

Bigi Pan Management Plan 2013-2023



Message from the minister (Preface)

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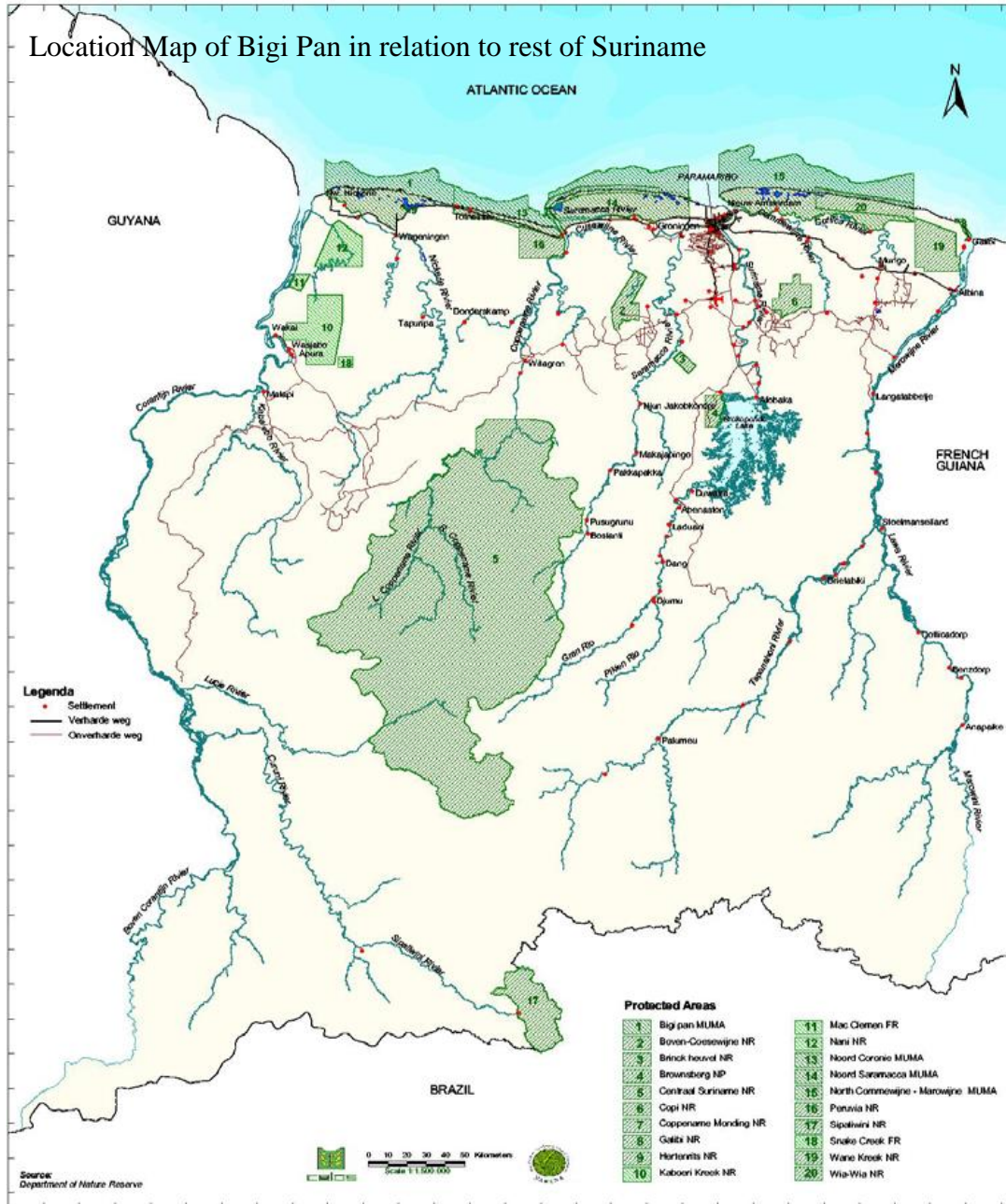
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List of abbreviations

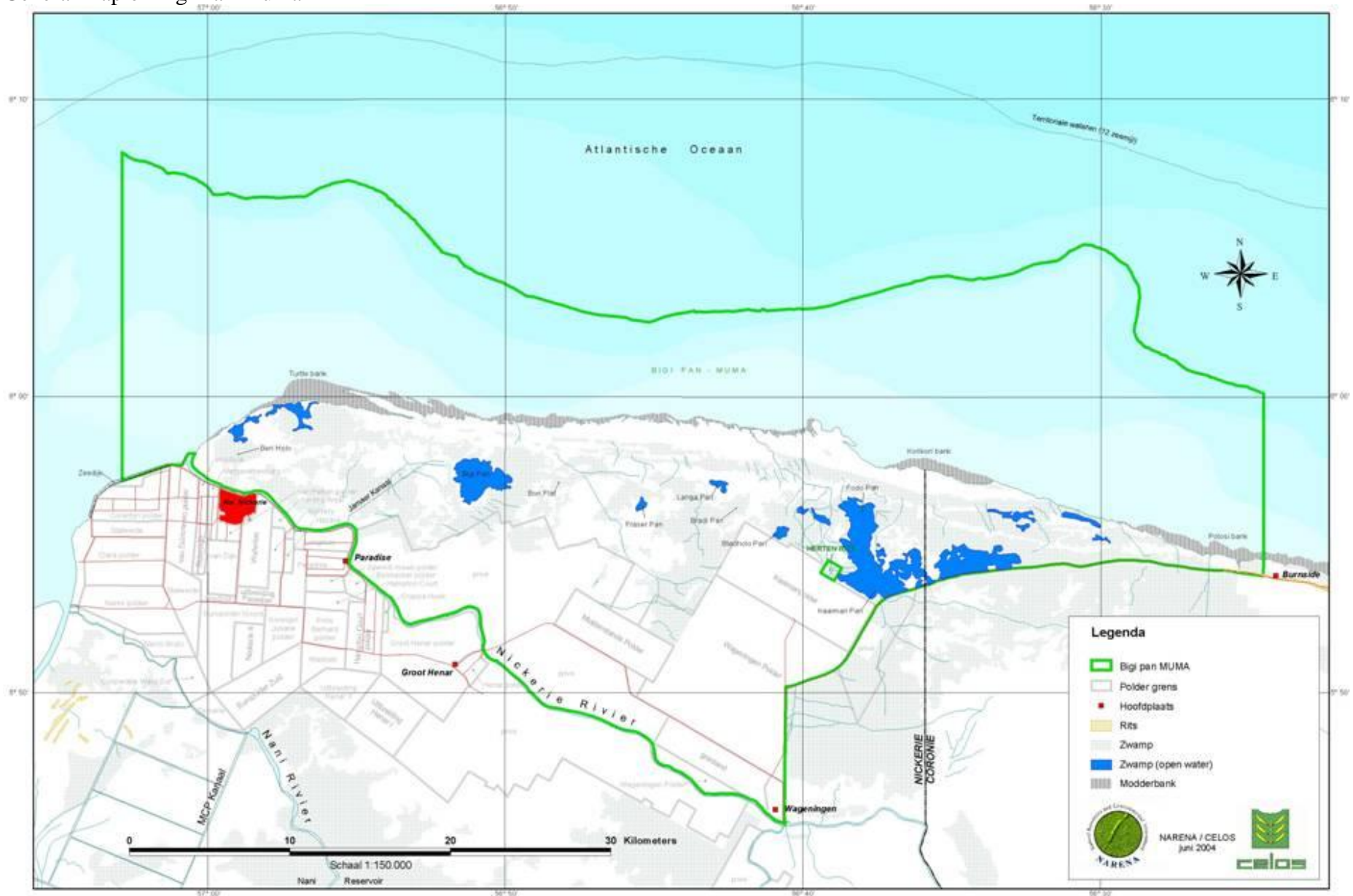
Adek	Anton de Kom University of Suriname
ADRON	Anne van Dijk Rice Research Centre Nickerie
CBD	Convention on Biodiversity
CELOS	Centre for Agricultural Research in Suriname
GEF	Global Environment Facility
IUCN	International Union for Conservation of Nature
LBB	Forest Service Suriname
LVV	Ministry of agriculture, animal husbandry and fisheries
(M)OP	Multi-Annual Development Plan
MUMA	Multiple Use Management Area
NARENA	Department of Natural Resources and Environmental Resources of CELOS
NBS	National Biodiversity Strategy
NCD	Nature Conservation Division of Suriname
PoWPA	Program of Work on Protected Areas
RAMSAR	RAMSAR Convention on Wetlands
RGB	Ministry of Spatial Planning, Land and Forest Management
WHSRN	Western Hemisphere Shorebird Reserve Network
WLA	Hydraulic Department of the Ministry of Public Works

