in Rodrigues over the last few decades with:

- a good ten young turtles observed in January 2002 swimming along the shore of Crab island;
- an emergence observed in 1988 on Baladirou beach;
- a laying on Mourouk-Ouest beach about ten years ago;
- ascents on the beach of Saint François are observed every 2 or 3 years.

However, the situation on the ground remains worrying, and visibly since the Lartiges et al. report (2003), things have hardly changed: very few marine turtles come to lay their eggs, and poaching of these protected species is still frequent on the island (Frétey et al., 2012).

The project area does not regularly host these remarkable and emblematic species. Sea turtles may be observed in Topaz Bay (Palmiste Pointe), but this should be considered an occasional occurrence (Shoals Rodrigues pers. obs.). No turtle was observed in the area of influence during the dives in July 2019 and April 2023.

The green turtle is classified as "endangered" and "critically endangered" for the hawksbill turtle on the IUCN Red List (www.iucnredlist.org).

For this reason, marine turtles are of a high sensitivity.

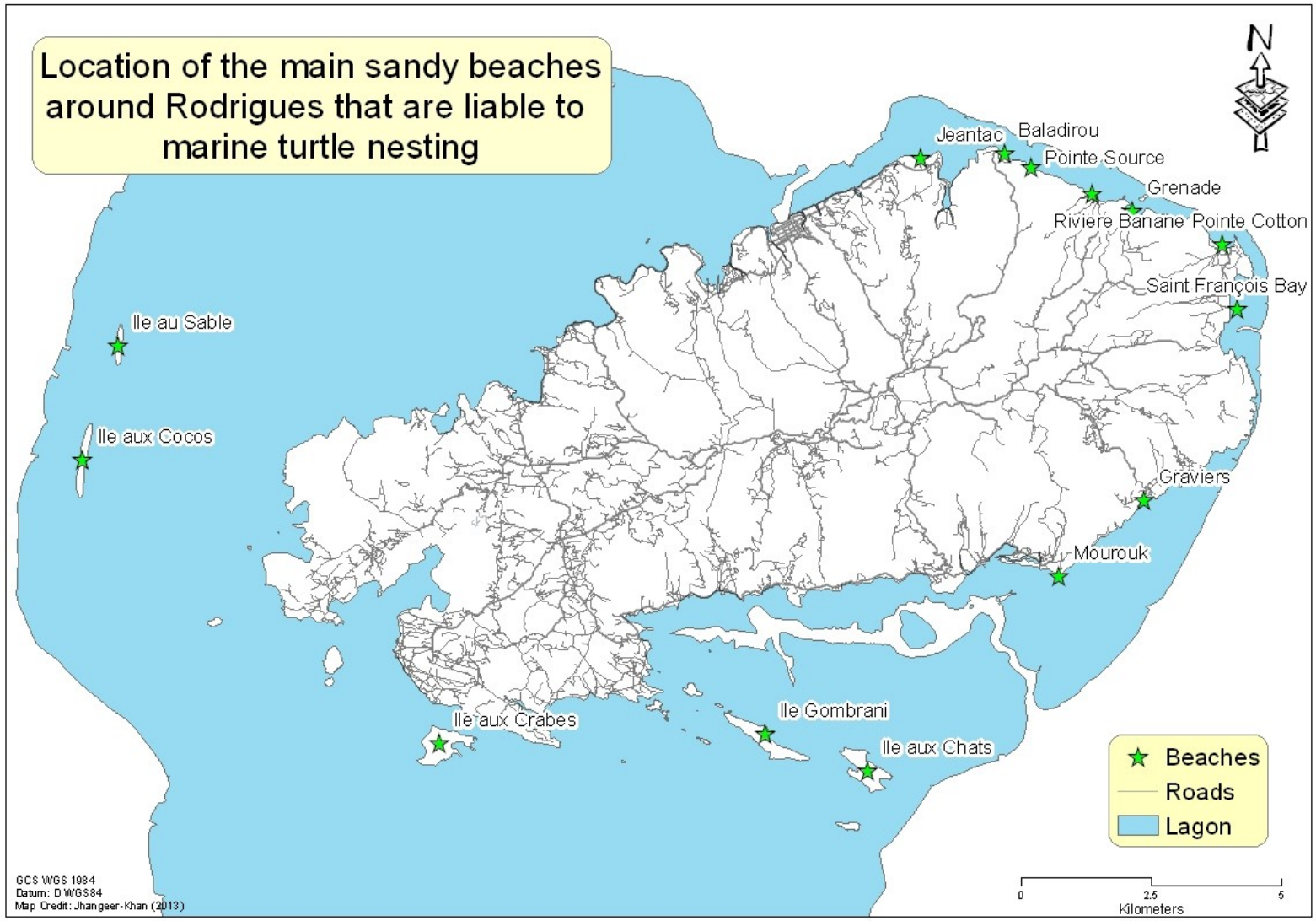


Figure 23: Location of potential egg-laying areas for marine turtles

3.5.2 Marine mammals

Five main species are observed in the coastal waters of Rodrigues (figure below):

- The spinner dolphin (*Stenella longirostris*);
- The pantropical spotted dolphin (*Stenella attenuata*);
- The common bottlenose dolphin (*Tursiops truncatus*);
- The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*);
- The humpback whale (*Megaptera novaeangliae*).

Figure 24: Stenella longirostris and Megaptera novaeangliae (http://www.mmcs-ngo.org/en/marine-environment/cetaceans.aspx)

Humpback whales are present during the southern winter, between August and September. Bottlenose dolphins (*Stenella* sp.) are present mainly around the lagoon, in deeper waters. These two species can form populations of several hundred individuals. Concerning bottlenose dolphins (*Tursiops* sp.), the common bottlenose dolphin also remains more attached to deep waters, whereas the Indo-Pacific bottlenose dolphin seems to be more coastal. The latter may form very localised metapopulations as little is known about deep water movements for this species (Cockcroft et al., 2011 in Biotope, 2016).

In the project area, there is no data to certify the presence of cetaceans in Topaz Bay. Considering the bathymetric characteristics of this area, it seems that the Indo-Pacific bottlenose dolphin is the most likely species to frequent the area, as this cetacean frequents shallow coastal waters (between 0 and 60m). However, with a shallow lagoon, its presence is still possible and certainly occasional. Outside the lagoon, all species are potentially present. No marine mammal was observed in the area of influence during the dives in July 2019.

For this reason, marine mammals are of a low sensitivity.

3.6 Estimated impact of the project on marine biocenoses

This part of the study was written in close collaboration with the assessment of the project's impacts on the abiotic components of the marine environment (physical environment sensitivity), namely:

- Marine sediment quality: contamination of marine sediments (medium sensitivity)
- Marine sediment dynamics: physical disturbance of sediments (medium sensitivity)
- Seawater quality: T°C, salinity, concentration of contaminants (high sensitivity)
- Physical coastal processes: shoreline, morphology, wave, currents (medium sensitivity).

It uses the same chapters and the same organization as the "Marine Impact Specialist Report" but only considers significant impacts on the physical environment, insignificant impacts on the abiotic components of the environment having no impact on the biological environment.

Furthermore, in order not to overload this study with redundant proposals, only the avoidance and mitigation measures not proposed in the impact report on the abiotic components of the environment are proposed there. These measurements do not concern aspects relating to industrial processes or work procedures (in connection with water and sediment quality), but focus on the periodicity of ecological mechanisms and the spatialization of ecological issues, following the estimation habitats sensitivity.

Finally, other information on the abiotic environment was taken from the "Factual Report for Noise & Air Quality (26.03.2023)" and the "Factual Report for Water (23.03.2023)" in order to quantify the sound pressures and the runoff quality.

Information on the nature, number and intensity of the lighting provided for the infrastructures is subject to the Civil Aviation Code. Thus, all Airfield Ground Lighting (AGL), Navaids and illuminated signage provided for the runway will be compliant with the ICAO. On the other hand, no information was found on the hours of lighting and on the possible presence of night work, having recourse during the construction phase to temporary lighting installations.

However, this information is essential for estimating the impact of the works and the operation of the airport runway on sea turtles. Indeed, these amphibious reptiles lay eggs on the beaches at night and are greatly frightened and disoriented by light pollution. The potential egg-laying site on Crabs Island, located less than 500m from the future runway, could experience a drop-in attendance if this pressure is not considered. Reduction measures are proposed in this chapter.

3.6.1 Methodology

In previous aspects of this study, habitats were defined and evaluated. The chapter below aims to evaluate the consequences of the project (impacts), on all the habitats identified in the baseline.

The impacts are defined and classified according to whether they are:

- Temporary work impacts. These impacts are intended to appear during the project implementation phase, but to disappear once the works phase is completed (e.g. noise caused by the work equipment);

- Definitive work impacts. These impacts are intended to appear during the works phase, and to continue once the work is completed (e.g. destruction of habitat located in the project footprint);
- Operational impacts. These impacts are linked to the very existence and operation of the project (e.g. noise caused by the planes landing and taking off).
- For each of these three types of large impacts, an assessment of the intensity was first
- Conducted and rated on the basis of their severity (impact severity) as: 1 - not significant, 2 - low, 3 - medium, 4 - high, 5 - major.

The severity impacts were confronted with the sensitivity of the habitats they affect. The evaluation of impact severity and receptors sensitivity is done regarding the previously described environmental impact assessment process and according to the various consultations and meetings with stakeholders during the field study. This provides the level of impact (impact magnitude). The severity of the environmental impacts and sensitivity of the receptors are then combined through a matrix to obtain the magnitude of the impact. This matrix applies both to adverse and positive impacts. The specific criteria used to assess the magnitude of each type of environmental impact are those defined in the assessment of impacts.

Table 2: Magnitude matrix of environmental impacts (SETEC, 2019)

Impact severity	Not significant	Low	Medium	High	Major
Receptor sensitivity					
Low	Negligible	Low	Low	Low	Medium
Medium	Negligible	Low	Low	Medium	High
High	Negligible	Low	Medium	High	Major
Major	Low	Medium	High	Major	Major

- Following the identification and assessment of impacts, avoidance, reduction and impact compensation measures have been defined and numbered. The same measure can correspond to avoiding or mitigating several impacts.
- Finally, to correct previously identified impacts, these measures made it possible to carry out a new assessment of the impact's intensity. This is the mitigated impact or residual impact.

3.6.2 Temporary Impact during construction

3.6.2.1 Impact BioM-Hab-W-Temp-1: Effects of suspended matter and water turbidity

3.6.2.1.1 Exposure levels (impact severity)

As specified in the "Marine Impact Specialist Report", the construction conditions of the formwork, where the airstrip will cover part of the maritime domain, and the dredging in front of the boathouse will determine the intensity of the impact of the turbid plumes resulting from this phase of the works. It is assumed that all equipment available for marine construction is land-based, no contamination from maritime equipment is considered.

Filling the enclosing structure with sediment implies evacuating water once decantation is achieved. It is recommended to pump water from the fenced area and discharge into the ocean

in order to be able to regulate the flow rate and concentration of fine particles. The extent, intensity and persistence of construction generated sediment plumes are determined by hydrodynamic and quality numerical models under main hydrodynamic condition.

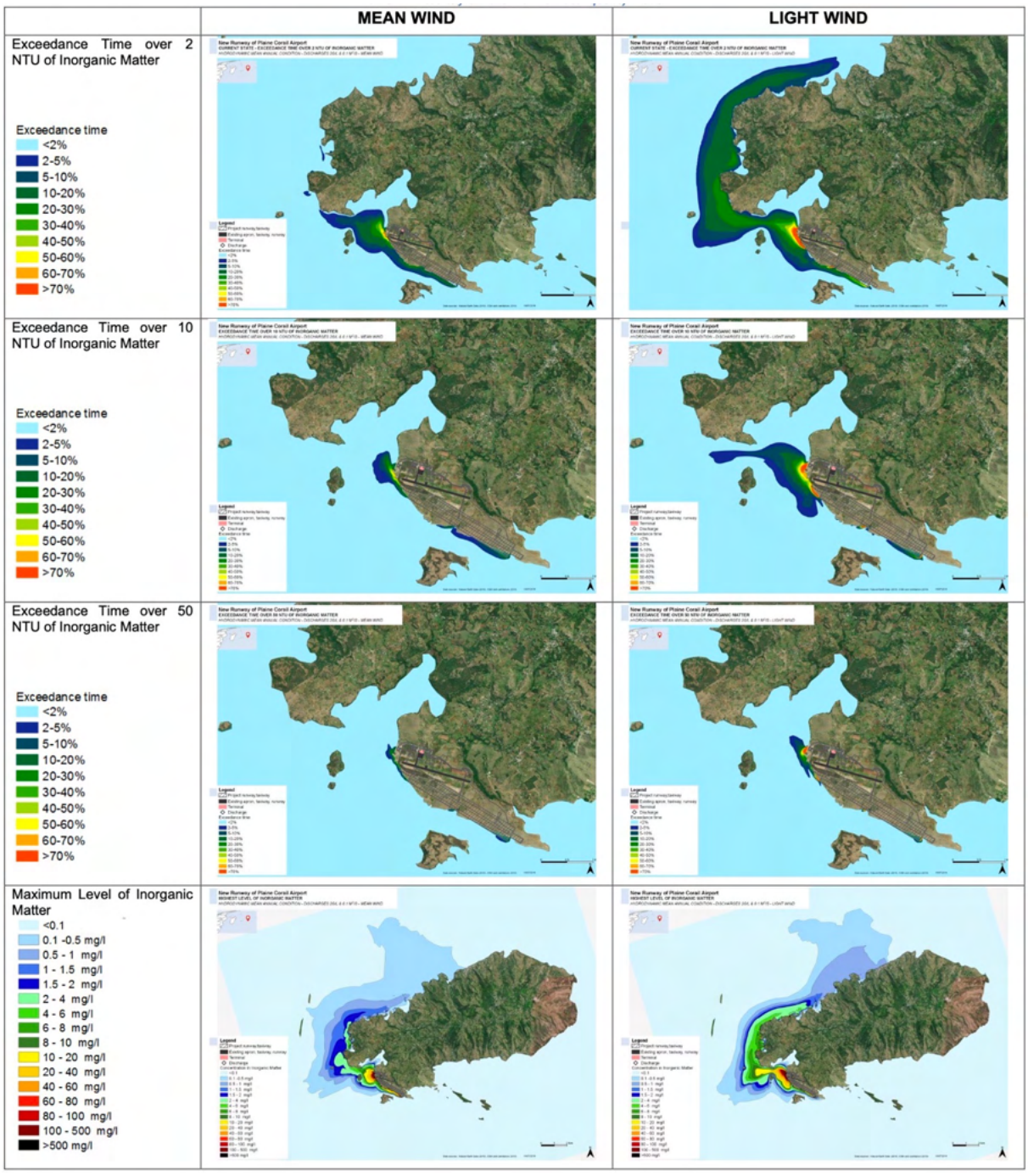


Figure 25: Results from the marine water quality model (SETEC, 2019)

An overall analysis of the temporal and special variability of the sediment plume highlights 4 main characteristics:

- The plume spreads in the same direction as the current (North-East);
- The level of inorganic matter is the highest at the West side of the new runway where the current is lower and so the dispersion is weaker;

- The inner and shallow part of Topaz Bay is not impacted which it consistent with the local circulation, almost non-existent in this area;
- Spatial variations in the lagoon are much greater with lighter wind. The plume reaches;
- North Bay with light wind but barely passes Pointe Mapou when mean wind blows, respectfully at 9.9km and 4.4km of the boathouse. With lighter wind, the plume tends to go farther west, up to 2km west from Fregate Island.

3.6.2.1.2 Impact magnitude before mitigation

Although all organisms are sensitive to high loads of suspended solids, whether direct impacts (degradation of branchial epithelia) or indirect (reduction of light penetration and therefore of photosynthesis), the hydrological measurements acquired during the April 2023 campaign, carried out under normal conditions at the end of the wet season (no heavy rain during the campaign), revealed very high turbidity values within and near Topaz Bay. We can therefore deduce a certain adaptation of ecosystems, in particular seaweed and seagrass beds, to high values of chronic turbidity. These values were maximum at the West side of the new runway (appendix 2).

Only the small fringing reef of the Mapou plain, whose benthic populations are composed mainly of corals of the *Acropora muricata* species, is moderately sensitive to an increase in the level of turbidity during the work phase. Indeed, although studies show a capacity for resistance to siltation in certain species of corals (Williams, 2001), this ability cannot be generalized to all species, in particular the genus Acropora, which are very sensitive to it. In addition, it is very likely that the mechanisms put in place weaken the organisms by monopolizing a significant part of their energy. In addition, by reducing the quality of available light (water turbidity), siltation leads to a reduction in the photosynthesis of zooxanthellae and consequently a reduction in the energy resources of the coral (Ogden, 1983). Organisms that can be satisfied with low light (non-coral sessile fauna: sponges, ascidians, gorgonians) can then be favoured (Williams, 2001).

The exposure level (impact severity) of the fringing reef dominated by *Acropora muricata* of the Plaine Mapou can be considered as major before reduction and its overall ecological sensitivity is estimated as medium. We can therefore consider that the **impact magnitude before reduction is High**.

3.6.2.1.3 Residual impact magnitude after mitigation

In addition to the reduction measures proposed in the "Marine Impact Specialist Report" (Phy-Mar-Mit1 to 4), the effect of which should significantly reduce the severity of the impact by confining the water loaded with inorganic suspended matter (by the effect of currents and water containment devices), the map of global ecological sensitivity reveals the presence of ecosystems highly resistant to turbidity and siltation within a radius of 1km around the footprint of the project. This ecological characteristic provides reduction measures with a relatively wide scope of implementation (particularly relating to the spreading and settling of formwork pumping water).

Assuming the application of Phy-Mar-Mit1 to 5 measures and in a context of very low sensitivity (not significant) of the ecosystems located within a radius of 1km around the footprint, only an

attenuated residual plume (high impact severity) should reach the fringing reef dominated by *Acropora muricata* (medium ecological sensitivity). **The residual impact magnitude after mitigation can therefore be estimated as Medium**.

3.6.2.2 Impact BioM-Hab-W-Temp-2: Effects of siltation and modification of the seabed

3.6.2.2.1 Exposure levels (impact severity)

The turbid plume also affects the seabed. Change in its composition might be detectable after the fine-sediment has settled down. Areas around the discharge location are the most impacted. The thickness of inorganic matter related to the construction can locally be larger than 10cm. Sediment deposits in the entrance of Topaz Bay reach a maximum of 5mm.

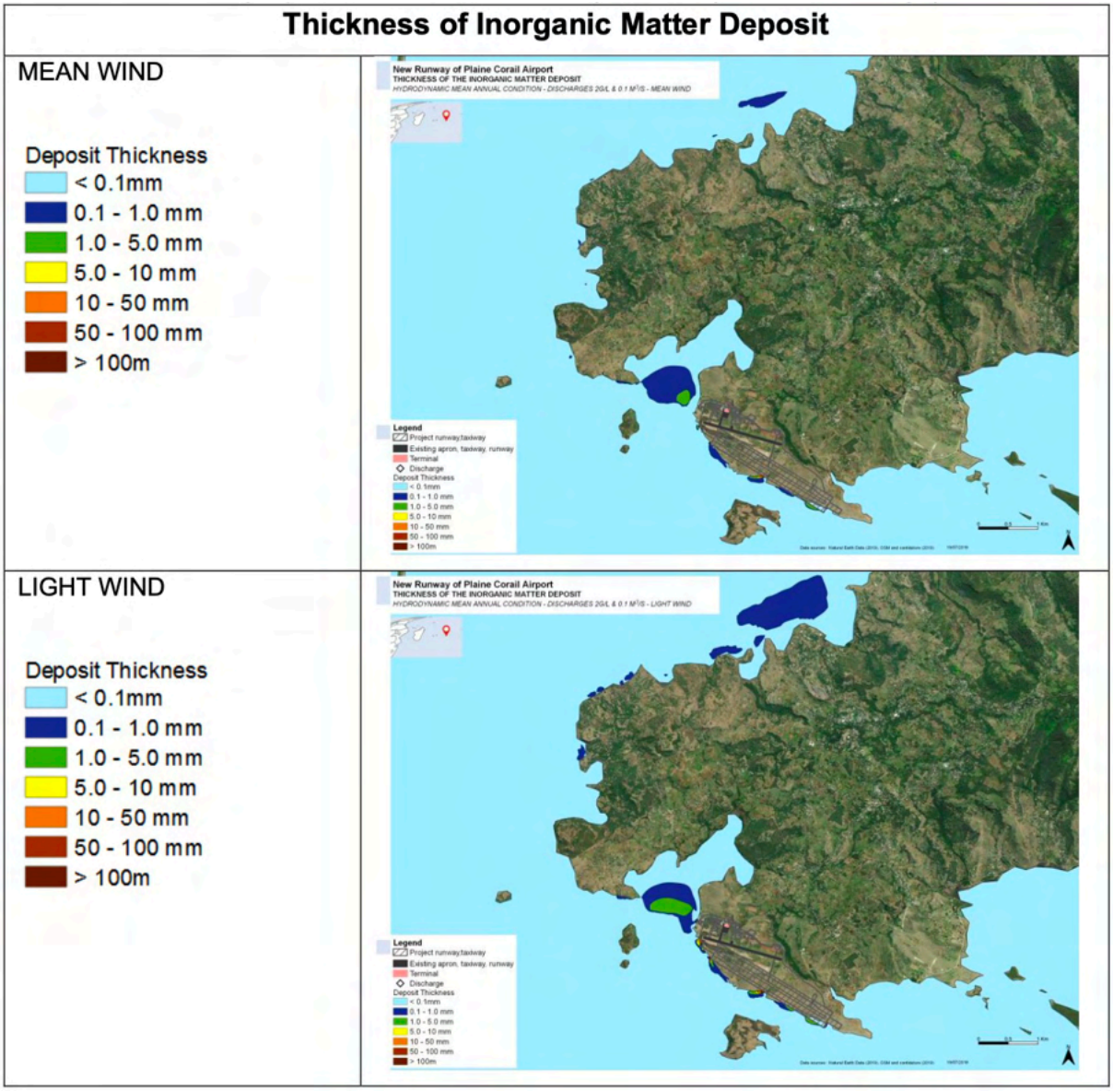


Figure 26: Thickness of siltation in the surrounding of Plaine Corail (SETEC, 2019)

3.6.2.2.1 Impact magnitude before mitigation

According to the dispersion model, the fine sediment layer decanted from the pumping water from the airstrip formworks should concern only the entrance to Topaz Bay, characterized by a muddy substrate where only a few burrowing organisms (crustaceans and lugworms) were observed and considered to be of non-significant ecological sensitivity.

However, the model shows a limited deposit (>1mm) at the level of the fringing reef of the Mapou plain. This low severity impact, considering that the fringing reef is already exposed to a silting phenomenon, provides a **Low impact magnitude**.

3.6.2.2.1 Residual impact magnitude after mitigation

The preceding mitigation measures can also be applied to limit the dispersion of the turbid plume and its effects on the marine sediment content. The proposed measures result in low severity mitigated impact. **The residual impact is of Low magnitude**

3.6.2.3 Impact BioM-Hab-W-Temp-3: Effects of wastewater treatment plant and desalination plant discharge

3.6.2.3.1 Exposure levels (impact severity)

Water supply needs during construction phase will logically lead to an increase in wastewater discharges. If discharges are made into the marine environment, it is necessary to know the extent of the plume. The extent, intensity and persistence of WWTP discharge plume are determined by hydrodynamic and quality numerical models under main hydrodynamic condition.

Hypothesis considered will be the same as those used for the Phy-Mar-Op-3 impact, which corresponds to the operation of the WWTP at the operational stage. It is therefore assumed that WWTP discharges during the construction phase will be lower than during the operational phase:

- 1 discharge located in the vicinity of the WWTP, near the boathouse;
- An average flow of 21.5m^3/d with a peak flow of 5,8m^3/h.

Water supply needs require the potabilization of water. The desalination process makes it possible to supply drinking water by pumping salt water and discharging brine. The extent, intensity and persistence of desalination plant discharge plume are determined by hydrodynamic and quality numerical models under main hydrodynamic condition.

Modelling hypotheses are listed below:

- 1 discharge located in the vicinity of the desalination plant, near the boathouse;
- Ambient salinity: 35ppm;
- Average flow, peak flow and salinity extracted from final design;
- Salinity of discharged water: 40ppm;
- Volume rejected: constant rejection of 5m^3/h.

The characteristics of the brine discharged (flow rate and salinity) are deduced from the consumption of fresh water. Thus, for a consumption of 21m^3/d, rounded up to 30m^3/d, the

daily flow discharged is equal to 120m^3/d. By integrating a buffer tank, the smoothed hourly flow rate is equal to 5m^3/h.

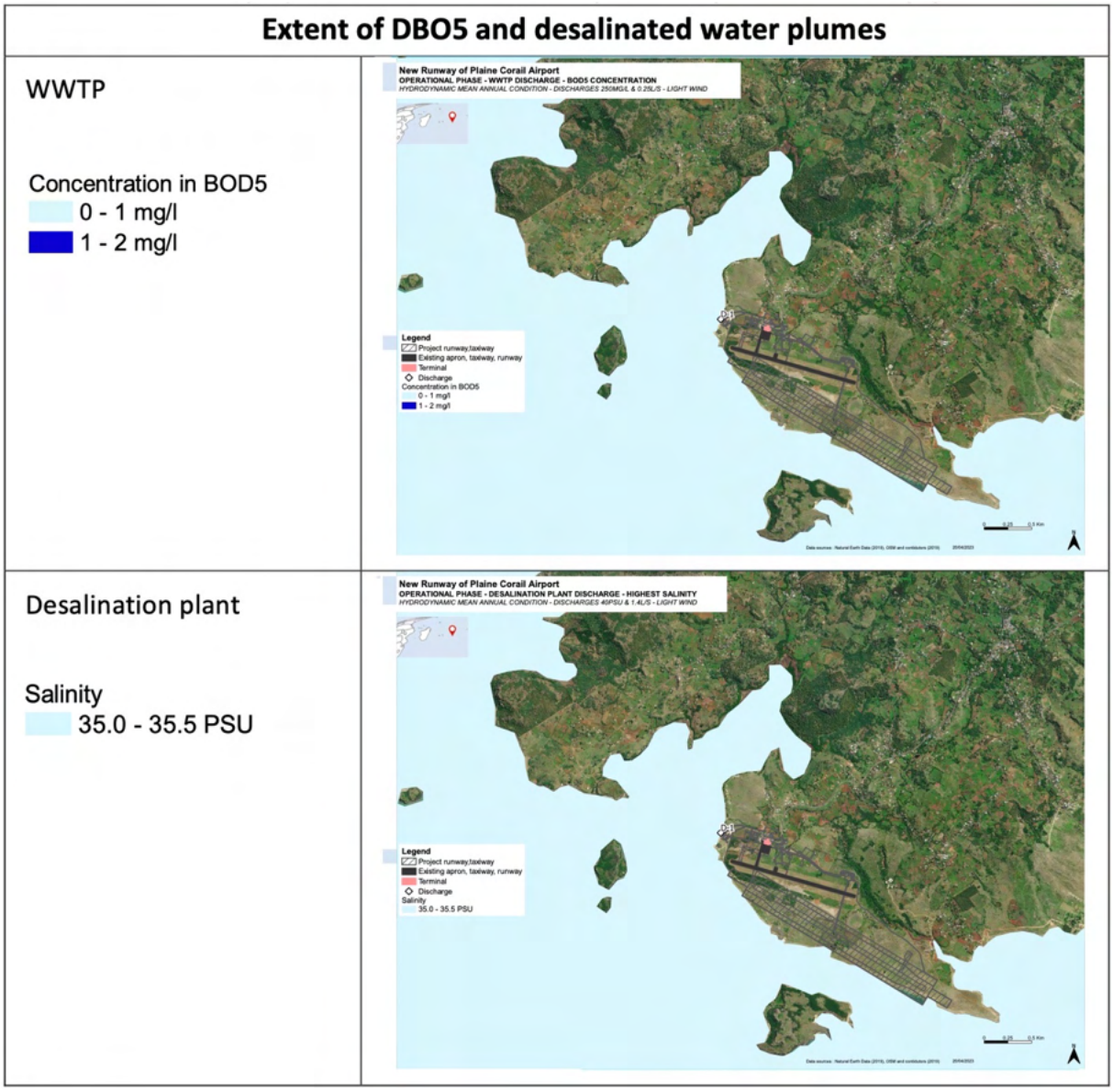


Figure 27: Water plumes of WWTP and desalination plant (SETEC, 2019)

3.6.2.3.1 Impact magnitude

Although the discharge water from a wastewater treatment plant and the brine from a desalination plant can have very significant impacts on biological populations, the very low discharge volumes from the facilities envisaged under this project and the rapid dilution of the plumes within a radius of a few tens of meters tend to minimize this risk of impact. Indeed, the communities located within a radius of 1km around the supposed discharge point of the facilities (near the new boatway) have a very low ecological sensitivity.

The severity of the impact within a radius of a few tens of meters can be estimated as high, but the sensitivity of the ecosystems concerned is estimated as very low. In this context, **the magnitude of the impact can be estimated as Low**.

3.6.2.4 BioM-Spe-W-Temp-1: Temporary impact during construction on sea turtles

3.6.2.4.1 Exposure levels (impact severity)

Still on the basis of the hypothesis of work carried out on land (therefore without risk of collision with the megafauna in the marine environment), the main pressures likely to disturb sea turtles, both in feeding and in reproduction, are noise and light pollutions, mainly at night. If the data on the phasing of the construction stages of the new airstrip will be extracted from the final design, it is common for certain airport extension stages to be carried out at night so as not to disrupt air traffic, which takes place mainly from day.

In the event of carrying out certain stages of construction at night, the proximity (less than 500m) of the egg-laying site of the Crabs Island must be the subject of specific measures in order to avoid any temporary or permanent abandonment by female turtle populations.

3.6.2.4.1 Impact magnitude before mitigation

If the sense of smell and hearing of sea turtles seem relatively weak, their vision is on the other hand very developed. The great particularity of sea turtles lies in their exceptional sense of direction. During their lifetime, these species frequent very different environments (growth and development areas, feeding sites, egg-laying beaches), sometimes several thousand kilometers apart, which they reach cyclically during major migrations.

This sense of orientation is related to a multifactorial coupling involving several senses, including sight, particularly during impregnation with site fidelity (homing) and orientation during juvenile emergence and the first course towards the ocean (Claro and Bardonnet, 2011). Disturbance of these senses by coastal developments, nocturnal frequentation of egg-laying sites by visitors or domestic animals can profoundly frighten and disorient turtles, both during emergence, egg-laying climbs and in a few observation situations. tens of meters offshore, during their active search for spawning sites.

Thus, if the severity of the impact is to be defined, sea turtles can be considered as highly sensitive to light disturbances. **The impact magnitude will therefore depend on whether or not the night work phases are carried out**.

3.6.2.4.1 Residual impact magnitude after mitigation

Two types of measures can be proposed which, if taken early in the decision-making process related to the development of the site, do not represent a significant additional cost. First (BioM-Mit-1), the type and orientation of lighting can significantly reduce the impact of artificial light on wildlife. Thus, by judiciously positioning the lights, they can be concealed on the sea side and avoid any nuisance beyond the limits of the concession to be secured.

The second (BioM-Mit-2) type of measurement concerns the choice of the type of lamp. Lamps with a broad spectrum or emitting strongly in the blue (mercury vapor, blue LEDs) should be avoided in favor of lamps with yellow, amber to red light (sodium vapor, yellow LEDs) (Tab. 15). Indeed, sea turtles are extremely sensitive to blue and green lights, but much less to yellow, orange and red lights.