SURINAME
Protected Area

Location Map of Bigi Pan in relation to rest of Suriname



General map of Bigi Pan Muma



INSERT BIGI PAN ZONE MAP

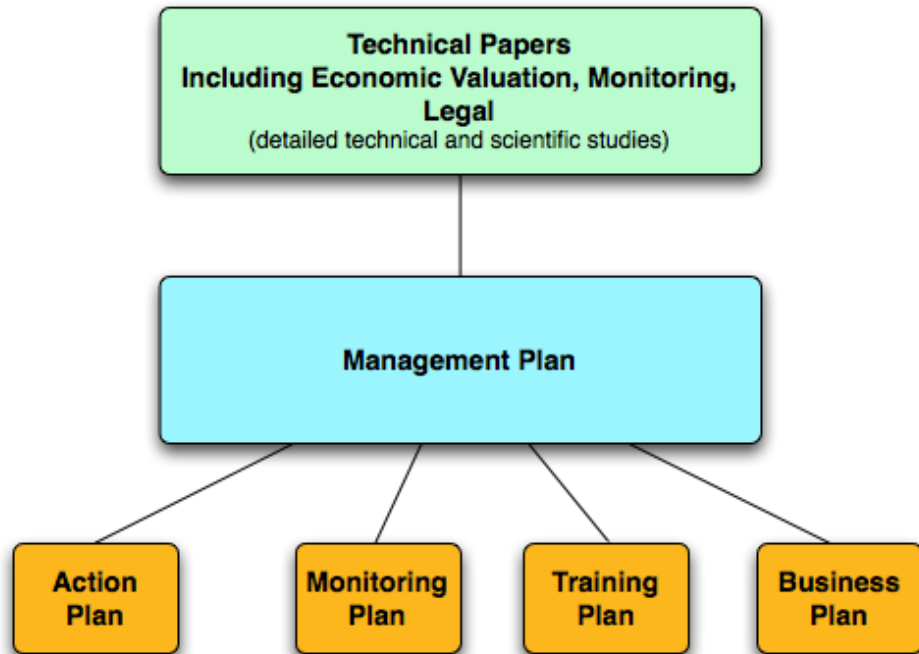
Introduction

The Bigi Pan Multiple Use Management Area is located in Northwest Suriname; partly in the District Coronie and in the District Nickerie. The area encompasses about 68,300 ha of land (partly inundated by fresh or brackish water) and at least an equal area of sea (water). The size of the marine area is determined by the six meters depth line during low tide, which fluctuates due to the coastal dynamics of the presence and absence of mudflats. According to the IUCN guidelines for applying protected area management categories, the Bigi Pan MUMA belongs in Category VI: Protected area with sustainable use of natural resources. The primary objective of this category is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

Bigi Pan is a Western Hemisphere Shorebird Reserve Network (WHSRN) site and a proposed RAMSAR site with growing national and international tourism interest. It is an area mainly used by local fishing interests and a location targeted for oil exploration. This is an area where the decentralization of governance is well advanced, when compared to the rest of rural Suriname. However, a variety of unsustainable anthropogenic activities threatens this multiple-use coastal area. Suriname coastal protected area managers are ill-equipped to address existing and emerging conservation challenges due to two interrelated barriers: insufficient management capacity and inadequate financial resources.

The Nature Conservation Division of Suriname started a GEF co-funded project in 2011 to remove these barriers and improve the conservation capacity of three target coastal MUMAs, including the Bigi Pan MUMA. The GEF co-funded Suriname Coastal Protected Area Management Project promotes the conservation of biodiversity through improved management of protected areas along the western coast of Suriname by supporting: (i) protected area management and local government to describe transparent financial management arrangements, (ii) the creation of a tourism revenue generation model to trial new financial arrangements, including investment in appropriately scaled infrastructure designed to enhance guest services and capture additional tourism revenue; (iii) local consultation commissions to determine best methods of reinvesting a portion of conservation revenue on the community level; and, (iv) the collating of pilot results to capture and report lessons learned and improve and upscale the initial model.

The following scheme shows the relationship between the management plan and various other documents that are tied to this management plan:



This management plan is related to various annexes that are relevant to this management plan. These annexes are listed below:

- Annex 1:
 - Annex 1a: Zoning document
 - Annex 1b Action plan
 - Annex 1c Background document for mgt and monitoring plan
 - Annex 2 Monitoring plan
 - Carrying capacity
- Annex 3 Legal assessment
- Annex 4 Economic Valuation
- Annex 5 Business plan

- Annex 6 Training plan
- Annex 7

Vision

The vision for the Bigi Pan MUMA, as developed when Bigi Pan was established as MUMA in 1987, still prevails and is defined as:

“Maintenance of the biodiversity and long term optimization of the natural productivity of the Bigi Pan MUMA through sustainable use of the natural resources”

Guiding principles of management

Three pillars of sustainable development

The international community recognizes three interdependent and mutually reinforcing pillars of sustainable development which are:

i) Economic development

The aim of authentic economic development is to create social, political and economic conditions that allow each person to reach his or her full potential. The capacity of the human person to generate wealth using knowledge, skills and creativity is unique and reflects a fundamental aspect of human dignity. It is this dignity and the value of human capital as a whole that comprise our greatest resource, and form the basis upon which to ground all steps toward economic development.

ii) Social development

When societies are built upon respect for human dignity and the family, sustainable economic growth and environmental protection become achievable. Social development is thus a prerequisite for a thriving economy and environment. Basic necessities such as access to clean water, sanitation, and adequate healthcare are essential for development. Progress in the reduction of maternal morbidity and mortality likewise are critical given the integral role a woman plays in fostering development in her community. By affirming the fundamental human needs, desires, and rights of each person, a unified commitment to sustainable development may be made.

iii) Environmental protection

Each person is called to recognize his or her personal responsibility to be an effective steward of our natural environment. The fundamental premise upon which responsible stewardship is based is the belief that each person is a precious resource, and that together we may answer the challenges of a growing population with innovation and invention. The goals of development and environmental protection do not stand in opposition, but are instead mutually attainable through a person-centred approach.

Wise use

Wise use of a wetland relates to the concept of the Ramsar Convention on Wetlands and is defined as “the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.”

Precautionary principle

If there are threats of serious environmental damage, lack of scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

Ecological resilience

The capacity of an ecosystem or natural population to resist or recover from major changes in structure and function following natural and human-caused disturbances, without undergoing a shift to a vastly different regime that is undesirable and very difficult to reverse from a human perspective

Principles of an ecosystem approach

The ecosystem approach fosters the sustainable use of ecosystems and the equitable distribution of their benefits. An ecosystem approach is successful if it preserves or increases the capacity of an ecosystem to produce the desired benefits in the future, and increases the capacity of society to fairly apportion benefits and costs. It recognizes the complex functioning of ecosystems and respects their biological thresholds. It conserves ecosystem structure in order to maintain ecosystem productivity.

Participatory co-management

A situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources. It is pluralist approach to managing natural resources, incorporating a variety of partners in a variety of roles, generally to the end goals of environmental conservation, sustainable use of natural resources and the equitable sharing of resource-related benefits and responsibilities. It thrives for social justice and “democracy” in the

management of natural resources compatible with both indigenous knowledge and scientific evidence which is capable of meeting the needs of conservation and development.

Policy framework

A range of plans and strategies exist at the national and regional level that are applicable to the protection and enhancement of natural and cultural values of the Bigi Pan MUMA. Suriname ratified the Convention on Biological Diversity in 1996 and developed a National Biodiversity Strategy (NBS) in 2006, stressing the need for conservation and sustainable use of biodiversity. Suriname began drafting its National Biodiversity Action Plan in 2009 and the initial findings recommend improved monitoring and management of the coastal zone, including updating of management plans. The CBD (Convention on Biodiversity) Program of Work on Protected areas also relates to the management of the MUMA. The PoWPA (Program of Work on Protected Areas) for Suriname mentions protection of lowland ecosystems, protection of the coastal strip with wildlife populations, protection of an important catchment area. The Multi-Annual Development Plan (OP 2012-2016) highlights the need to create integrated management of the coastal zone. The protection of mangrove habitats is identified as a key requirement of the Climate Action Plan for the Coastal Zone of Suriname. The Forest Policy of 2003 is also supportive of the objectives of this project. Suriname is also an active participant and supporter of the RAMSAR Convention. This includes designating and proposing many coastal RAMSAR sites. On a local scale, the Strategic Development Plan for the district of Nickerie (2008 and on) identifies Bigi Pan MUMA as potential for tourism activities, including revenue generation. This plan also focuses on sustainable fisheries, environmental and waste management, as well as public participation.

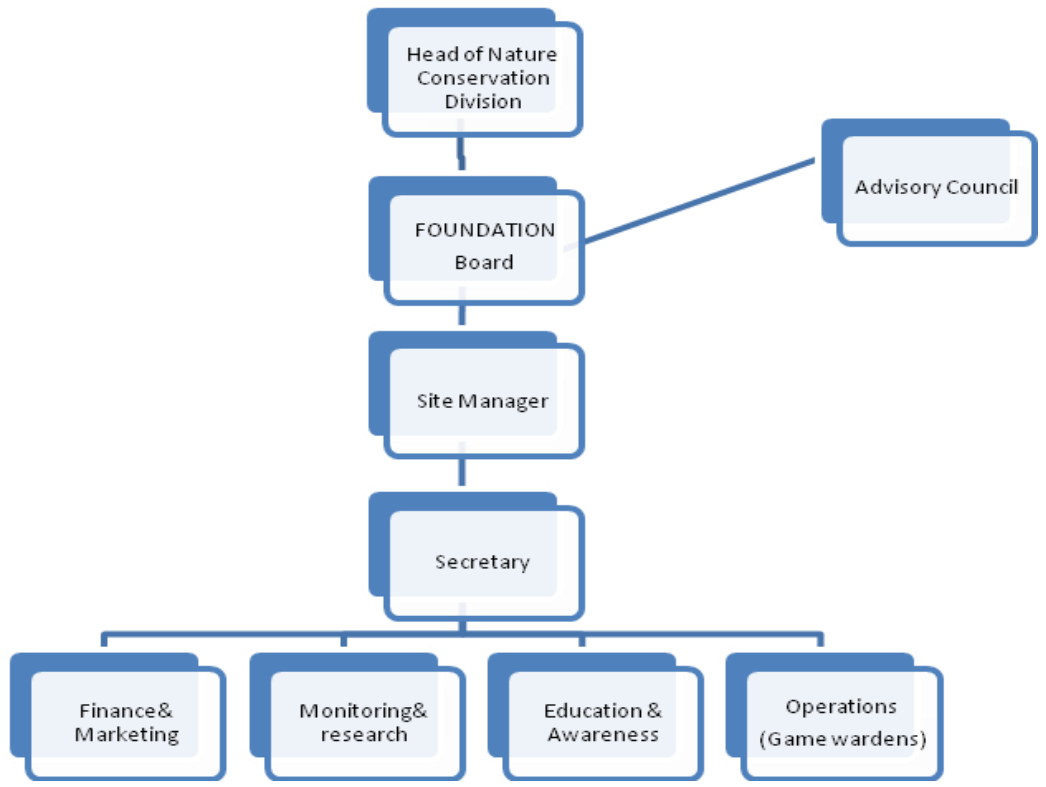
A number of national laws are applicable to the management of the Bigi Pan MUMA. The Game Law (1954) and the Game Resolution (2002) deal with regulation concerning hunting activities. For instance, the law defines time intervals in which specific species of wildlife may be hunted during a calendar year. The Law on Forest Management (1992) provides a basis for special protection of mangrove forests. The Fish Protection Act (1961, updated in 1981) the The Fisheries Act (1980) cover provisions to protect the fish stocks in inland waters (excludes territorial sea and adjoining economic zone). The Law on Sea Fisheries (1980) provides stipulations for the registration of fishing vessels and permit system for sea fisheries. The Mining Decree (1986) contains rules mining exploration and exploitation activities and procedures while the Petroleum Act (1991) deals with regulations concerning petroleum based exploration and exploitation. The Ministerial Decree on Guidelines Issuance of Land in Estuarine Management Areas (2005), the Agricultural Act and Pesticide law are also applicable to the Bigi Pan MUMA.