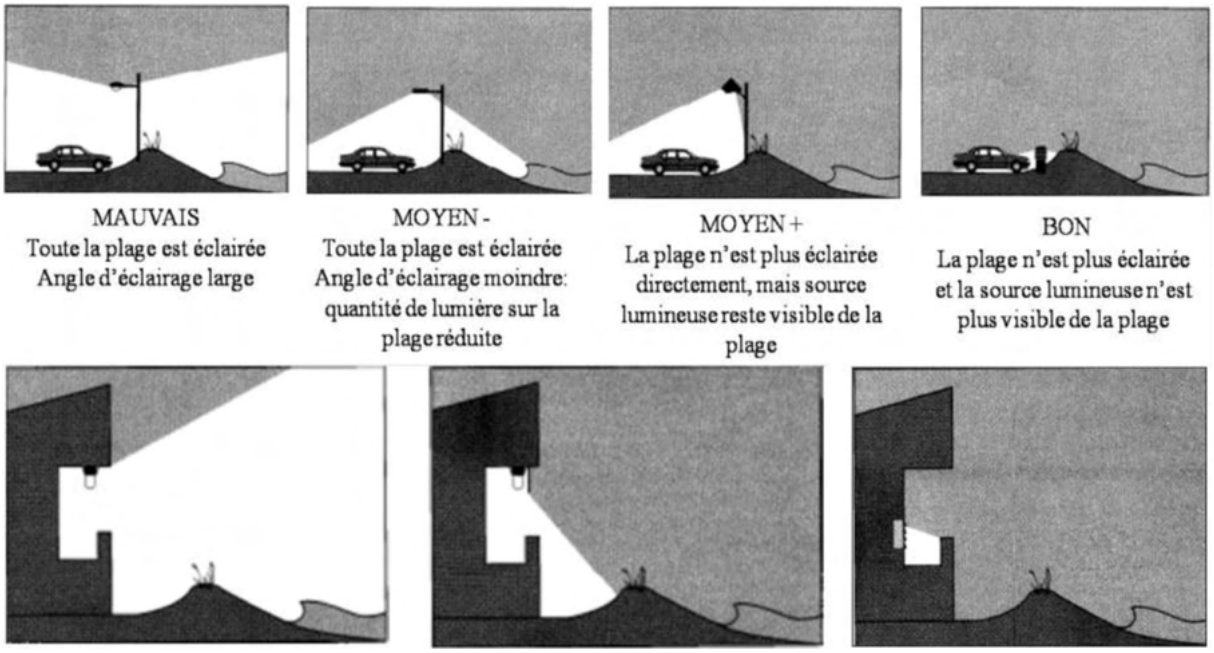


Figure 28: Effect of orientation, lamp post height and installation of light shields on beach illuminance (Witherington and Martin, 1996).

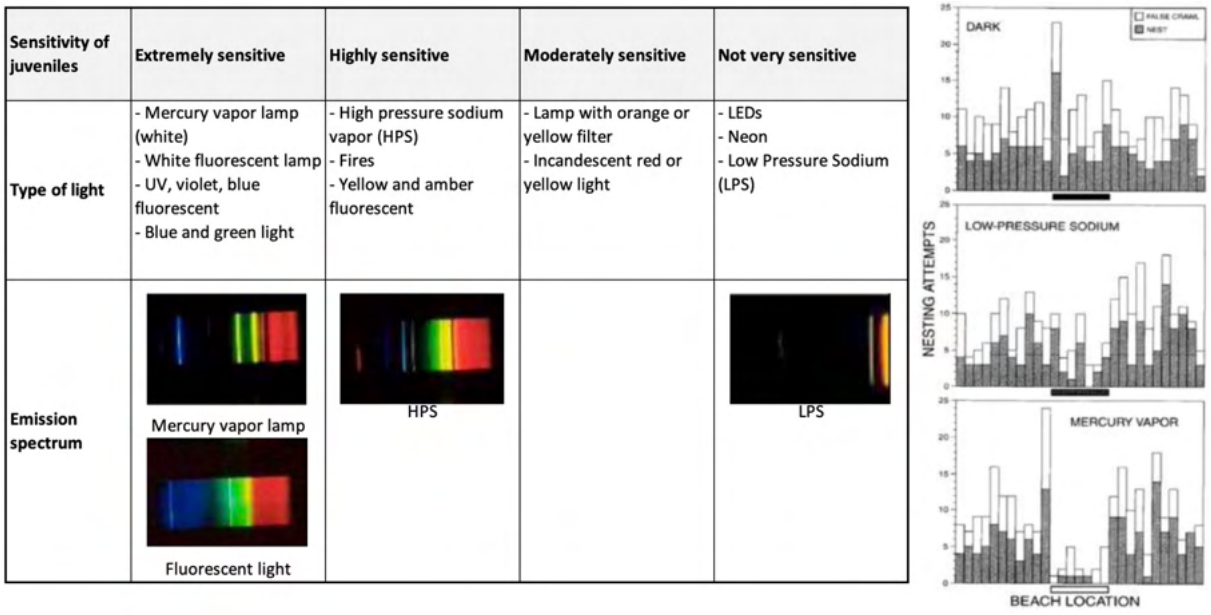


Figure 29: Example of a classification of the different types of light according to the sensitivity of a sea turtle species (left) and the effect of the nature of the lighting on nesting behavior in the Green Turtle (right) (Gorjux et al., 2006; Witherington and Martin, 1996).

In the event that some work is carried out at night, if mitigation measures are applied, the severity of the impact will be greatly reduced (medium to low). Thus, **the magnitude of the impact can be estimated as Low**. Assuming work carried out exclusively during the day, the magnitude of the impact can be considered **Negligible**.

3.6.2.5 BioM-Spe-W-Temp-1: Temporary impact during construction on marine mammals

Marine mammals were assessed as being of low sensitivity due to their low attendance at the study site (too shallow depths). Thus, although they can also be disturbed by noise and light pollution, especially at night, **the impact magnitude on marine mammals can be considered as Low**.

3.6.2.6 Summary

Table 3: Temporary Impact during Construction

	Impact ID	Impact name	Direction	Impact mitigation	Measure ID	Avoidance and Mitigation Measures	Residual impact
Marine habitat	BioM-Hab-W-Temp-1	Effects of suspended matter and water turbidity on ecosystems	Adverse	High	None	Apply measures to reduce water turbidity (Phy-Mar-Mit-1 to 5)	Medium
	BioM-Hab-W-Temp-2	Effects of siltation and modification of the seabed on ecosystems	Adverse	Low	None	Apply measures to reduce water turbidity (Phy-Mar-Mit-1 to 5)	Low
	BioM-Hab-W-Temp-3	Effects of WWTP and desalination plant discharge on ecosystems	Adverse	Low	None	Low volumes discharged and low sensitivity of adjacent ecosystems	Low
Marine species	BioM-Spe-W-Temp-1	Temporary impact during construction on sea turtles	Adverse	To define	BioM-Mit/-1	Type and orientation of lighting can reduce the impact of artificial light on wildlife	Low
					BioM-Mit/-2	Lamps with a broad spectrum or white light should be avoided in favor of lamps with yellow, amber to red light	
	BioM-Spe-W-Temp-2	Temporary impact during construction on marine mammals	Adverse	Low	None	Low attendance of marine mammals at the study site (too shallow depths).	Low

3.6.3 Permanent and irreversible impacts during construction

3.6.3.1 Impact BioM-Hab-W-Def-1: Effect of alteration of the local bathymetry and shoreline

3.6.3.1.1 Exposure levels (impact severity)

Although the vast majority of the project footprint is located on emerged land, three embankments, with a total surface area of 2.5ha, will be carried out on the maritime domain (intertidal zone) according to the plans of January 2023 from the Airport of Rodrigues Ltd.

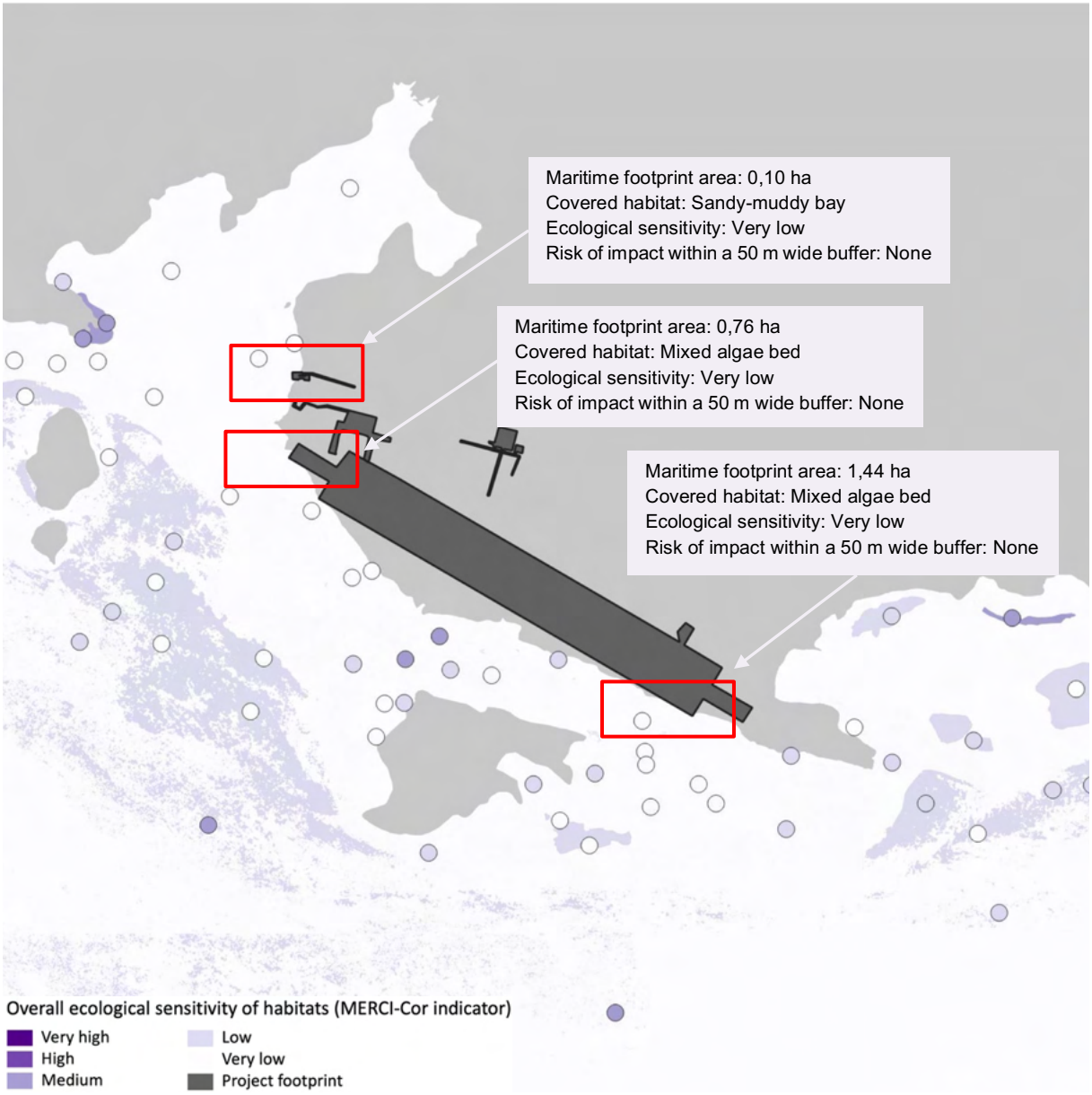


Figure 30: Location of the three embankment areas on the map of global ecological sensitivity (MAREX, 2023)

Mechanical damage may be due to the covering of the substrate by construction materials, direct contact with tools or various mechanisms likely to cause collateral damage (temporary anchors, chafing of mooring chains, etc.). However, no dredging operation is planned at this

stage of the project. Thus, in addition to the footprint itself, concerned by a risk of permanent recovery, a close perimeter of 50m, located around the offshore project infrastructure, can be considered as subject to the transient risk of mechanical damage.

3.6.3.1.1 Impact magnitude before mitigation

The impacts concern the permanent cover of 1.4ha of sublittoral rocks dominated by Ochrophyta, 0,8ha of algae bed dominated by Rhodophyta and 0.10ha of muddy bay, these three habitats being of very low ecological sensitivity. To these definitively covered surfaces can be added the 50m wide buffers, which represent 5.7ha of mixed algae bed and muddy bay, subject to temporary pressures (risk of mechanical damage during the works).

The impact severity is major but the sensitivity of the ecosystems concerned is very low. The **magnitude of the impact before reduction is therefore Medium**.

3.6.3.1.1 Residual impact magnitude after mitigation

A few coral heads were observed on the sublittoral rocks, near the formworks. These coral heads may be avoided (BioM-Av-1) during the works phase or moved a few dozen meters beyond the footprint of the dikes before the start of the works. These few coral heads avoided, **the magnitude of the impact can be qualified as Low**.

3.6.3.2 Impact Phy-Mar-W-Def-2: Effect of modification of the sediment transit

3.6.3.2.1 Exposure levels (impact severity)

The extension of the airport will change the coastline geometry, seabed morphology and flow pattern leading to changes in sediment balance, transport and deposition regime. Areas exposed to current and wave action are different from before the construction. The sedimentary composition of the seabed has changed: new sediments are available in the vicinity of the discharge and sediment that used to be on the area reclaimed from the sea has been replaced by artificial structure, non-erodible. A numerical sediment transport model was constructed and exploited to identify deposit/erosion areas and sediment movement pattern in general.

3.6.3.2.1 Impact magnitude

The results of the sediment deposition and erosion model around the sea dykes of the new airstrip show a main effect at the east end of the airstrip (Fig. 31a and b), marked mainly by erosion that can reach several centimeters. However, this erosion will probably not take place, given the hard nature of the substrate in the places considered (sublittoral rock).

At the other end of the airstrip, the bathymetric modifications will be more erratic (mixture of erosion and deposition) and less extensive (more or less a few centimeters in height). They will concern a soft sandy-muddy substrate, dominated by an assemblage of Rhodophyta of very low ecological sensitivity. It is also likely that the algal cover naturally attenuates sedimentary movements at this place.

Due to the very low sensitivity of the ecosystems concerned and the low impact severity, **the impact magnitude can be considered Negligible**.

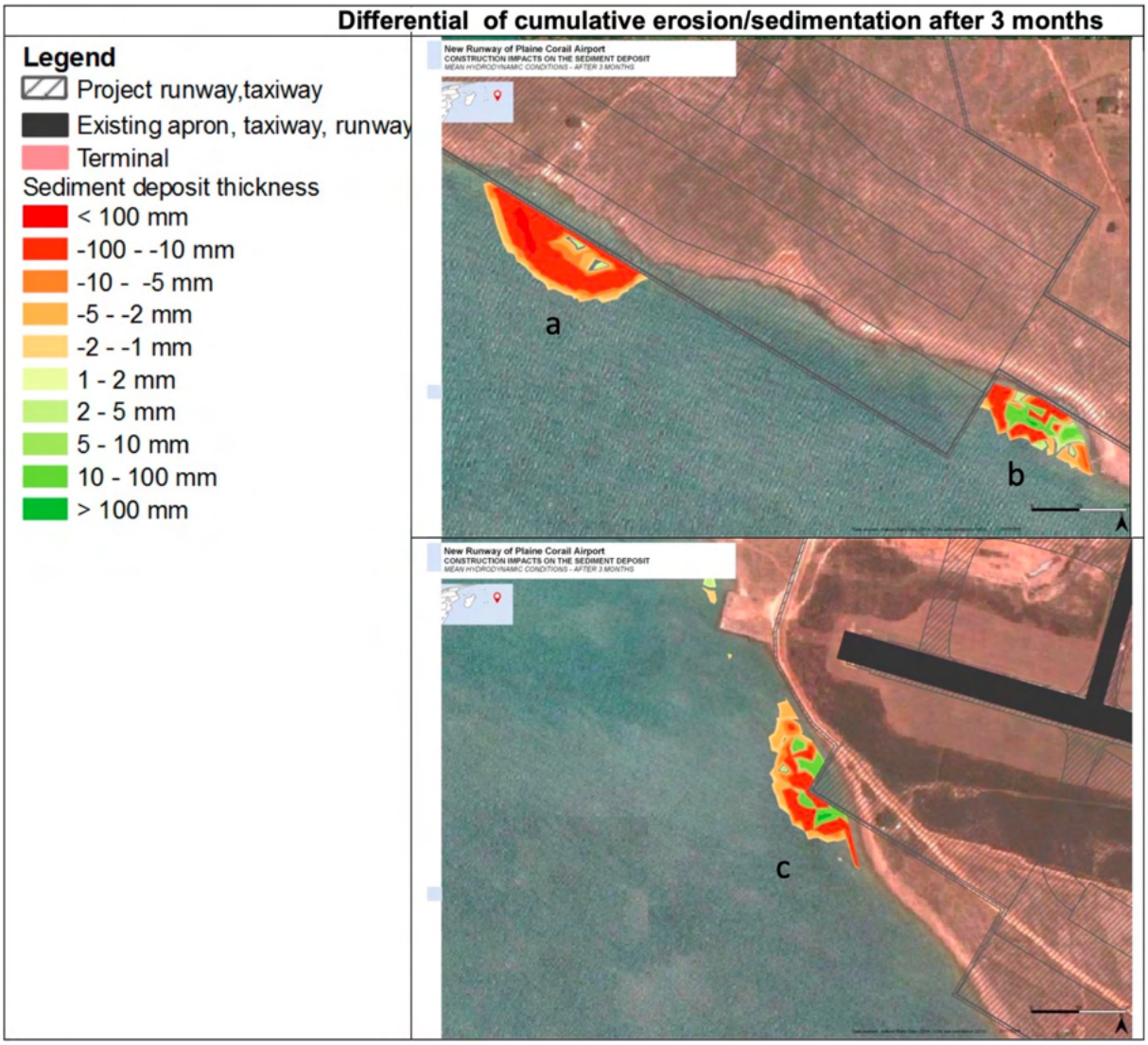


Figure 31: Impact on sediment deposit due to the construction of the Runway (SETEC, 2019)

3.6.3.3 BioM-Spe-W-Def-1: Permanent impact during construction on sea turtles

3.6.3.3.1 Exposure levels (impact severity)

As with the estimation of temporary impacts, the level of exposure of sea turtles to noise and light pollution will depend on the final design of the project, which remains to be defined. However, it will depend on whether or not the night work phase is carried out. In the extreme and unlikely case of high intensity nocturnal nuisances (sound and light), prolonged over a long period (extension of the works within the framework of administrative derogations), the nesting site of the Crabs Island could be permanently abandoned (maybe not definitively, but over several years).