Management approach - review of the current plan

The first management plan for the Bigi Pan MUMA was developed in 1990. It was reviewed and updated in 1995, revealing that the original plan was hardly implemented and recommending the implementation of the original plan. Until the development of this management plan, less than 10% of the original plan of 1990 has been implemented due to various factors. The management decisions for the Bigi Pan MUMA were made by the Nature Conservation Division; mainly by the Head Office in Paramaribo. The management lacks quantitative and qualitative capacity to implement the management plan effectively and necessary equipment to carry out management tasks was missing for a great deal. In addition, there was a low availability of equipment, including little or no maintenance of existing equipment.

There was also no delegated site manager of or co-management for the MUMA. Local communities were not consulted during the establishment of the MUMA; they had some input in the development of the work plan, but no decision making role. Furthermore, the local communities have some economic benefits from the area, including fishing, ecotourism and hunting. There was only an insignificant secure budget available in relation to Bigi Pan Management, only for existing staff salaries. While the MUMA is highly dependent on donor funding, limited fundraising efforts were undertaken.

Despite the obstructions in effective management, the natural and cultural values of the MUMA are mostly still intact. However, an adapted approach to management, different from the approach in the former two management plans, is apparently necessary to realize effective management of the Bigi pan MUMA. The current management plan will be implemented by a local-based foundation, governed by representatives from government authorities and agencies, as well as local user groups. The plan will be executed in close collaboration with the local users of the MUMA. The plan will be operational between 2013 and 2023 and will be subject to review in 5 years. The management structure of the foundation is given below.



Strategic goal

“To maintain the biological diversity of the Bigi Pan MUMA through conservation and ‘wise use’ of its natural resources based on stakeholder participatory decision making.”

Objectives

The management goals for the Bigi Pan are summarized below by their category.

Bigi Pan MUMA in general

The overarching objectives defined for the MUMA in order to improve general management of the area is contained in the table below. The specific objectives in relation to the different management categories are dealt with in the following tables.

Category	Objectives of management	Justification of the objectives
Bigi Pan MUMA in whole (BPG)	BPG1 To conserve and enhance the natural environment of the estuary and its surroundings	The MUMA comprises a range of marine and terrestrial wetland ecosystems and habitats. These ecosystems and habitats contain a rich variety of flora and fauna of national and international significance.
	BPG2 To enable better overall conservation management of the MUMA through increasing and improving land maintenance activities	Reduced accessibility due to poor infrastructural maintenance (of creeks and canals) can form an obstacle in the management activities of the MUMA.
	BPG3 To engage in identification and implementation of actions to mitigate climate change within conservation and resource management activities	Sea level rise due to climate changes is also likely to affect the environment, ecology and socio-economic conditions of the whole coastal area significantly in the future.
	BPG4 To minimize the environmental impact of human	It is foreseen that economic activities both within and around the

	activities in and around the MUMA (and their associated problems), and to limit the impact of external changes to the natural equilibrium of the estuary.	MUMA impact on the areas environment and biodiversity. Through the monitoring procedures adopted, future data will determine the extent of these impacts and the management procedures required to minimize them.
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Biodiversity

The Bigi Pan MUMA is a tropical estuarine ecosystem which is among the most biologically productive of the world and thus rich in biodiversity. However, these ecosystems are also the most vulnerable to stress and disturbance. The mangrove-covered estuarine ecosystem is an excellent breeding area and nursery of juvenile aquatic organisms and waterfowl; hence it's "nursery function". Open sea fisheries also lie at the basis of the maintenance of the mangrove ecosystem, which forms a temporary habitat for juvenile fish and crustaceans before they migrate to the open sea waters in sub-adult or adult stage. The Bigi Pan MUMA offers many important ecosystem services, of which the most important are hydrological interactions, production of organic matter, food provision for the adjacent marine area; buffer capacity, shoreline protection and stabilization, habitat for migratory and other shorebirds, including birds of international importance. The colony of Scarlet Ibis, for instance, is the second most important/largest one of the species and accounts for 25% of the world population. The MUMA also harbours at least 16 species of international importance and is an established Important Bird Area (IBA) which is a regional conservation work program by BirdLife International, confirming the international biodiversity conservation importance of the site. The Bigi Pan MUMA is also part of an Endemic Bird Area due to the common occurrence of three range-restricted species: Guyanan Piculet, Blood-colored Woodpecker, and Rufous Crabhawk. Therefore, it received the status of "Hemispheric Reserve" within the Western Hemisphere Shorebird Reserve Network (WHSRN). 38 mammal species were identified in the MUMA, as well as 30 fish species. Due to the high biodiversity of the area, the social, economic and cultural importance of the Bigi Pan area cannot be overlooked. The MUMA plays a key role in the livelihoods of the citizens of Nickerie and Coronie because of the many important ecological functions, mentioned above.

Category	Objectives of management	Justification of the objective
Biodiversity (BIO)	BIO1 To conserve and enhance native habitats and wildlife of the Bigi Pan estuary and pay special attention to those areas which support species of conservation and /or economic importance.	The high biodiversity of the MUMA make this biome both locally, nationally and internationally important, for example conservation of the breeding habitats of the Scarlet Ibis and protection of the fisheries 'nursery' function.
	BIO2 To seek to improve the water quality to a level	The maintenance of the hydrological function. Water quality is

	which supports both a healthy estuarine ecosystem and the local community's recreational, aesthetic and commercial needs.	vital to the health of the estuarine ecosystem and is the basis for maintaining healthy biota and its diversity within the MUMA.
	BIO3 To determine the impacts of external influences on the MUMA and manage their impact on biological resources.	Determine the impact of agricultural runoff and excess freshwater inflow from agriculture activities on MUMA.
	BIO4 To determine impacts of oil exploration on MUMA	For example examine the impacts of subsurface and seismic exploration (when high noise levels are reached) on breeding bird colonies, dolphins and manatees (in the coast).

Fisheries

Fishing is an important economic activity within the MUMA. This includes inland fisheries (lagoon and swamp) and marine fisheries (along the coastline until the 6 meter depth line at low tide). Accordingly, different types of fisheries are practiced in the waters of the Bigi Pan MUMA. Next to commercial fishing, many visitors to the MUMA engage in sports and recreational fishing. Some fishermen specialize in certain species of fish and their activities are confined to certain seasons, while others fish the whole year through. Most of the fish, crab and shrimp from the MUMA is sold in New Nickerie and parts of the catch finds its way to Paramaribo and Guyana.

Category	Objectives of management	Justification of the objective
Fisheries (marine and inland) FIS	FIS1 To encourage the conservation of native fish, shellfish and bait stocks and to minimize the environmental impact of their exploitation.	The over-arching goal of commercial and recreational fisheries management is to ensure the long-term sustainability of fisheries resources thereby safeguarding the availability of these resources for future generations. Sustainability of fisheries resources includes conserving biodiversity at all levels, including genetic diversity, as well as supporting terrestrial and aquatic ecosystems.
	FIS2 To sustainably manage the fisheries and water management infrastructure for legitimate users	Unsupervised fisheries activities are taking place in the MUMA and the concern of overfishing remains. Fishermen occasionally damage natural dams for an easier crustacean harvest, with due negative impact on the ecosystem.
	FIS3 To reduce the incidence of poaching activities within the fisheries	The incidence of poaching of fish and crustaceans species occurs across the MUMA area. This undermines the legitimate fishing activities and puts increased

	pressure on the carrying capacity of the MUMA by sustaining fish stocks.
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Ecotourism

Ecotourism is also one of the important activities within the Bigi Pan MUMA. Several tour operators in Paramaribo and New Nickerie offer sight-seeing and bird watching tours. The diversity of landscapes within the MUMA offer abundant potential for nature tourism, including beautiful land- and waterscapes, especially at sunrise and sunset, and over the spectacular scenery of flying flocks of birds. Some other attractions for tourists include swimming, fishing, mud-baths and kayaking. Attractions for bird watchers include the Scarlet Ibis (*Eudocimus ruber*) and the Roseate Spoonbil (*Platalea ajaja*); among the inventoried 122 bird species mentioned earlier; including the 16 birds species of international importance. With regard to both flora and fauna, tourism can have a significant impact on some species, for example, the disturbance of breeding shorebird colonies, as the tourist may come too close to the nests during sight-seeing. Outdoor recreation, like sport or recreational hunting and fishing is mostly done by local people who want to spend the weekend away from home. The Bigi Pan lagoon is currently mostly exploited for tourism activities. There are several simple wooden camps present in the lagoon to accommodate the tourists and there is increasing pressure from developers to create more camps both in Bigi Pan Lagoon and elsewhere. Fishermen camps are also used for this purpose. Approximately 6,000 tourists (estimated) are registered annually for the Bigi Pan lagoon, while the carrying capacity in relation to tourism has not yet been defined.

Category	Objectives of management	Justification of the objective
Eco tourism (ECT)	ECT1 To accommodate and encourage managed recreational use of the estuary at a scale that is appropriate and sustainable to the estuary environment.	Until the tourism carrying capacity has been determined, concerns remain with regard to the impact of tourism numbers on the fragile environmental resources. Furthermore tourism development can create levels of environmental pollution which requires amelioration and management.

Hunting

This activity concerns mainly mammals and birds. A hunting permit has to be obtained for legal hunting. Mammal hunting mainly occurs on the shell- and sand ridges in the MUMA, most probably because of the high frequency in occurrence of game animals. These ridges form a raised strip in the landscape and have a generally east to west orientation. The main species hunted on these ridges is the white tailed deer (“strandhert”; *Odocoileus virginianus*), but reptiles e.g. caiman and iguanas, and other game species are also hunted on these ridges, whenever they are encountered. Birds, especially bush duck, are also popular hunting targets and they are shot throughout the whole MUMA. However, they are also poached (during closed hunting season); especially at their nesting sites. Research shows that a lot of poaching (hunting protected

species and game species in closed hunting season) is taking place the whole year through in the Bigi Pan MUMA. Unfortunately this problem of illegal hunting seems to be rather structural (often and regular) than incidental. Until now no data has been gathered on the game yield of the MUMA, nor the population dynamics (and distribution) of the game species occurring in the MUMA.

Category	Objectives of management	Justification of the objective
Hunting (HNT)	HNT1 To conserve the genetic diversity of game species and permit wildlife stock harvest of the estuary at a scale that is appropriate and sustainable to the estuary's environment.	Unsupervised hunting activities take place in the MUMA, as well as poaching of game in closed hunting season. This also includes illegal hunting (without permits). These activities put the game populations at risk.
	HNT2 To encourage the conservation of protected species and their habitats	Protected species, including birds of international importance are poached; mainly at their breeding sites. These actions puts a greater threat on species that are already at risk.

Research

Some research has been carried out within the Bigi Pan MUMA, but structural research is important for better understanding of the unique ecosystem dynamics. Therefore, research needs to be carried out or continued to ultimately add to the improved management of the MUMA. For instance, the carrying capacity development process includes separate ecosystem aspects which need elucidation.

Focus area	Objectives of management	Justification of the objective
Research (RES)	RES1 To encourage the highest standards of scientific research and monitoring surveys, with minimal environmental impact, that are of value to the conservation management, understanding of the estuary and/or its ecological processes.	There is missing data on the area which impedes management decision making. Missing data includes incomplete fauna species lists and fish population dynamics for the determination of calculation of the optimum fish harvest or fisheries carrying capacity. Other studies required include the rehabilitation of declined fishing areas and optimizing apiculture.

Public participation

The users of the Bigi Pan MUMA have an important input in the management of the MUMA. They emphasize the incorporation of local participation within the management, as to raise more ownership of the MUMA. The users of the Bigi Pan MUMA therefore support the local-based management structure proposal. They encourage the incorporation of user input and feedback in the management structure and also support organizational/management measures which need to be taken in order to increase the quality of the resource utilization and optimal sustainability of the area. Therefore, a holistic approach is recommended to the management approach, with incorporation of user input on a local scale. The revenues which will result from the implementation of the management strategies should eventually support the Bigi Pan management system resulting in a win-win situation, which in turn, will enforce participation of the local users, as well as increase ownership of the area.

Focus area	Objectives of management	Justification of the objective
Public participation (PPT)	PPT1 To seek to manage the Bigi Pan MUMA in a way that is sustainable to the estuarine environment and actively involves the local community, recreational users and commercial interests of the estuary.	Involving the local users and the general public increases ownership of the area and results in a joint effort, as well as shared revenues.
	PPT2 To involve all those with an interest in the estuary in the conservation management of its environment by their inclusion within its program of conservation – monitoring, interpretation and enhancement.	Integrating public participation in every level of management of the Bigi Pan MUMA will result in effective management. For instance, accommodating paying volunteers to take part in research and monitoring will add value to the general management.

Education and awareness

Education and awareness are important keys to the effective management of the MUMA. When the unique characteristics of the area are known to everyone, as well as the permitted action and restrictions within the MUMA, then the management strategies are likely to become more effective.

Focus area	Objectives of management	Justification of the objective
Education and	EAA1 To increase the community's awareness regarding the Bigi Pan MUMA, its ecology and needs, and about the	The local, national, regional and international importance of the MUMA should be advocated in order to improve the

Awareness (EAA)	Management Plan itself, its aims and objectives and the responsibilities of the community towards the continued conservation of the estuarine ecosystem of the Bigi Pan MUMA.	management of the MUMA. The public should be made aware of the importance of the area in order to contribute to the conservation needs and management. The public are also more likely to actively contribute to the management of the area when the management goals are clearly defined and known to everyone.
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The means of achieving the abovementioned objectives are mentioned in the action plan, located in Appendix 1b.

Bigi Pan management zones & prescriptions

The Bigi Pan MUMA comprises of a complex array of highly dynamic habitats and ecological zones, both the conservation and sustainable use of these ecosystems and habitats are central to the reason for designation of the MUMA. The boundaries of each of the ecological zones represented in the MUMA, can on the whole be clearly defined on the ground, thus making zone identification and therefore management a straightforward option in current circumstances¹. It is recommended that in this management plan, the ‘site management zones’ be determined on an ecological basis.