3.6.3.3.2 Impact magnitude before mitigation

If the severity of the impact is to be defined, sea turtles can be considered as highly sensitive to light disturbances. **The impact magnitude will therefore depend on whether or not the night work phases are carried out**.

3.6.3.3.3 Residual impact magnitude after mitigation

In the event that some work is carried out at night, if the same mitigation measures are applied as for temporary impacts, the severity of the impact will be greatly reduced (medium to low) and the exposure time will probably be too short to cause a risk of permanent abandonment of the egg-laying site. Thus, **the magnitude of the impact can be estimated as Low**. Assuming work carried out exclusively during the day, the magnitude of the impact can be considered **Negligible**.

3.6.3.4 BioM-Spe-W-Def-2: Permanent impact during construction on marine mammals

Marine mammals were assessed as being of low sensitivity due to their low attendance at the study site (too shallow depths). Thus, although they can also be disturbed by noise and light pollution, especially at night, **the impact magnitude on marine mammals can be considered as Low**.

3.6.3.5 Summary

Table 4: Permanent and irreversible Impact during Construction

	Impact ID	Impact name	Direction	Impact mitigation	Measure ID	Avoidance and Mitigation Measures	Residual impact
Marine habitat	BioM-Hab-W-Def-1	Effect of alteration of the shoreline on ecosystems	Adverse	Medium	BioM-Av-1	Avoid or move sparse coral heads located at the edge of the project	Low
	BioM-Hab-W-Def-2	Effect of modification of the sediment transit on ecosystems	Adverse	Negligible	None	-	Negligible
Marine species	BioM-Spe-W-Temp-1	Permanent effects during construction on sea turtles	Adverse	To define	BioM-Mit/-1	Appropriate choice of orientation and type of lamp	Low
					BioM-Mit/-2	Appropriate choice of lamp diffusion spectrum	
	BioM-Spe-W-Temp-2	Permanent effects during construction on marine mammals	Adverse	Low	None	Low attendance of marine mammals at the study site (too shallow depths).	Low

3.6.4 Permanent and irreversible impacts during operation

3.6.4.1 BioM-Hab-Op-1: Effect of accidental spillage

3.6.4.1.1 Exposure levels (impact severity)

The activities of the airport and the jetty facilities will not impact the marine physical environment on their normal operational phase. However, airport operational activities use various chemicals and dangerous substances. Accidental spills or leaks of solid or liquid waste into the surroundings of the airplane or jetty during operations might occur and result in marine water contamination.

3.6.4.1.1 Impact magnitude before mitigation

Without being able to really estimate the risk of occurrence of a major accident during the operation phase of the airport, without specific measures, this accident would have a major intensity (spill in the marine environment). Despite the absence of sensitive ecosystems within a radius of 1km around the footprint of the future airstrip, hydrocarbons, by nature lighter than water, can spread over very large areas, in the form of fine impermeable pellicles on the surface of the ocean and reach the most sensitive ecosystems, located approximately 1 km from the study site.

In this context, the severity of the impact is major and the ecological sensitivity average, resulting in a **High impact magnitude.**

3.6.4.1.2 Residual impact magnitude after mitigation

The “Marine Impact Specialist Report” recommends two mitigation measures: (Phy-Mar-Mit-6) Prevent spills and accidents by training personnel to avoid spills and (Phy-Mar-Mit-7) Implement rapid pollutant containment and treatment methodologies and spill clean-up protocols.

After the implementation of the spill risk reduction measures Phy-Mar-Mit-6 and 7, the severity of the impact can be estimated as low. Thus, **the residual impact is of Low magnitude**.

3.6.4.2 BioM-Hab-Op-2: Effects of wastewater treatment plant and desalination plant discharge

3.6.4.2.1 Exposure levels (impact severity)

In the absence of technical data on the load capacities and abatement levels of the primary treatment of the Sewer Treatment Plant (septic tank), no dispersion model specific to this permanent installation could be provided by SETEC.

Thus, in order to estimate the severity of the impact generated during the operating phase by the two facilities:

- The Sewer Treatment Plant
- The Potable Water Supply

We started from the hypothesis of a conservation of the technical characteristics of the WWTP and the desalination plant deployed during the works phases.

In the probable hypothesis of a significant extension of these facilities in the medium term, in order to meet the operating needs of the new airstrip in the long term, a specific impact study will have to be programmed, on the basis of the already made biological inventories.

3.6.4.2.1 Impact magnitude

Although the discharge water from a wastewater treatment plant and the brine from a desalination plant can have very significant impacts on biological populations, the very low discharge volumes from the facilities envisaged under this project and the rapid dilution of the plumes within a radius of a few tens of meters tend to minimize this risk of impact. Indeed, the communities located within a radius of 1km around the supposed discharge point of the facilities (near the new boatway) have a very low ecological sensitivity.

The severity of the impact within a radius of a few tens of meters can be estimated as high, but the sensitivity of the ecosystems concerned is estimated as very low. In this context, **the magnitude of the impact can be estimated as Low**.

3.6.4.3 BioM-Hab-Op-3: Effects of stormwater drainage

3.6.4.3.1 Exposure levels (impact severity)

The implementation of the new airstrip will alter stormwater runoff and may increase freshwater input to some coastal areas. The magnitude of these potential freshwater plumes has been modelled to estimate their impact on marine life. The extent, intensity and persistence of stormwater drainage plume are determined by hydrodynamic and quality numerical models under main hydrodynamic condition (SETEC, 2023).

It should be noted that stormwater runoff also occurs today, before the construction of the new airstrip. However, this will generate a waterproofing which will result in an increase in the phenomenon of runoff. It can therefore be considered that the severity of the stormwater impact only concerns the part that would have been infiltrated by the ground without the airstrip, which represents a lesser severity than that of the model.

It is also important to specify that runoff water will pass through settling ponds and will be treated for the recovery of hydrocarbons leached on the impermeable surfaces of the airstrip (“Specialist Report for Water Management”). The water discharged into the sea will therefore be depolluted, on the assumption that the stormwater treatment facilities will operate optimally.

3.6.4.3.1 Impact magnitude

The stormwater drainage discharge points, located at both ends of the new airstrip, will produce desalinated plumes in stormy weather subject to the general current. Their small surface area and their confinement close to the coast are in favour of a low severity impact. In addition, the habitats located in front of the discharge points (Algae bed dominated by Rhodophyta - D1 and Sublittoral rocks dominated by Ochrophyta - D2) have a very low ecological sensitivity, in particular to haline anomalies, these ecosystems being located in intertidal zone. **The magnitude of the impact can be considered Low**.

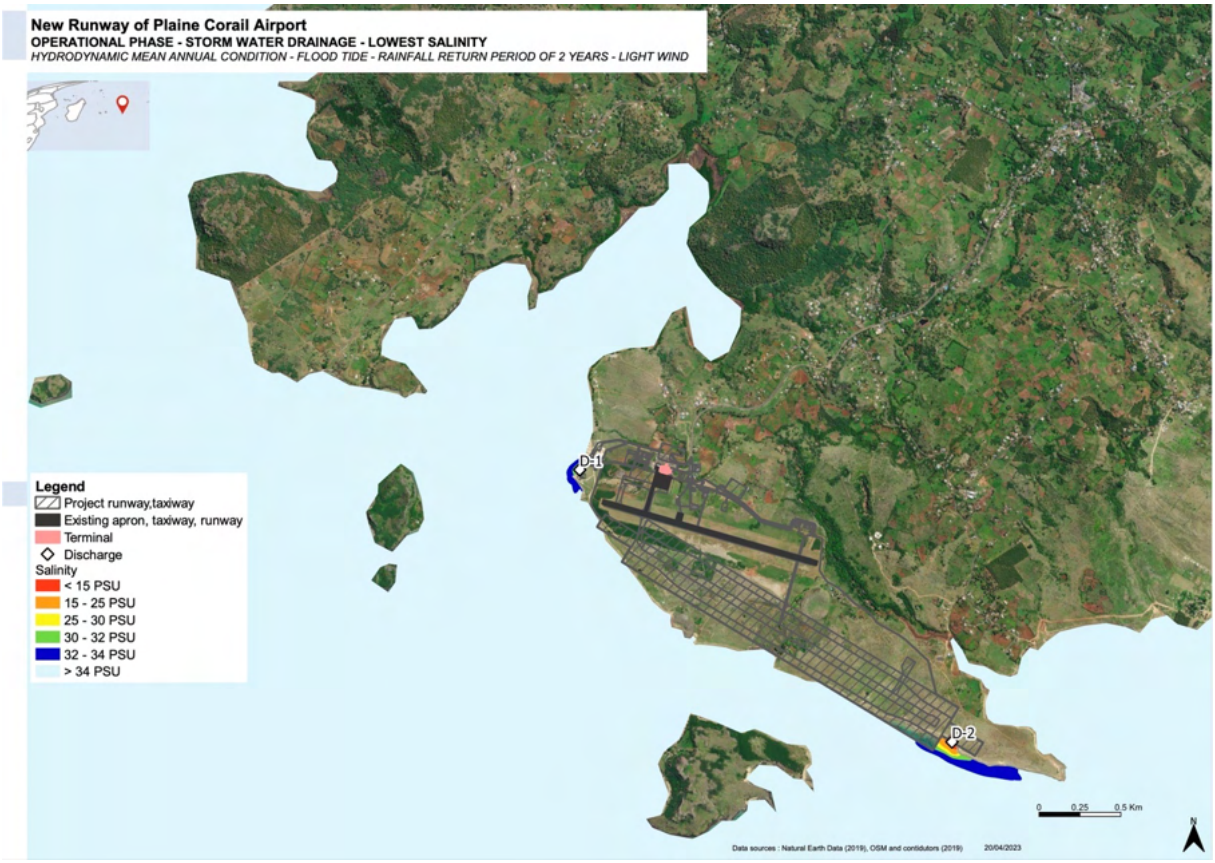


Figure 32: Sormwater drainage plumes model (SETEC, 2023)

3.6.4.4 BioM-Spe-W-Def-1: Permanent effects during operation on sea turtles

3.6.4.4.1 Exposure levels (impact severity)

As with the estimation of impacts during construction, the level of exposure of sea turtles to noise and light pollution will depend on the final design of the project, which remains to be defined. This impact will depend on the lighting design and the nocturnal illumination schedules of the airstrip and the adjoining infrastructures (security, operations).

Although the information on the nature, number and intensity of the lighting provided for the infrastructures is subject to the Civil Aviation Code - all Airfield Ground Lighting (AGL), Navaids and illuminated signage provided for the runway will be compliant with the ICAO - reduction measures may be provided.

3.6.4.4.2 Impact magnitude before mitigation

If the severity of the impact is to be defined, sea turtles can be considered as highly sensitive to light disturbances. **The impact magnitude will therefore depend on the lighting design and the nocturnal illumination schedules of the airstrip and the adjoining infrastructures**.

3.6.4.4.3 Residual impact magnitude after mitigation

In the event that the lighting design and lighting schedules of the airstrip allow for significant lighting beyond 9 p.m., if the same mitigation measures are applied as for impacts during construction, the severity of the impact will be greatly reduced (medium to low). Thus, **the magnitude of the impact can be estimated as Low**.

3.6.4.5 BioM-Spe-W-Def-2: Permanent effects during operation on marine mammals

Marine mammals were assessed as being of low sensitivity due to their low attendance at the study site (too shallow depths). Thus, although they can also be disturbed by noise and light pollution, especially at night, **the impact magnitude on marine mammals can be considered as Low**.

3.6.4.6 Summary

Table 5: Permanent and irreversible Impact during Operation

	Impact ID	Impact name	Direction	Impact mitigation	Measure ID	Avoidance and Mitigation Measures	Residual impact
Marine habitat	BioM-Hab-Op-1	Effect of accidental spillage on ecosystems	Adverse	High	None	Apply measures to reduce accidental impact (Phy-Mar-Mit-6 and 7)	Low
	BioM-Hab-Op-2	Effects of WWTP and desalination plant discharge on ecosystems	Adverse	Low	None	-	Low
	BioM-Hab-Op-3	Effects of stormwater drainage on ecosystems	Adverse	Low	None	-	Low
Marine species	BioM-Spe-Op-1	Permanent effects during operation on sea turtles	Adverse	To define	BioM-Mit/-1	Appropriate choice of orientation and type of lamp	Low
					BioM-Mit/-2	Appropriate choice of lamp diffusion spectrum	
	BioM-Spe-Op-2	Permanent effects during operation on marine mammals	Adverse	Low	None	Low attendance of marine mammals at the study site (too shallow depths).	Low

3.7 Cumulative and synergistic effects

3.7.1 Carbon footprint and climate change

Developed in the context of ecological transition incumbent on any organization, the carbon footprint (estimated in volumes of CO_2) is a tool for measuring the impact of an entity (individual or collective) on the climate. It can be direct (transport, industry) or indirect, such as that generated by the manufacture and transport of worksite products. According to the December 2019 report by the NGO Transport & Environment, European maritime transport of goods and passengers generated more than 139 million tons of CO_2 in 2018, much more than car transport. However, CO_2 coupled with methane and nitrous oxide account for almost 95% of the Greenhouse Gases (GHGs) targeted by the Kyoto Protocol.

Given the global scale of the phenomenon, it is difficult to isolate the specific contribution of an activity or a territory to climate change. However, this process, which has been underway for several decades, has an increasingly distinct impact on all living organisms on land and at sea. Since 1998, the Rodrigues lagoon has successively suffered major environmental crises, more or less directly linked to climate change, all marine organisms (coral bleaching, reduction of seagrass beds, episodes of epizootics, imbalance in the sex ratio of sea turtle births, sensory disorientation of marine mammals, etc.).

In this context, the contribution of CO_2 emissions related to the work and operation of this project to global climate change can be considered **High** and **Permanent** and represents a potential lever for action in favor of the environment.

3.7.2 Synergistic impact

Synergistic impact refers to the results of the combination of several factors or impacts that contribute to a given effect. Considered individually, these factors or impacts may be of little interest, whereas they take on a significant dimension when combined. Synergistic effects are considered at two levels: synergy between the repercussions specific to an intervention and synergy between the individual or combined repercussions of an intervention and the environment in which it is implemented (Environmental Dictionary, 2010).

In the case of this project, the cumulative effect of noise and light pollution and water turbidity contributes to the sensory disorientation of organisms, mainly sea turtles, and to the solicitation of additional energy resources by photosynthetic benthic organisms (corals, seagrasses), during their growth and the synchronization of their reproductive events.

In this sense, the synergistic impact of these different pressures on the organisms in the study area can be considered as **Medium** and **Permanent**.