Each zone description includes a purpose statement of the Conservation Objective and Management Intention, thereby highlighting the management and conservation focus of each individual zone. Additionally purpose statements are further amplified by descriptions of:

- permitted activities (those activities which do not require individual management approval each time they are undertaken)
- incompatible activities (those activities which are deemed to be clearly incompatible with the purposes of the zone and will generally not be permitted in that zone except in exceptional circumstances) and
- activities requiring management approval (those activities which are not clearly incompatible with the purposes of the zone but which may have adverse impacts and therefore require case by case management approval, in some cases following an environmental impact assessment).

Bigi Pan management zones

INSERT SMALL REPRESENTATIVE PHOTO OF EACH ZONE TYPE AND ZONE MAP (GIS LAYER FOR EACH ZONE TYPE)

(MMZ) Marine Management Zone	Prescription
Conservation Objectives	<ul style="list-style-type: none"> • The maintenance of marine biodiversity and ecosystem functioning in the Bigi Pan Marine Zone
Management Intentions	<ul style="list-style-type: none"> • To promote sustainable fishing activities. • Management / protection of marine biota.

¹ The methodology based on land uses was discounted at this stage because of lack of geographical data and current land use data. Furthermore the ability of a new Bigi Pan Foundation being able to manage a more complex system of zoning without long term capacity building and experience was not considered feasible at this stage.

	<ul style="list-style-type: none"> • Provide effective protection for existing biodiversity and recovery of degraded habitats, leading to increased biodiversity and resource production. • Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone. • Develop adaptive management to combat global warming sea changes.
Permitted Activities	<ul style="list-style-type: none"> • Licensed fishing activities. • Passive recreation activities such as bird watching.
Incompatible Activities	<ul style="list-style-type: none"> • Fishing without permits. • Fishing with explosives. • Fishing with illegal net sizes. • Fishing using highly damaging bottom trawling and dredging techniques. • Dumping of waste materials (including liquids, oils and human waste).
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority • Introduction of non-traditional fishing activities. • Development of tourism infrastructure and / or non-passive tourism activities. • Prospecting for oil or other minerals. • Access for the purposes of research, education and training Access for the purposes of research, education and training as licensed by NCD.

(LMZ) Littoral Zone	Prescription
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LMZ1 Mud Flats LMZ2 Sand Beach	
Conservation Objectives	<ul style="list-style-type: none"> • The maintenance of marine biodiversity and ecosystem functioning in the Bigi Pan Littoral Zone
Management Intentions	<ul style="list-style-type: none"> • To ensure conservation of the marine habitats located between the low and high water marks. • To conserve the breeding / feeding areas for Crustaceans. • To protect bird and wildfowl feeding areas. • Access for the purposes of education and training. • Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone. • .
Permitted Activities	<ul style="list-style-type: none"> • Fishing for Crustaceans using traditional methods • Ecotourism (bird watching / boat safari)
Incompatible Activities	<ol style="list-style-type: none"> 1. Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. 2. Sand Mining (LMZ2) <ul style="list-style-type: none"> • Dumping of waste materials (including liquids, oils and human waste). 3. Poaching / taking of birds and waterfowl without license and / or out of the hunting season defined by law.
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority • Development of tourism infrastructure and /or non-passive tourism activities (LMZ2).

	<ul style="list-style-type: none"> • Any use or application of chemicals (fertilisers, biocides, etc. • Access for the purposes of research, education and training Access for the purposes of research, education and training as licensed by NCD. • Prospecting for oil or other minerals.
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(SRM) Sand Ridges	Prescription
Conservation Objectives	<ul style="list-style-type: none"> • Conservation of sand ridge habitats and its associated flora and fauna.
Management Intentions	<ul style="list-style-type: none"> • Promote annual sustainable harvesting of game species through introduction of ‘game management plans’ • Conservation of flora / fauna habitat types found on sand ridges. • Develop adaption and responses measures to climate change and mitigate its effects through wise use of the sand ridge resources. • Develop compatible Ecotourism activities.
Permitted Activities	<ul style="list-style-type: none"> • Legal hunting activities. • Passive ecotourism such as hiking and bird watching. • Prescribed targeted monitoring. • Habitat management including fire-fighting, • Control/removal of non-native species • Management of visitor effects, maintenance of public infrastructure and erosion control, • Collection of non-timber forest products (berries, medical herbs etc). • Apiculture and placing of beehives.
Incompatible Activities	<ul style="list-style-type: none"> • Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. • Poaching game and other species.

	<ul style="list-style-type: none"> • Taking of game out of hunting season. • Exceeding the allowed 'game bag'. • Lighting of fires. • Dumping of waste materials (including liquids, oils and human waste). • Introduction of non native species. • Removal of aggregates, construction and operation of industrial facilities. • Conversion of land to agricultural production.
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority • Development of tourism infrastructure and / or non-passive tourism activities. • Access for the purposes of research, education and training Access for the purposes of research, education and training as licensed by NCD. • Any use or application of chemicals (fertilisers, biocides, etc.) • Commercial harvesting of timber or other products. • Prospecting for oil or other minerals.

(MGZ) Mangrove MGZ1 Juvenile Forest MGZ2 Mature Forest MGZ3 Dying Forest	Prescription
Conservation Objectives	<ul style="list-style-type: none"> • Conservation and protection of the Mangrove Ecosystem from degradation and maintenance of its 'nursery' functions.
Management Intentions	<ul style="list-style-type: none"> • Respond to climate change and mitigate its effects through the protection,

	<p>rehabilitation and wise use of Suriname mangrove ecosystems.</p> <ul style="list-style-type: none"> • Restoration of degraded Mangrove areas; • Maintenance of genetic diversity of endemic mangrove species. • Maintain and protect the feeding, breeding, spawning and hatching of sedentary and migratory fish species on which local fishermen depend. • Creation of awareness among the population on importance of Mangrove Ecosystem and the need for their conservation. • Promote sustainable tourism based on ‘mangrove experience’ including construction of walkways and interpretation facilities.
Permitted Activities	<ul style="list-style-type: none"> • Habitat management including fire-fighting. • Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone. • Control/removal of non-native species. • Management of visitor effects, maintenance of public infrastructure and erosion control. • Removal of dead mangrove poles for traditional use in fishing industry (MGZ3). • Establishment of mangrove nursery facilities and removal of vegetative material for propagation purposes. • Apiculture and placing of beehives.
Incompatible Activities	<ul style="list-style-type: none"> • Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. • Introduction of non-native species. • Cutting live mangrove without consent. • Lighting fires. • Hunting activities without permit and poaching game and non game species.

	<ul style="list-style-type: none"> • Dumping of waste materials (including liquids, oils and human waste) • Conversion to other uses (fishponds, wharves etc). • Conversion of land to agricultural production.
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority. • Cutting of new dykes and waterways. • Construction of tourist facilities. • Construction of agriculture facilities / fish farming. • Prospecting for oil or other minerals. • Small scale sustainable activities / production (craft materials, specialized foods etc). • Sustainable forestry activities. • Access for the purposes of research, education and training Access for the purposes of research, education and training as licensed by NCD. • Commercial collection of leaves and fruits. • Extraction of resins. • Any use or application of chemicals (fertilisers, biocides, etc.

(LGZ) Lagoon	Prescription
Conservation Objectives	<ul style="list-style-type: none"> • Conservation and protection of the Lagoon and open water environment and maintain sustainable use / harvesting of the resources.
Management Intentions	<ul style="list-style-type: none"> • To ensure monitoring and maintenance of water quality. • To manage the hydrological requirements of the Bigi Pan MUMA

	<ul style="list-style-type: none"> • Conservation of flora and fauna. • Maintain and manage a sustainable fishery. • Identify and develop low impact ecotourism opportunities that directly benefit local communities.
Permitted Activities	<ul style="list-style-type: none"> • Licensed fishing activities. • Passive recreation activities such as bird watching. • Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone. • Control/removal of non-native species. • Management of visitor effects, maintenance of public infrastructure.
Incompatible Activities	<ul style="list-style-type: none"> • Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. • Commercial fishing without permits and poaching. • Sport fishing without permits and poaching. • Fishing with explosives. • Fishing with illegal net sizes. • Hunting activities without permit and poaching game and non game species. • Dumping of waste materials (including liquids, oils and human waste). • Introduction of non-native species. • Tourism activities that disturb wildlife and / or tranquility of lagoon environment (high speed leisure craft etc). • Draining and conversion of land to agricultural production.
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval

	<p>by the MUMA Management Authority.</p> <ul style="list-style-type: none"> • Any use or application of chemicals (fertilisers, biocides, etc). • Access for the purposes of research, education and training Access for the purposes of research, education and training as licensed by NCD. • Establishment of fish / shrimp farms • Cutting of new dykes and waterways in / out of lagoon. • All tourism infrastructure development proposals. • Construction of fishing infrastructure (jetties, landing stages etc) • Extraction of water. • Prospecting for oil or other minerals.
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MRZ Marsh	Prescription
(MRZ1) Brackish short grass (MRZ2) Brackish fern marshes (MRZ3) Brackish-Fresh Water short grass / fern marsh (MRZ4) Brackish to fresh-water tall grass marsh (MRZ5) Freshwater tall grass marshes	
Conservation Objectives	<ul style="list-style-type: none"> • Conservation of marsh habitats and diversity of the flora and fauna present.
Management Intentions	<ul style="list-style-type: none"> • Promote ‘wise use’ of the Bigi Pan marshland. • Develop and promote ecotourism activities based on bird watching and other commensurate activities.
Permitted Activities	<ul style="list-style-type: none"> • Passive recreation activities such as bird watching. • Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone. • Habitat management including fire-fighting. • Control/removal of non-native species.

	<ul style="list-style-type: none"> • Management of visitor effects, maintenance of public infrastructure and erosion control. • Legal hunting activities. • Collection of non-timber forest products (berries, medical herbs etc). • Apiculture and placing of beehives.
Incompatible Activities	<ul style="list-style-type: none"> • Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. • Lighting Fires • Hunting activities without permit and poaching game and non-game species. • Introduction of non-native species. • Removal of aggregates, construction and operation of industrial facilities. • Dumping of waste materials (including liquids, oils and human waste). • Draining and conversion of land to agricultural production.
Activities Requiring Management Approval	<ul style="list-style-type: none"> • Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. • Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority. • Stock grazing. • Cutting of new dykes and waterways. • All tourism infrastructure development proposals. • Any use or application of chemicals (fertilisers, biocides, etc). • Access for the purposes of research, education and training as licensed by NCD. • Prospecting for oil or other minerals.

(FRZ) Forest FRZ1 Swamp Wood Brackish to fresh-water swampwood FRZ2 Mesophytic	Prescription
Conservation Objectives	<ul style="list-style-type: none"> ● Protection, rehabilitation and conservation of forests.
Management Intentions	<ul style="list-style-type: none"> ● Sustainable management of forest resources.
Permitted Activities	<ul style="list-style-type: none"> ● Introduce an effective monitoring program of both biological and socio-economic impacts of the marine management zone.Habitat management including fire-fighting, ● Control/removal of non-native species. ● Management of visitor effects, maintenance of public infrastructure and erosion control. ● Apiculture and placing of beehives.
Incompatible Activities	<ul style="list-style-type: none"> ● Unauthorised collection, destruction, or disturbance of indigenous wild fauna and flora. ● Lighting Fires ● Hunting activities without permit and poaching game and non-game species. ● Removal of aggregates, construction and operation of industrial facilities. ● Introduction of non-native species. ● Draining and conversion of land to agricultural production.
Activities Requiring Management Approval	<ul style="list-style-type: none"> ● Activities that are neither permitted nor clearly incompatible with the conservation objectives and management intentions of the zone. ● Activities subject to an Environmental Impact Assessment prior to possible approval by the MUMA Management Authority. ● Limited forestry operations particularly aimed at forest recovery. ● Any use or application of chemicals (fertilisers, biocides, etc). ● Access for the purposes of research, education and training as licensed by NCD.

Bigi Pan Recreational Carrying Capacity and Indicators

Carrying Capacity is defined by the IUCN as:

“The capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability and capability of renewal, thus, carrying capacity is the upper capacity of human activity which when exceeded causes deterioration in the resource base”

Scientists and managers have discussed the concept of carrying capacity for many years and attempts to determine carrying capacity have been undertaken at various scales from regional down to single sites. Early attempts to determine Carrying capacity were based on setting maximum numbers of persons using a site by day and by year, this was found to be both highly inaccurate and impractical for management purposes, since carrying capacity varies depending on place, season, time, user behavior, facility design, patterns and levels of management and the dynamic characteristics of the site itself. Although even today, attempts are made by some managers to apportion numbers to sites, this has largely been superseded by progressive managers who manage visitor numbers through a continual process based on setting a framework for assessing capacity indicators and continuous monitoring to determine the management decisions. There are a wide number of frameworks on which this approach can be based, the most common being the Limits of Acceptable Change.

Although Bigi Pan is an extensive area, visitors are currently concentrated into one small area comprising of the Bigi Pan lagoon and the main entrance canal to the lagoon and it is within this immediate area where visitor impacts will be most significant for the foreseeable future, these include:

- Lowering of water quality resulting from:
 - inadequate sewage treatment mainly resulting from the lack of sewage collection / treatment in the lake ‘ecolodges’
 - pollution from lake bathing
 - increased use of motor powered boats
- Disturbance to wildlife
- Destruction of vegetation on canal and lakeside banks / bottom from boat induced water swell
- Litter (especially plastics)

Apart from Bigi Pan lagoon, potential for further development also exists in the Afdamming area, especially around the lakes and waterways, this area is highly accessible from the road and therefore could attract large numbers of visitors if investment in tourist infrastructure is made.