3.8 Feasibility and sizing of compensatory measures

At the end of the environmental impact study on marine biocenoses, only the effect of the turbid plume during the works phase (BioM-Hab-W-Temp-1) retains a residual impact (after implementation of avoidance and reduction measures) of medium magnitude. This impact specifically concerns the small fringing reef dominated by the protected coral species *Acropora muricata*, located on Pointe Mapou, 1km downstream from the current, located on the northwest coast of the Topaz Bay.

The ecological sensitivity of this small reef has been estimated as medium due to its already largely degraded state of health before the initiation of the construction phase of the airport runway and the low richness of the biological communities that inhabit it. These two observations are the consequence of a progressive and chronic degradation of the abiotic conditions of the environment (coastal water desalination, increase in turbidity, warming of sea surface temperature) for several decades.

These degradations are themselves the intertwined consequence of climate change (water warming and rainfall disturbances) and rapid human development, particularly around town centers (La Fouche, La Ferme, Maréchal, Cascade Jean Jacques, Plaine Corail), from the south of Rodrigues Island. This development leads to a new occupation of land for housing, collective infrastructure (transport, schools, sanitation, fresh water and energy plants, etc.), roads, agriculture, pastoral activity and small industries, all these activities having an impact on the environment.

Developing a compensation measure in favor of the fringing reef of Pointe Mapou must above all consider this dynamic context of the marine and coastal environment of the southern sector of Rodrigues Island.

The study of marine habitats also revealed a study site largely dominated by soft substrates (more than 90% of the total surface) and a trend towards degradation of all sampled fringing reefs, some of which had already been totally dead for several years. This context is not in favor of transplanting endangered corals, any attempt to move all or part of the Pointe Mapou reef would then be limited by:

- The very poor state of health of the colonies to be moved (diseases, necrosis, biofouling, etc.), which would cause very high mortality within the transplants and potentially within the host site (cross-contamination),
- The absence of a host site with both available hard sublittoral substrates and favorable abiotic conditions for coral development (low turbidity, stable salinity and temperature) within a sufficiently small area for the operation to be technically feasible.

Thus, despite the persistence of a temporary impact on water quality (turbidity) during the construction phase, it is proposed to focus the compensation measures towards reducing the synergistic impact, by participating in improving the general abiotic conditions of the study site. These measures relate to:

- The revegetation of the riparian forests and the coasts of Topaz Bay by native species adapted to the climate of the south of the island and to the recurrent water stresses;

- Support for the development of mangroves with *Rhizophora mucronata* by planting propagules (viviparous seedlings), collected on site, directly through the sediment.

In the event of a choice in favor of compensation measures carried out on the watershed, as proposed above, a feasibility study must be carried out in order to determine:

- The cadaster and territorial division of the natural spaces surrounding Topaz Bay;
- The most relevant species combining robustness, adaptation to climate change, growth and nativity ("Specialist Report for Terrestrial Biodiversity");
- The nurseries likely to produce the necessary plants;
- The companies potentially carrying the planting, maintenance and replacement of dead plants project over a period to be determined of 2 to 5 years;
- The production, maintenance and labor costs.

Particular attention should also be paid to the proper implementation of the Phy-Mar-Mit-1 to 5 reduction measures, guaranteeing a limitation of the impact of the turbid plume on the coastal water mass during the construction phase.

These compensation measures are also consistent with the Plaine Corail airport extension project, which will have the indirect effect of increasing pressure on land use in the south of Rodrigues Island.

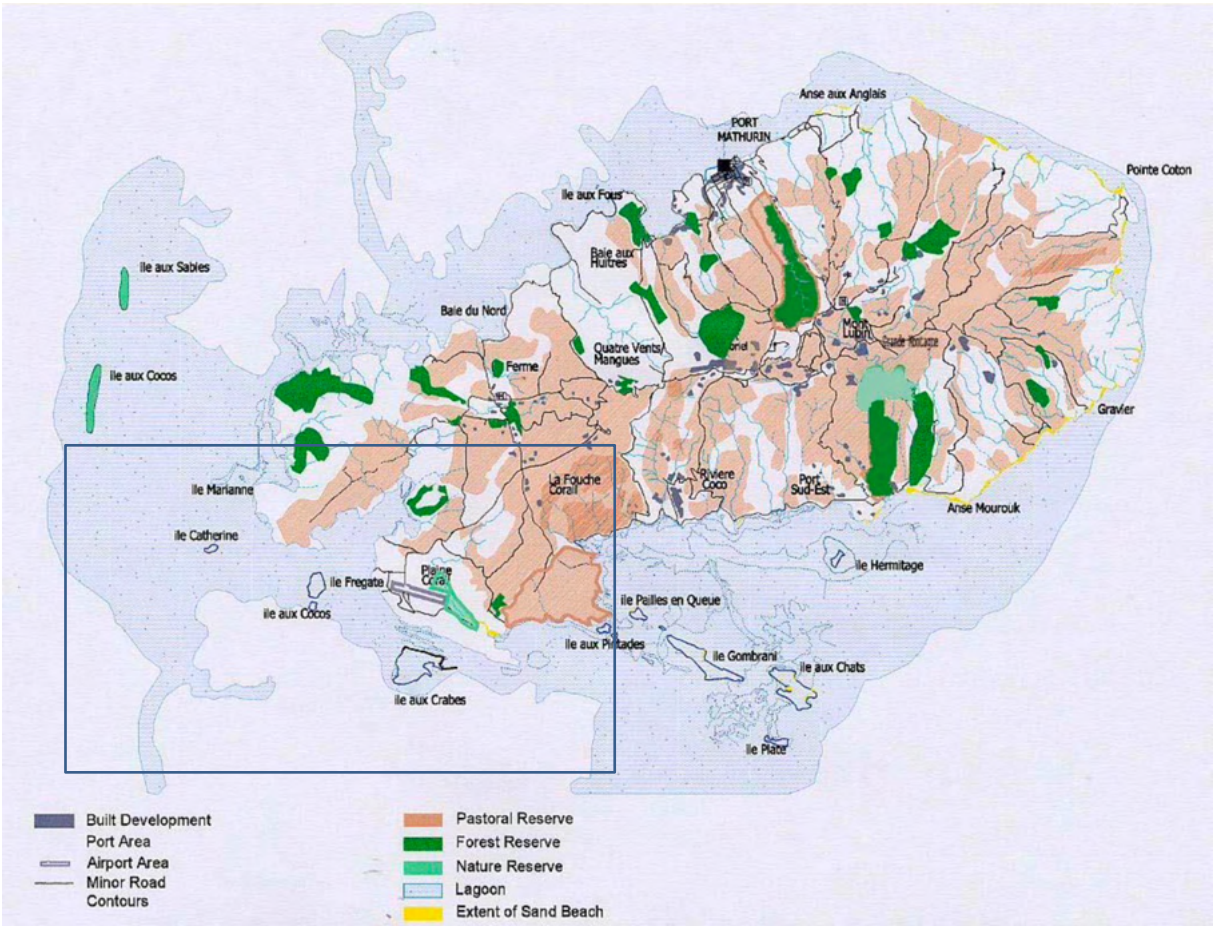


Figure 33: Rodrigues land use map (adapted from NDS, 2003, in Biotope, 2016)

3.9 Marine biocenoses monitoring plan

The proposed marine biocenoses monitoring plan concerns only the habitat of fringing reef dominated by *Acropora muricata*, which is the only ecosystem of significant ecological sensitivity located within range of the negative effects of the airstrip project. The fringing reef of Cite Patate, located upstream of the general current, could be monitored as a control site and the fringing reef of Pointe Mapou, exposed to the project effects, could be monitored as impacted site.

A GCRMN-type protocol (Global Coral Reef Monitoring Network - Hill and Wilkinson, 2004) combining, on each station, the sampling of:

- a 60m long (or 3 x 20m) linear intercept transect (LIT),
- a 5m wide and 100m long (or 2 x 50m) belt transect (BELT) and possibly
- several 1m^2 quadrats.

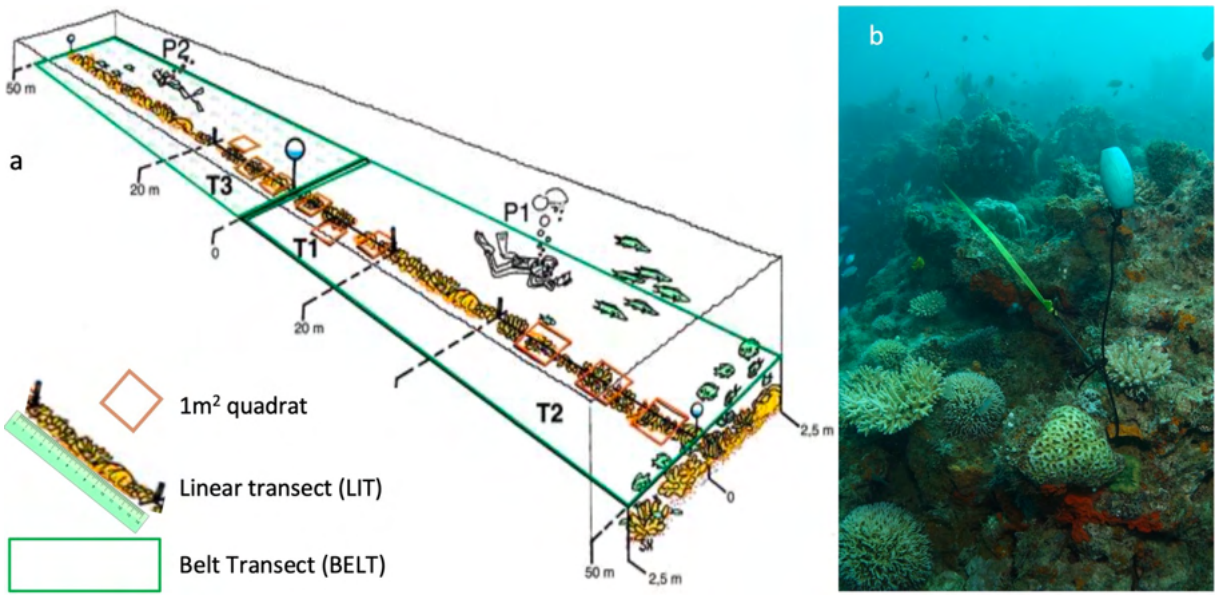


Figure 34: Global Coral Reef Monitoring Network protocol (Hill and Wilkinson, 2004)

In practice, the monitoring stations must be materialized by a tarred rope or fishing floats and visual markers throughout the duration of the monitoring protocol in order to ensure the replication of identical monitoring from a campaign to another.

The LIT method consists of noting on a waterproof slate the category of benthic organisms located vertically on a graduated transect 60m long (3 x 20m), previously unrolled on the substrate, as well as any changes in benthic communities (intercepts). The categories of organisms are grouped according to their bio-indicator characteristics in order to provide relevant keys to interpreting the state of health of the benthic communities sampled.

The BELT method consists of counting fish within a corridor 5m wide and 100m long (2 x 50m), i.e. 500m^2. All species are identified, the number of individuals is noted and the size of 8 target families, grouping together carnivores (Carangidae, Chaetodontidae, Labridae, Lethrinidae, Lutjanidae, Serranidae) and herbivores (Acanthuridae, Scaridae), is estimated to centimetre precision. Ecological characteristics intrinsic to each surveyed species (trophic diet,

demography, maximum adult size, gregariousness, etc.) then make it possible to deduce the structure of the sampled fish community, both in terms of biomass and abundance.

The quadrat method allows random and standardized sampling (replication of 1m2) of the abundances of macro-invertebrates. This method is adapted to the study site, where the species *Holothuria atra* is extremely abundant.

The advantage of this protocol, compared to ecological sensitivity assessment following the MERCI-Cor method, is the strict quantitative nature of the indicators measured. This complementary approach, thus allows the fine sampling of reference stations, judiciously placed in the ecological context of the study site and likely to highlight subtle disturbances of the communities, exposed to the project pressures, during and after the construction phase (Before-After Control-Impact - BACI - methodology).

The sampling of these monitoring stations will allow, if necessary, the comparison of the results acquired before, during and after the construction phase, both on the Pointe Mapou station, subject to the effects of the project (impact station) and on the Cite Patate station, located outside the influence of the project (control station).

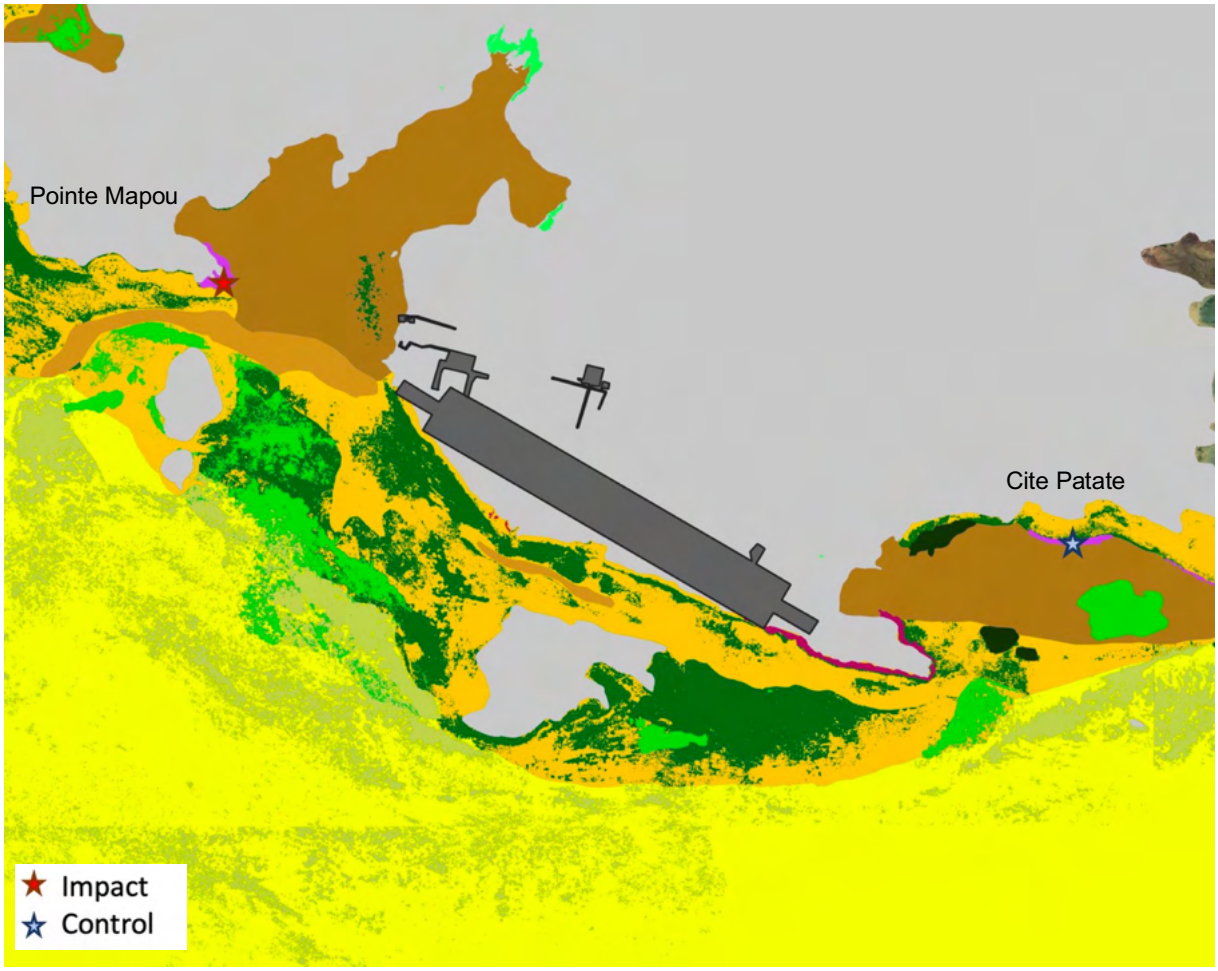


Figure 35: Proposed location of two monitoring stations of fringing reefs dominated by Acropora muricata

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Appendix 1: biodiversity inventories (MAREX, 2023)

FISHES											
CLASS	ORDER	FAMILY	SPECIES	NEW REC	PROTEC	IUCN	CITES	CMS	FISHERIES	HARD SUBST	SOFT SUBST
ACTINOPTERYGII	*ANGUILLIFORMES*	*MURAENIDAE*	*Echidna nebulosa*			LC			MINOR	X	
			Gymnothorax griseus			LC			MINOR	X	
			Gymnothorax meleagris	X		LC			MINOR	X	
			Gymnothorax undulatus			LC			MINOR	X	
	BERYCIFORMES	*HOLOCENTRIDAE*	*Myripristis murdjan*			LC			MINOR	X	
			Neoniphon sammara			LC				X	
			Sargocentron diadema			LC			MINOR	X	
			Sargocentron spiniferum			LC			MAJOR	X	
			Sargocentron tiere			LC			MAJOR	X	
	GOBIBOIDEI	*GOBIIDAE*	*Amblygobius albimaculatus*			LC					X
			Amblygobius semicinctus			LC					X
			Asterropteryx semipunctata			LC					X
			Bathygobius cocosensis			LC					X
			Cryptocentrus caeruleomaculatus			LC					X
			Cryptocentrus malindiensis	X		LC					X
			Cryptocentrus strigilliceps			LC				X	
			Gnatholepis anjerensis			LC					X
			Oplopomus oplopomus			LC					X
			Valenciennea sexguttata			LC					X
			Vanderhorstia delagoae			LC					X
			Vanderhorstia ornatissima			LC					X
		MICRODESMIDAE	*Ptereleotris evides*			LC				X	
	PERCIFORMES	*ACANTHURIDAE*	*Acanthurus nigricauda*			LC			MINOR	X	
			Acanthurus nigrofuscus			LC			MINOR	X	
			Acanthurus triostegus			LC			MINOR	X	
			Ctenochaetus striatus			LC			MINOR	X	
			Naso tuberosus			LC			MAJOR	X	
			Naso unicornis			LC			MAJOR	X	
			Zebrasoma desjardinii			LC			MINOR	X	
			Zebrasoma scopas			LC			MINOR	X	
		APOGONIDAE	*Cheilodipterus quinquelineatus*			LC				X	
		BLENNIIDAE	*Blenniella gibbifrons*			LC				X	
			Ecsenius lineatus			LC				X	
		CAESIONIDAE	*Pterocaesio tile*			LC			MINOR	X	
		CALLIONYMIDAE	*Diplogrammus infulatus*								X
		CARANGIDAE	*Caranx ignobilis*			LC			MAJOR	X	
		CHAETODONTIDAE	*Chaetodon auriga*			LC				X	
			Chaetodon guttatissimus			LC				X	
			Chaetodon lineolatus			LC				X	
			Chaetodon lunula			LC				X	
			Chaetodon madagaskariensis			LC				X	
			Chaetodon melannotus			LC				X	
			Chaetodon trifasciatus			LC				X	
			Chaetodon vagabundus			LC				X	
			Chaetodon xanthocephalus			LC				X	
			Heniochus monoceros			LC				X	
		CIRRHITIDAE	*Paracirrhites arcatus*			LC				X	
			Paracirrhites forsteri			LC				X	
		EPHIPPIDAE	*Platax orbicularis*	X		LC			MINOR	X	
			Platax teira	X		LC			MINOR		X
		KYPHOSIDAE	*Kyphosus cinerascens*			LC			MINOR	X	
		LABRIDAE	*Anampses twistii*			LC				X	
			Bodianus anthioides			LC			MINOR	X	
			Bodianus axillaris			LC				X	
			Cheilinus chlorourus			LC			MINOR	X	
			Cheilinus fasciatus			LC			MINOR	X	
			Coris caudimacula			LC					X
			Cymolutes torquatus			LC					X
			Epibulus insidiator			LC			MINOR	X	
			Halichoeres cosmetus			LC				X	
			Halichoeres hortulanus			LC				X	
			Halichoeres nebulosus			LC				X	
			Halichoeres scapularis			LC				X	
			Hemigymnus fasciatus			LC			MINOR	X	
			Hologymnosus annulatus			LC			MINOR	X	
			Labroides bicolor			LC				X	
			Labroides dimidiatus			LC				X	
			Pseudocheilinus octotaenia	X		LC				X	
			Stethojulis albovittata			LC				X	
			Stethojulis strigiventer			LC					X
			Thalassoma genivittatum			LC				X	
			Thalassoma hardwicke			LC				X	

		LETHRINIDAE	Gnathodentex aureolineatus			LC			MINOR	X	
			Lethrinus harak			LC					X
			Lethrinus obsoletus			LC					X
			Lethrinus variegatus			LC					X
			Monotaxis grandoculis			LC			MAJOR	X	
		LUTJANIDAE	Aphareus furca	X		LC			MAJOR	X	
			Lutjanus bohar			LC			MAJOR	X	
			Lutjanus fulviflamma			LC			MINOR	X	
			Lutjanus fulvus			LC			MAJOR	X	
			Lutjanus gibbus	X		LC			MAJOR	X	
			Lutjanus kasmira			LC			MAJOR	X	
		MONODACTYLIDAE	Monodactylus argenteus			LC				X	
		MULLIDAE	Mulloidichthys flavolineatus			LC			MAJOR	X	
			Parupeneus barberinus			LC			MAJOR	X	
			Parupeneus ciliatus			LC			MAJOR	X	X
			Parupeneus cyclostomus			LC			MAJOR	X	
			Parupeneus macronemus			LC			MINOR	X	
			Parupeneus trifasciatus			LC			MAJOR	X	
		PEMPHERIDAE	Pempheris schwenkii			LC				X	
		POMACANTHIDAE	Apolemichthys trimaculatus			LC				X	
			Centropyge bispinosa			LC				X	
			Pomacanthus imperator			LC			MINOR	X	
		POMACENTRIDAE	Abudefduf sexfasciatus			LC			MINOR	X	
			Abudefduf vaigiensis	X		LC			MINOR	X	
			Azurina lepidolepis			LC				X	
			Chromis chrysura			LC				X	
			Chromis viridis			LC				X	
			Chrysiptera brownriggii			LC				X	
			Chrysiptera glauca			LC				X	
			Dascyllus abudafur			LC				X	
			Dascyllus trimaculatus			LC				X	
			Pomacentrus caeruleus			LC				X	
			Pycnochromis fieldi			LC				X	
			Pycnochromis nigrurus			LC				X	
			Stegastes limbatus		R1, P1	LC				X	
			Stegastes lividus	X		LC				X	
			Stegastes nigricans			LC				X	
		SCARIDAE	Chlorurus capistratoides			LC			MINOR	X	
			Chlorurus sordidus			LC			MINOR	X	
			Chlorurus strongylocephalus			LC			MAJOR	X	
			Scarus caudofasciatus	X		LC			MAJOR	X	
			Scarus frenatus			LC			MAJOR	X	
			Scarus globiceps			LC			MAJOR	X	
			Scarus psittacus			LC			MAJOR	X	
			Scarus rubroviolaceus			LC			MAJOR	X	
			Scarus scaber			LC			MAJOR	X	
		SERRANIDAE	Cephalopholis argus			LC			MAJOR	X	
			Cephalopholis nigripinnis			LC			MINOR	X	
			Cephalopholis spiloparaea	X		LC			MINOR	X	
			Epinephelus coioides	X		LC			MAJOR	X	
			Epinephelus fasciatus			LC			MAJOR	X	
			Epinephelus hexagonatus			LC			MINOR	X	
			Epinephelus macrospilos			LC			MAJOR	X	
			Epinephelus merra			LC			MINOR	X	
			Epinephelus tauvina			LC			MAJOR	X	
			Gracila albomarginata	X		LC			MAJOR	X	
			Plectropomus punctatus			LC			MAJOR	X	
			Pseudanthias evansi			LC				X	
			Variola louti			LC			MAJOR	X	
		SIGANIDAE	Siganus argenteus			LC			MAJOR	X	X
			Siganus sutor			LC			MAJOR	X	
		ZANCLIDAE	Zanclus cornutus			LC				X	
	SCORPAENIFORMES	SCORPAENIDAE	Pterois miles			LC			MINOR	X	
	SILURIFORMES	PLOTOSIDAE	Plotosus lineatus			LC					X
	SYNGNATHIFORMES	SOLENOSTOMIDAE	Solenostomus cyanopterus	X		LC					X
		SYNGNATHIDAE	Corythoichthys flavofasciatus			LC				X	
	TETRAODONTIFORMES	BALISTIDAE	Balistoides conspicillum			LC			MINOR	X	
			Balistoides viridescens			LC			MINOR	X	
			Rhinecanthus aculeatus			LC			MINOR		X
			Sufflamen bursa			LC			MINOR	X	
		MONACANTHIDAE	Pervagor janthinosoma			LC				X	
		TETRAODONTIDAE	Arothron hispidus	X		LC					X
			Arothron immaculatus			LC					X
			Ostracion cubicus			LC					X
			Ostracion meleagris			LC				X	
ELASMOBRANCHII	CARCHARHINIFORMES	CARCHARHINIDAE	Carcharhinus amblyrhynchos	X		EN			MAJOR	X	
	RAJIFORMES	DASYATIDAE	Taeniura meyeni			VU			MAJOR	X	

HARD CORALS											
CLASS	ORDER	FAMILY	SPECIES	NEW REC	PROTEC	IUCN	CITES	CMS	FISHERIES	HARD SUBST	SOFT SUBST
ANTHOZOA	*SCLERACTINIA*	*ACROPORIDAE*	*Acropora abrotanoïdes*			LC	Appendix II			X	
			Acropora digitifera			NT	Appendix II			X	
			Acropora humilis			NT	Appendix II			X	
			Acropora hyacinthus			NT	Appendix II			X	
			Acropora muricata		P1, P2, R2	DD	Appendix II			X	
			Acropora sp1.			DD	Appendix II			X	
			Montipora cf. spumosa			LC	Appendix II			X	
			Montipora cf. verrucosa			LC	Appendix II			X	
			Montipora sp1.			DD	Appendix II			X	
		AGARICIIDAE	*Gardineroseris planulata*			LC	Appendix II			X	
			Leptoseris mycetoseroides			LC	Appendix II			X	
			Pavona frondifera			LC	Appendix II			X	
			Pavona maldivensis			LC	Appendix II			X	
			Pavona varians			LC	Appendix II			X	
		DENDROPHYLLIIDAE	*Turbinaria frondens*			LC	Appendix II			X	
			Turbinaria reniformis			VU	Appendix II			X	
		FAVIIDAE	*Cyphastrea microphtalma*			LC	Appendix II			X	
			Echinopora cf. forskaliana			NT	Appendix II			X	
			Favites pentagona			LC	Appendix II			X	
			Favites russelli			NT	Appendix II			X	
			Favites sp1.			DD	Appendix II			X	
			Leptoria phrygia			NT	Appendix II			X	
			Oulophyllia crispa			NT	Appendix II			X	
			Platygyra crosslandi			NT	Appendix II			X	
			Platygyra daedalea			LC	Appendix II			X	
			Plesiastrea versipora			LC	Appendix II			X	
		FUNGIIDAE	*Fungia sp1.*			DD	Appendix II			X	
		MERULINIDAE	*Dipsastraea matthaii*			NT	Appendix II			X	
			Dipsastraea sp1.			DD	Appendix II			X	
			Goniastrea cf. pectinata			LC	Appendix II			X	
			Goniastrea sp1.			DD	Appendix II			X	
			Goniastrea stelligera			NT	Appendix II			X	
			Hydnophora microconos			NT	Appendix II			X	
		MUSSIDAE	*Acanthastrea echinata*			LC	Appendix II			X	
			Lobophyllia corymbosa			LC	Appendix II			X	
			Lobophyllia hemprichii			LC	Appendix II			X	
			Lobophyllia radians			LC	Appendix II			X	
		OCULINIDAE	*Galaxea fascicularis*			NT	Appendix II			X	
		PECTINIIDAE	*Echinophyllia aspera*			LC	Appendix II			X	
			Oxypora lacera			LC	Appendix II			X	
		POCILLOPORIDAE	*Pocillopora damicornis*			LC	Appendix II			X	
			Pocillopora grandis			NT	Appendix II			X	
			Pocillopora verrucosa			LC	Appendix II			X	
		PORITIDAE	*Goniopora sp1.*			DD	Appendix II			X	
			Porites lobata			NT	Appendix II			X	
			Porites lutea			LC	Appendix II			X	
			Porites monticulosa			LC	Appendix II			X	
			Porites rus			LC	Appendix II			X	
		PSAMMOCORIDAE	*Psammocora profundacella*			LC	Appendix II			X	
	ANTHOATHECATA	*MILLEPORIDAE*	*Millepora exaesa*			LC	Appendix II			X	

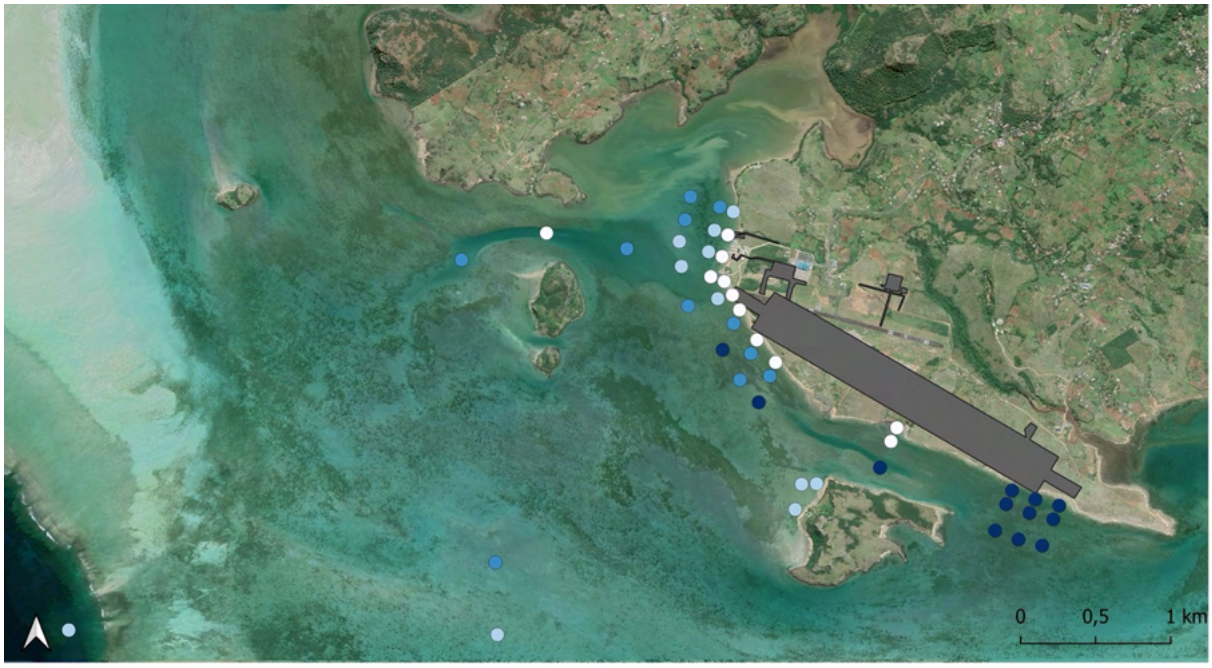
MACROINVERTEBRATES											
CLASS	ORDER	FAMILY	SPECIES	NEW REC	PROTEC	IUCN	CITES	CMS	FISHERIES	HARD SUBST	SOFT SUBST
ARTHROPODA											
MALACOSTRACA	*DECAPODA*	*ALPHEIDAE*	*Alpheus sp.*								X
		CALAPPIDAE	*Calappa hepatica*								X
		CALLIANASSIDAE	*Callianassa cf. kraussi*								X
		PALINURIDAE	*Panulirus versicolor*			LC			MAJOR	X	
ECHINODERMATA											
ASTEROIDEA	*VALVATIDA*	*OPHIDIASTERIDAE*	*Linckia multifora*								X
ECHINOIDEA	*CAMARODONTA*	*ECHINOMETRIDAE*	*Echinometra mathaei*							X	
	STOMOPNEUSTOIDA	*STOMOPNEUSTIDAE*	*Stomopneustes variolaris*							X	
HOLOTHUROIDEA	*APODIDA*	*SYNAPTIDAE*	*Synapta maculata*								X
	HOLOTHURIIDA	*HOLOTHURIIDAE*	*Bohadschia vitiensis*			DD			MINOR		X
			Holothuria atra			LC			MINOR		X
			Holothuria leucospilota			LC			MAJOR		X
			Holothuria nobilis			EN	Appendix II		MAJOR		X
	SYNALLACTIDA	*STICHOPODIDAE*	*Stichopus chloronotus*			LC			MINOR		X
MOLLUSCA											
BIVALVIA	*CARDIIDA*	*TELLINIDAE*	*Quidnipagus palatam*						MINOR		X
	MYTILOIDA	*MYTILIDAE*	*Modiolus auriculatus*						MINOR		X
	OSTREIDA	*PINNIDAE*	*Pinna muricata*								X
	VENERIDA	*CARDIIDAE*	*Trachycardium angulatum*						MINOR		X
			Tridacna maxima			LC	Appendix II		MAJOR	X	
		VENERIDAE	*Gafrarium pectinatum*								X
			Periglypta crispata								X
CEPHALOPODA	*OCTOPODA*	*OCTOPODIDAE*	*Octopus cyanea*			LC			MAJOR	X	
GASTROPODA	*LITTORINIMORPHA*	*CYPRAEIDAE*	*Arestorides argus*						MINOR	X	
			Cypraea tigris						MAJOR	X	
			Lyncina carneola						MINOR	X	
			Monetaria caputserpentis						MINOR	X	
		STROMBIDAE	*Lambis sp.*						MINOR	X	
		NATICIDAE	*Natica sp.*								X
		STROMBIDAE	*Canarium mutabile*								X
		TONNIDAE	*Tonna perdix*						MINOR		X
	NEOGASTROPODA	*FACIOLARIIDAE*	*Pleuroploca trapezium*						MINOR		X
	NEOTAENIOGLOSSA	*CERITHIIDAE*	*Rhinoclavis aspera*								X
	SACOGLOSSA	*OXYNOIDAE*	*Oxynoe viridis*								X
	TROCHIDA	*TURBINIDAE*	*Turbo argyrostomus*						MINOR	X	
PLATHELMINTHES											
TREPAXONEMATA	*POLYCLADIDA*	*PSEUDOCEROTOIDEA*	*Phrikoceros baibaiye*								X

MARINE PHANEROGAMS											
CLASS	ORDER	FAMILY	SPECIES	NEW REC	PROTEC	IUCN	CITES	CMS	FISHERIES	HARD SUBST	SOFT SUBST
LILIOPSIDA	*HYDROCHARITALES*	*HYDROCHARITACEAE*	*Halophila ovalis*			LC					X
			Halophila stipulacea			LC					X

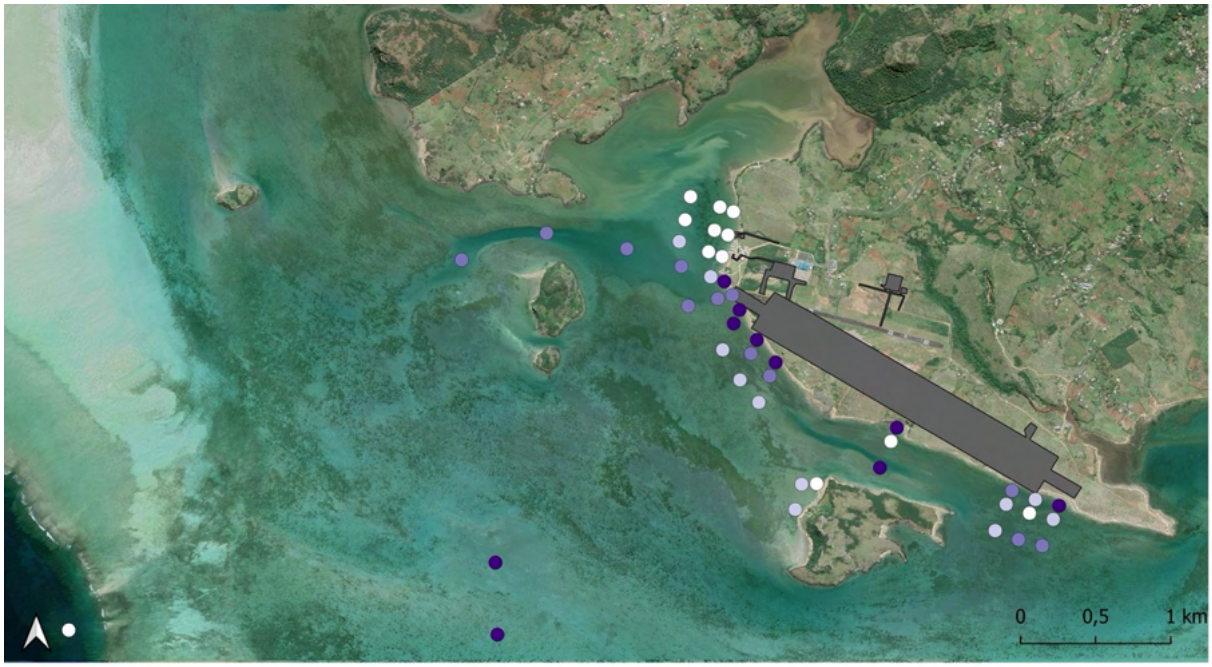
MARINE MACROALGAE											
CLASS	ORDER	FAMILY	SPECIES	NEW REC	PROTEC	IUCN	CITES	CMS	SEAFOOD	HARD SUBST	SOFT SUBST
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa brachypus*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa chemnitzia*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa cupressoides*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa racemosa*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa serrulata*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*CAULERPACEAE*	*Caulerpa taxifolia*						MINOR		X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*HALIMEDACEAE*	*Halimeda discoidea*							X	
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*HALIMEDACEAE*	*Halimeda opuntia*								X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*UDOTEACEAE*	*Avrainvillea amadelpha*								X
BRYOPSIDOPHYCEAE	*BRYOPSIDALES*	*UDOTEACEAE*	*Udotea palmetta*								
ULVOPHYCEAE	*CLADOPHORALES*	*SIPHONOCLADACEAE*	*Dictyosphaeria cavernosa*							X	
ULVOPHYCEAE	*CLADOPHORALES*	*VALONIACEAE*	*Valonia ventricosa*							X	
PHAEOPHYCEAE	*DICTYOTALES*	*DICTYOTACEAE*	*Canistrocarpus cervicornis*							X	
PHAEOPHYCEAE	*DICTYOTALES*	*DICTYOTACEAE*	*Padina boergesenii*							X	
PHAEOPHYCEAE	*FUCALES*	*SARGASSACEAE*	*Sargassum ilicifolium*								X
PHAEOPHYCEAE	*FUCALES*	*SARGASSACEAE*	*Turbinaria ornata*						MINOR	X	
FLORIDEOPHYCEAE	*CERAMIALES*	*CERAMIACEAE*	*Acanthophora spicifera*						MINOR	X	
FLORIDEOPHYCEAE	*CERAMIALES*	*RHODOMELACEAE*	*Digenea simplex*						MINOR	X	
FLORIDEOPHYCEAE	*CERAMIALES*	*RHODOMELACEAE*	*Palisada perforata*								X
FLORIDEOPHYCEAE	*CORALLINALES*	*CORALLINACEAE*	*Jania sp.*								X
FLORIDEOPHYCEAE	*CORALLINALES*	*CORALLINACEAE*	*Litophyllum sp.*							X	
FLORIDEOPHYCEAE	*GIGARTINALES*	*CYSTOCLONIACEAE*	*Hypnea cornuta*							X	
FLORIDEOPHYCEAE	*ND*	*ND*	*Turf*							X	
FLORIDEOPHYCEAE	*NEMALIALES*	*GALAXAURACEAE*	*Galaxaura rugosa*							X	
FLORIDEOPHYCEAE	*RHODYMENIALES*	*CHAMPIACEAE*	*Champia compressa*								X
FLORIDEOPHYCEAE	*RHODYMENIALES*	*CHAMPIACEAE*	*Coelothrix irregularis*	X							X

Appendix 2: Physiochemical analyses

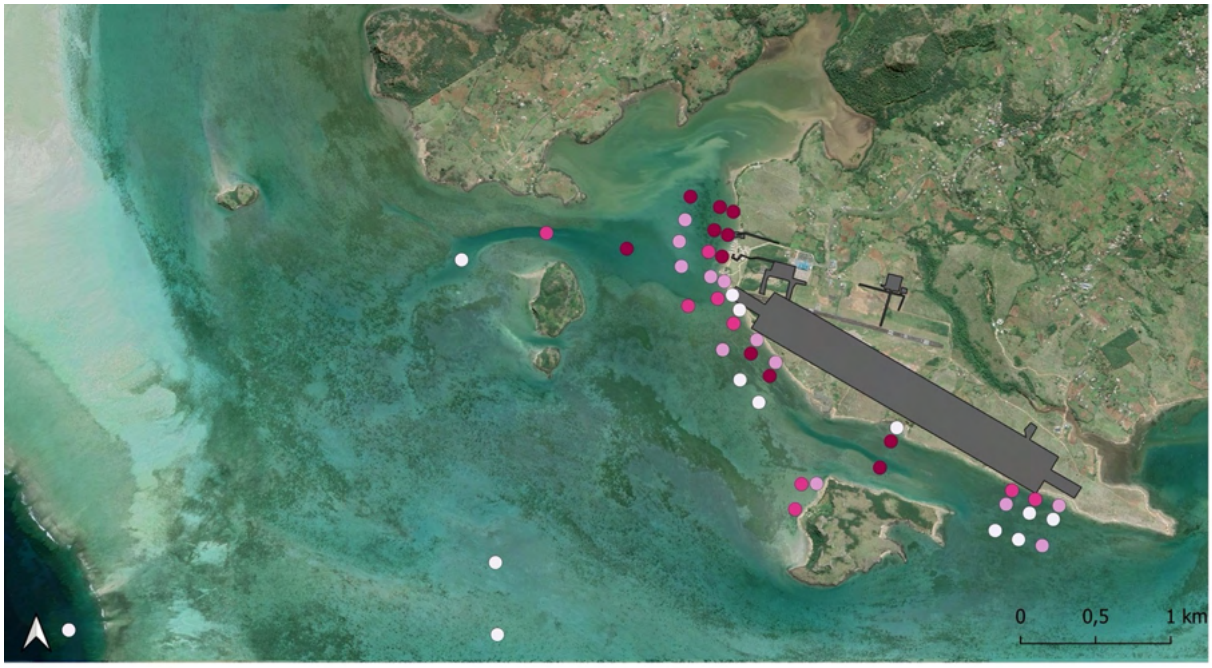
SAMPLING			PARAMETRES					
DATE	STATION	TIME	TEMP (°C)	DO (%)	DO (mg/L)	SAL (PSU)	pH	TURB (NTU)
21/04/2023	HYD01	11:35	27,7	98,0	6,48	35,15	7,88	1,86
21/04/2023	HYD02	11:42	27,6	107,1	7,40	34,83	7,91	4,17
21/04/2023	HYD03	11:46	26,8	108,8	7,11	35,16	8,10	1,95
21/04/2023	HYD04	11:57	26,7	102,7	6,70	35,12	8,51	1,69
21/04/2023	HYD05	12:00	26,5	99,2	6,48	35,03	8,49	1,68
21/04/2023	HYD06	12:03	26,7	101,6	6,63	34,99	8,45	1,44
21/04/2023	HYD07	12:08	26,5	101,0	6,63	35,11	8,54	1,92
21/04/2023	HYD08	12:11	26,7	94,0	6,17	34,98	8,52	1,60
21/04/2023	HYD09	12:13	26,6	102,3	6,70	35,01	8,47	1,68
21/04/2023	HYD10	12:18	26,5	106,7	6,93	35,05	8,59	1,78
21/04/2023	HYD11	12:21	26,7	101,3	6,60	35,01	8,56	1,92
21/04/2023	HYD12	12:23	26,7	102,8	6,74	35,03	8,39	1,79
21/04/2023	HYD13	12:55	27,2	120,5	7,87	34,85	8,28	1,65
21/04/2023	HYD14	13:08	26,9	120,4	7,79	34,91	8,12	1,69
21/04/2023	HYD15	13:16	27,1	100,7	6,54	35,10	8,06	1,60
21/04/2023	HYD16	13:23	27,1	100,4	6,45	35,09	8,10	2,36
21/04/2023	HYD17	13:30	27,2	90,7	5,81	35,08	8,10	2,48
21/04/2023	HYD18	13:58	26,8	101,5	6,59	34,99	8,17	2,21
21/04/2023	HYD19	14:00	27,0	105,8	6,87	35,16	8,18	2,14
21/04/2023	HYD20	14:03	27,3	110,4	7,12	35,07	8,14	3,27
21/04/2023	HYD21	14:06	27,4	107,5	6,92	35,05	8,13	2,54
21/04/2023	HYD22	14:08	26,9	105,7	6,82	35,13	8,19	2,10
21/04/2023	HYD23	14:11	26,8	101,7	6,65	34,99	8,21	2,28
21/04/2023	HYD24	14:15	26,7	101,8	6,56	35,05	8,22	1,92
21/04/2023	HYD25	14:17	27,0	106,6	6,85	35,09	8,31	2,45
21/04/2023	HYD26	14:20	27,8	110,6	7,10	35,02	8,22	3,62
21/04/2023	HYD27	14:22	27,9	105,7	6,76	35,02	8,20	4,39
21/04/2023	HYD28	14:25	27,2	106,5	6,86	35,09	8,22	2,91
21/04/2023	HYD29	14:27	26,9	102,9	6,66	35,11	8,19	2,39
21/04/2023	HYD30	14:31	27,7	106,9	6,84	35,04	8,09	4,76
21/04/2023	HYD31	14:33	27,4	101,4	6,50	35,05	8,09	4,21
21/04/2023	HYD32	14:57	27,1	103,3	6,69	35,08	7,97	3,23
21/04/2023	HYD33	15:01	27,6	94,5	6,07	35,18	7,97	7,53
21/04/2023	HYD34	15:03	27,3	96,8	6,22	35,18	8,04	8,44
21/04/2023	HYD35	15:05	27,1	98,6	6,34	35,17	8,16	6,91
21/04/2023	HYD36	15:07	26,9	95,4	6,17	35,18	8,20	6,50
21/04/2023	HYD37	15:11	26,8	95,2	6,06	35,17	8,15	5,49
21/04/2023	HYD38	15:17	26,9	105,6	6,84	35,01	8,10	2,23
21/04/2023	HYD39	15:22	27,4	106,5	6,75	35,11	8,06	2,60
21/04/2023	HYD40	15:25	26,8	106,1	6,90	35,15	8,05	2,17
21/04/2023	HYD41	15:30	26,8	98,6	6,38	35,06	8,00	4,11
21/04/2023	HYD42	15:32	27,1	97,0	6,29	35,16	7,98	6,60
21/04/2023	HYD43	15:34	27,1	98,1	6,32	35,12	7,96	6,94
21/04/2023	HYD44	15:36	27,2	100,3	6,50	35,08	7,97	4,84
22/04/2023	HYD45	12:50	27,2	101,0	6,52	34,75	8,14	0,45



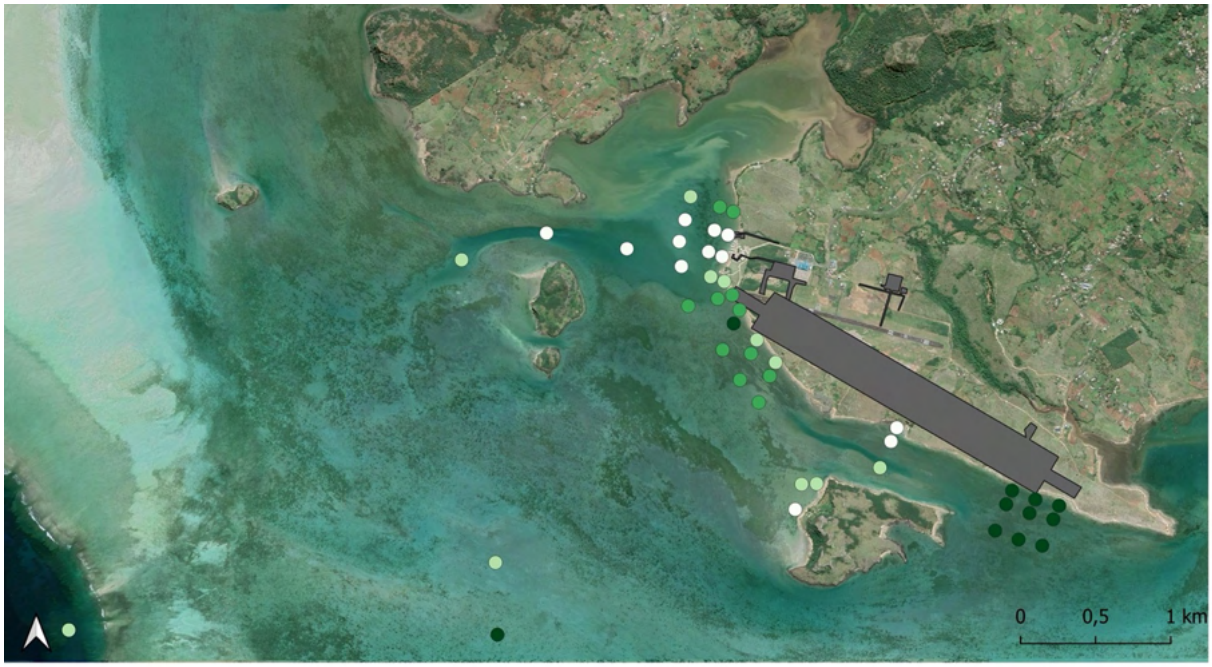
Température (°C) Projet de piste
- 26,5 - 26,77
- 26,77 - 27,01
- 27,01 - 27,22
- 27,22 - 27,9



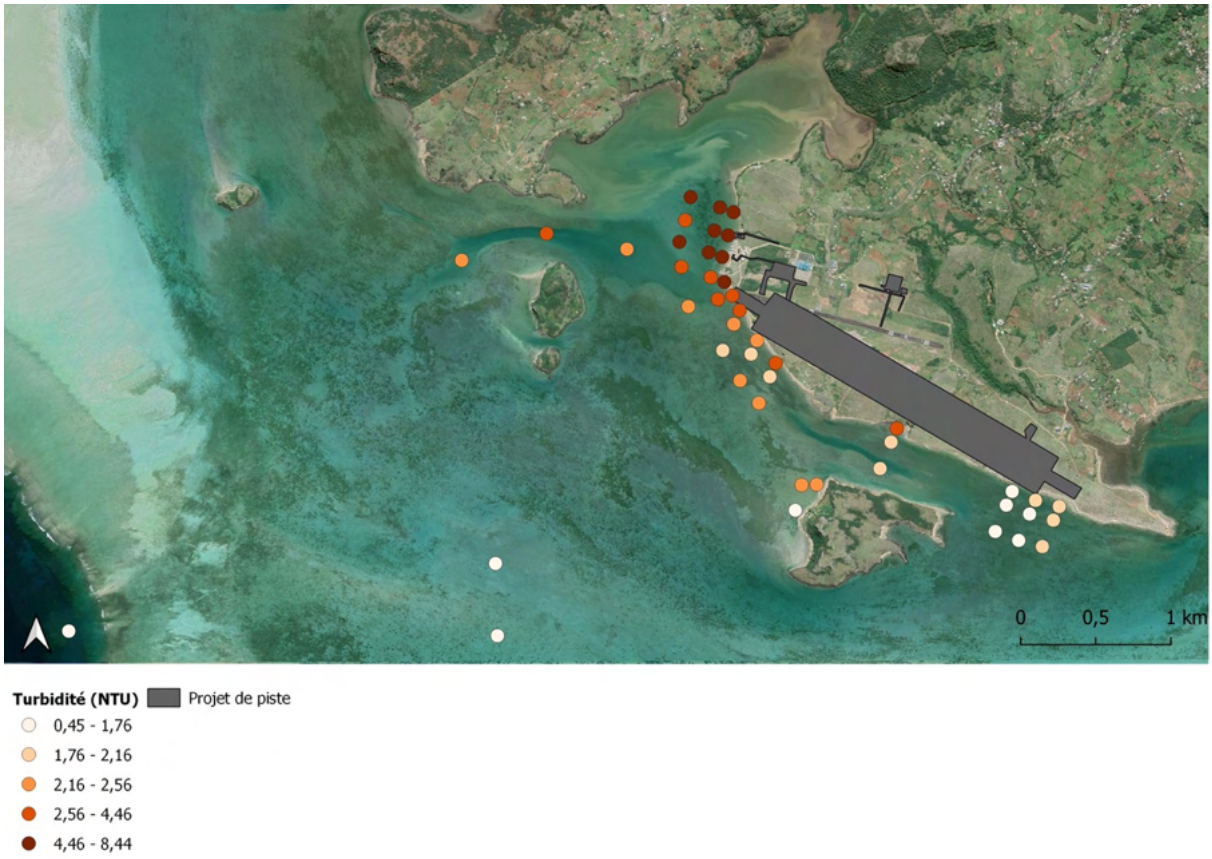
Pourcentage d'oxygène dissous Projet de piste
- 85,7 - 98,6
- 98,6 - 101,8
- 101,8 - 106,5
- 106,5 - 120,5



Salinité (PSU)
Projet de piste
34,75 - 35,02
35,02 - 35,08
35,08 - 35,12
35,12 - 35,18



pH
Projet de piste
7,88 - 8,06
8,06 - 8,15
8,15 - 8,22
8,22 - 8,59


0
0,5
1 km
Turbidité (NTU)
Projet de piste
0,45 - 1,76
1,76 - 2,16
2,16 - 2,56
2,56 - 4,46
4,46 - 8,44

Appendix 3: Sampling plan

SAMPLING PLAN					PARAMETRES			
DATE	STATION	TYPE	LONG	LAT	PHYSICOCHEMISTRY	SENSITIVITY	SUBSTRATES	SILTATION
18/04/2023	ROD67	Snorkeling	63,35651	-19,74321		X	X	X
18/04/2023	ROD66	Snorkeling	63,34787	-19,74721		X	X	X
18/04/2023	ROD81	Snorkeling	63,35383	-19,75071		X	X	X
18/04/2023	ROD29	Snorkeling	63,35210	-19,75144		X	X	X
18/04/2023	ROD03	Snorkeling	63,34474	-19,74973		X	X	X
18/04/2023	ROD04	Snorkeling	63,34263	-19,74774		X	X	X
18/04/2023	ROD45	Snorkeling	63,34432	-19,75159		X	X	X
18/04/2023	ROD44	Snorkeling	63,34360	-19,75049		X	X	X
18/04/2023	ROD34	Snorkeling	63,34704	-19,75330		X	X	X
18/04/2023	ROD55	Snorkeling	63,30741	-19,76626		X	X	X
18/04/2023	ROD54	Snorkeling	63,31016	-19,76557		X	X	X
18/04/2023	ROD53	Snorkeling	63,31218	-19,76440		X	X	X
18/04/2023	ROD52	Snorkeling	63,31456	-19,76065		X	X	X
18/04/2023	ROD51	Snorkeling	63,31807	-19,75880		X	X	X
18/04/2023	ROD50	Snorkeling	63,31959	-19,75838		X	X	X
18/04/2023	ROD49	Snorkeling	63,32371	-19,75318		X	X	X
18/04/2023	ROD16	Snorkeling	63,33102	-19,75169		X	X	X
18/04/2023	ROD30	Snorkeling	63,32504	-19,74364		X	X	X
18/04/2023	ROD10	Snorkeling	63,32854	-19,74008		X	X	X
18/04/2023	ROD33	Snorkeling	63,33069	-19,73608		X	X	X
18/04/2023	ROD09	Snorkeling	63,33732	-19,73766		X	X	X
18/04/2023	ROD06	Snorkeling	63,33506	-19,74930		X	X	X
18/04/2023	ROD01	Snorkeling	63,34027	-19,75154		X	X	X
18/04/2023	ROD02	Snorkeling	63,34235	-19,75169		X	X	X
18/04/2023	ROD07	Snorkeling	63,34080	-19,75328		X	X	X
18/04/2023	ROD47	Snorkeling	63,33785	-19,75482		X	X	X
18/04/2023	ROD46	Snorkeling	63,33770	-19,75664		X	X	X
18/04/2023	ROD32	Snorkeling	63,33805	-19,75196		X	X	X
19/04/2023	ROD05	Snorkeling	63,33801	-19,75021		X	X	X
19/04/2023	ROD31	Snorkeling	63,33611	-19,75140		X	X	X
19/04/2023	ROD48	Snorkeling	63,32833	-19,75847		X	X	X
19/04/2023	ROD08	Snorkeling	63,33390	-19,75977		X	X	X
19/04/2023	ROD21	Snorkeling	63,33785	-19,76174		X	X	X
19/04/2023	ROD23	Snorkeling	63,34344	-19,76514		X	X	X
19/04/2023	ROD24	Snorkeling	63,34740	-19,76524		X	X	X
19/04/2023	ROD87	Snorkeling	63,34501	-19,76368		X	X	X
19/04/2023	ROD43	Snorkeling	63,34711	-19,76226		X	X	X
19/04/2023	ROD22	Snorkeling	63,34799	-19,76029		X	X	X
19/04/2023	ROD86	Snorkeling	63,34486	-19,75621		X	X	X
19/04/2023	ROD42	Snorkeling	63,35070	-19,75810		X	X	X
19/04/2023	ROD68	Snorkeling	63,35466	-19,75881		X	X	X
19/04/2023	ROD41	Snorkeling	63,35757	-19,76171		X	X	X
19/04/2023	ROD40	Snorkeling	63,35662	-19,76204		X	X	X
19/04/2023	ROD25	Snorkeling	63,35234	-19,76593		X	X	X
19/04/2023	ROD80	Snorkeling	63,35171	-19,76851		X	X	X
19/04/2023	ROD65	Snorkeling	63,35668	-19,76621		X	X	X
19/04/2023	ROD77	Snorkeling	63,35920	-19,76598		X	X	X
19/04/2023	ROD75	Snorkeling	63,36138	-19,76649		X	X	X
19/04/2023	ROD78	Snorkeling	63,36337	-19,76676		X	X	X
19/04/2023	ROD39	Snorkeling	63,36660	-19,76601		X	X	X
19/04/2023	ROD71	Snorkeling	63,37066	-19,76896		X	X	X
19/04/2023	ROD84	Snorkeling	63,37079	-19,77045		X	X	X
19/04/2023	ROD20	Snorkeling	63,37085	-19,77108		X	X	X
19/04/2023	ROD83	Snorkeling	63,37107	-19,77312		X	X	X
19/04/2023	ROD82	Snorkeling	63,36837	-19,77150		X	X	X
20/04/2023	ROD38	Snorkeling	63,37786	-19,77065		X	X	X
20/04/2023	ROD85	Snorkeling	63,37423	-19,77296		X	X	X
20/04/2023	ROD19	Snorkeling	63,37339	-19,77202		X	X	X
20/04/2023	ROD11	Snorkeling	63,36810	-19,77498		X	X	X
20/04/2023	ROD36	Snorkeling	63,36936	-19,78307		X	X	X
20/04/2023	ROD70	Snorkeling	63,37763	-19,77420		X	X	X
20/04/2023	ROD35	Snorkeling	63,38438	-19,77296		X	X	X
20/04/2023	ROD58	Snorkeling	63,38690	-19,77441		X	X	X
20/04/2023	ROD69	Snorkeling	63,38793	-19,77824		X	X	X

20/04/2023	ROD13	Snorkeling	63,39053	-19,77231		X	X	X
20/04/2023	ROD57	Snorkeling	63,39241	-19,77207		X	X	X
20/04/2023	ROD12	Snorkeling	63,39674	-19,77247		X	X	X
20/04/2023	ROD15	Snorkeling	63,39965	-19,77003		X	X	X
20/04/2023	ROD28	Snorkeling	63,39166	-19,76742		X	X	X
20/04/2023	ROD17	Snorkeling	63,38856	-19,76399		X	X	X
20/04/2023	ROD74	Snorkeling	63,38273	-19,76389		X	X	X
20/04/2023	ROD73	Snorkeling	63,39305	-19,76831		X	X	X
20/04/2023	ROD72	Snorkeling	63,38092	-19,76928		X	X	X
20/04/2023	ROD14	Snorkeling	63,38669	-19,76991		X	X	X
20/04/2023	ROD37	Snorkeling	63,38275	-19,77098		X	X	X
20/04/2023	ROD79	Snorkeling	63,36540	-19,77202		X	X	X
20/04/2023	ROD18	Snorkeling	63,36668	-19,77378		X	X	X
20/04/2023	ROD63	Snorkeling	63,36032	-19,77534		X	X	X
21/04/2023	ROD76	Snorkeling	63,36085	-19,76487		X	X	X
21/04/2023	ROD60	Snorkeling	63,34967	-19,77400		X	X	X
21/04/2023	ROD62	Snorkeling	63,33886	-19,77769		X	X	X
21/04/2023	ROD61	Snorkeling	63,33874	-19,77311		X	X	X
21/04/2023	ROD26	Snorkeling	63,35779	-19,76973		X	X	X
21/04/2023	ROD27	Snorkeling	63,35819	-19,76813		X	X	X
21/04/2023	ROD64	Snorkeling	63,35914	-19,76809		X	X	X
22/04/2023	ROD56	Scuba	63,31162	-19,77740		X	X	X
21/04/2023	HYD01	Onboard	63,36387	-19,76540	X			
21/04/2023	HYD02	Onboard	63,36425	-19,76450	X			
21/04/2023	HYD03	Onboard	63,36317	-19,76700	X			
21/04/2023	HYD04	Onboard	63,37157	-19,76850	X			
21/04/2023	HYD05	Onboard	63,37119	-19,76940	X			
21/04/2023	HYD06	Onboard	63,37050	-19,77100	X			
21/04/2023	HYD07	Onboard	63,37305	-19,76910	X			
21/04/2023	HYD08	Onboard	63,37268	-19,76990	X			
21/04/2023	HYD09	Onboard	63,37198	-19,77160	X			
21/04/2023	HYD10	Onboard	63,37456	-19,76940	X			
21/04/2023	HYD11	Onboard	63,37419	-19,77030	X			
21/04/2023	HYD12	Onboard	63,37349	-19,77200	X			
21/04/2023	HYD13	Onboard	63,33886	-19,77760	X			
21/04/2023	HYD14	Onboard	63,33874	-19,77310	X			
21/04/2023	HYD15	Onboard	63,35779	-19,76970	X			
21/04/2023	HYD16	Onboard	63,35819	-19,76810	X			
21/04/2023	HYD17	Onboard	63,35914	-19,76800	X			
21/04/2023	HYD18	Onboard	63,35547	-19,76290	X			
21/04/2023	HYD19	Onboard	63,35617	-19,76120	X			
21/04/2023	HYD20	Onboard	63,35654	-19,76030	X			
21/04/2023	HYD21	Onboard	63,35535	-19,75890	X			
21/04/2023	HYD22	Onboard	63,35498	-19,75980	X			
21/04/2023	HYD23	Onboard	63,35428	-19,76150	X			
21/04/2023	HYD24	Onboard	63,35318	-19,75950	X			
21/04/2023	HYD25	Onboard	63,35388	-19,75790	X			
21/04/2023	HYD26	Onboard	63,35425	-19,75700	X			
21/04/2023	HYD27	Onboard	63,35379	-19,75610	X			
21/04/2023	HYD28	Onboard	63,35286	-19,75630	X			
21/04/2023	HYD29	Onboard	63,35099	-19,75680	X			
21/04/2023	HYD30	Onboard	63,35328	-19,75520	X			
21/04/2023	HYD31	Onboard	63,35242	-19,75490	X			
21/04/2023	HYD32	Onboard	63,35055	-19,75420	X			
21/04/2023	HYD33	Onboard	63,35314	-19,75360	X			
21/04/2023	HYD34	Onboard	63,35351	-19,75220	X			
21/04/2023	HYD35	Onboard	63,35386	-19,75080	X			
21/04/2023	HYD36	Onboard	63,35300	-19,75050	X			
21/04/2023	HYD37	Onboard	63,35114	-19,74980	X			
21/04/2023	HYD38	Onboard	63,33658	-19,75380	X			
21/04/2023	HYD39	Onboard	63,34198	-19,75210	X			
21/04/2023	HYD40	Onboard	63,34709	-19,75310	X			
21/04/2023	HYD41	Onboard	63,35079	-19,75130	X			
21/04/2023	HYD42	Onboard	63,35265	-19,75190	X			
21/04/2023	HYD43	Onboard	63,35229	-19,75330	X			
21/04/2023	HYD44	Onboard	63,35042	-19,75270	X			
22/04/2023	HYD45	Onboard	63,31162	-19,77740	X			