Visitor numbers to Bigi Pan MUMA are estimated at between 6 – 12000 person visits / year, and it can be expected that this number will grow over the lifetime of the management plan. Managing the impacts of visitors will therefore increasingly become an issue for the MUMA's managers, thus immediate action needs to be taken to ensure growing visitor numbers can be accommodated without loss of environmental quality. It is therefore proposed that the following steps are taken.

1. Negotiations will take place with current owner / operators of 'ecolodges' located on Bigi Pan lagoon to take steps to manage the sewage outflows to the lagoon, with the ultimate aim of stopping all sewage outfall into the lagoon within ten years. Any new developments undertaken within the current ten- year management plan period will have to build systems which have zero impact on lagoon water quality.
2. MUMA Management will develop, publish and adopt in conjunction with the current owner / operators of tourist services / facilities using Bigi Pan Muma 'guidelines for sustainable visitor management for Bigi Pan Muma.
3. Special attention will be paid to the results gathered from the ongoing environmental monitoring, and furthermore, additional monitoring specific to visitor management will be commenced (Annex xx) to identify visitor impacts and subsequently initiate the interventions required to manage the impacts.
4. A moratorium on any increase in numbers of 'ecolodges' within Bigi Pan lagoon will be put in place, until such time that the environmental impact of the current developments have been determined and actions taken to reduce their impact on the lagoon environment. Any new developments will only be allowed if it is determined that carrying capacity for Bigi Pan lagoon has not already been exceeded.
5. The MUMA management within the next two years develop and publish a tourism strategy including master plans for Bigi Pan lagoon and Afdamming. Special attention will be paid to the combined results of monitoring in the previous two years to determine a framework for calculating 'limits of acceptable change'.

Appendix 1b: Bigi Pan management action plan

The action plan, formulated according to the management objectives, is given in the table below.

Three priority levels are used: H = High
 M = Medium
 L = Low

Category	Objectives	Actions	Deliverables/indicators	Time target	Priority	Key Partners
Bigi Pan MUMA in general (BPG)	BPG1 To conserve and enhance the natural environment of the estuary and its surroundings	Have Bigi Pan Management Plan adopted and operational and develop procedure handbook	Management Plan adopted by government Procedure handbook	2013	H	NCD
		Establish foundation management structure and have main personnel appointed, trained and operational	Foundation operational	2013	H	NCD
		Establish regular coordinating meetings with (decentralized and governmental) stakeholders of the MUMA (like the water board and the Ministry of public works)	Meeting notes	3014	H	Bigi Pan Management Foundation
		Purchase of equipment and perform periodic maintenance of equipment	Equipment purchases Equipment inventory and maintenance schedule	2014	H	NCD/ Bigi Pan Management Foundation
		Establish a good equipped facility/ checkpoint office at the entrance to the Bigi Pan lagoon (“sleephelling”)	Checkpoint building in place with necessary equipment	2013	H	NCD/ Bigi Pan Management Foundation

		Establish satellite camp at Kaaimanpolder adjacent to Zeedijk	Satellite camp in place with necessary equipment	2015	M	Bigi Pan Management Foundation
		Formulate rules and regulations in regard of actions allowed and prohibited within the MUMA	Publication of rules and regulation of the MUMA	2014	H	Bigi Pan Management foundation
	BPG2 To enable better overall conservation management of the MUMA through increasing and improving land maintenance activities	Compile an up to date map of the area containing issued land within and around the MUMA with the types of issued land	Up to date map of MUMA containing types of issued land	2013	H	NCD
		Extract issued land areas within the MUMA from the management areas of the MUMA	Official map of adjusted MUMA area according to abovementioned map	2013	H	NCD
		Assess the possibility of establishing buffer areas around the terrestrial boundaries of the MUMA (with according land use prescriptions). This could also include altered land.	Map/report with assessed possibilities and recommendations using the above mentioned maps	2014	M	NCD/Bigi Pan Management foundation
	BPG3 To engage in identification and implementation of actions to mitigate climate change within conservation and resource management activities	Complete a flood study for the MUMA and surrounding land that takes into account the latest prediction for sea level rise	Flood simulation report	2014	H	Bigi Pan Management foundation / WLA / Adek
	BPG4 To minimize the environmental impact of human activities in and	Obligate preparation of social and environmental impact assessment for major planning	EISA required by ministerial decree	2014	H	NCD/Bigi Pan Management foundation

around the MUMA (and their associated problems), and to limit the impact of external changes to the natural equilibrium the estuary.	applications for any area within, adjoining or related to the MUMA				
	Facilitate monitoring of people and cargo in and out of the MUMA	Monitoring programs databases in place and updated regularly	2014	H	Bigi Pan Management foundation
	Develop a waste management master plan for the Bigi Pan lagoon	Waste management plan adopted and implemented	2013-2017	H	Bigi Pan Management foundation/Adek
	Implement a monitoring program for pesticide levels in water and biota	Pesticide monitoring database	2014	H	WLA/ADRON/CELOS
	Facilitate equipment and implement frequent control patrols program by the game wardens and assess activities of the users within the MUMA (inland and marine)	Patrols reports	2013	H	Bigi Pan Management
	Compile a crisis/disaster management protocol to deal with drastic changes in the characteristics of the MUMA, including water quality	Disaster management protocol	2015	M	Bigi Pan stakeholders
	Conduct habitat mapping of the estuary including the aquatic and semi aquatic vegetation every two years.	GIS layer showing habitat distribution	2014	M	NARENA/RGB
	Conduct mangrove mapping	GIS layer showing mangrove areas	2015	M	Bigi Pan Management Foundation / NARENA
	Regulate boat traffic on the	Implement and publish boat	2013	M	Bigi Pan Management

		estuary to minimize impacts (water turbidity), enhance safety, and reduce pollution and nuisance by permitting boats with 6 persons maximum and 15 HP engine	traffic requirements			and stakeholders
Biodiversity (BIO)	BIO1 To conserve and enhance native habitats and wildlife of the Bigi Pan estuary and pay special attention to those areas which support species of conservation and /or economic importance.	Rehabilitate estuarine habitat damaged by (illegal) rice cultivation activities	Improvements in ecological health and aesthetic indices	2016	M	Bigi Pan management foundation/Adek
		Conduct habitat mapping of the estuary including the aquatic and semi aquatic vegetation every two years.	GIS layer showing habitat distribution	2014	M	NARENA/RGB
		Continue process to establish Ramsar status for Bigi Pan MUMA	Ramsar status established	2014	H	NCD/Bigi Pan Management foundation
	BIO2 To improve the water quality to a level which supports both a healthy estuarine ecosystem and the local community's recreational, aesthetic and commercial needs.	Support brackish water characteristics in the MUMA by maintaining the water accessibility of the canals and creek mouths	Patrols reports Water quality monitoring results	2014	M	Bigi Pan Management foundation
		Establish and maintain a database to track ongoing water quality monitoring programs in the estuary	Water quality monitoring programs database in place and updated regularly	2014	H	WLA/ADEK Hydrology and or Environmental dept
		Compile a crisis/disaster management protocol to deal with drastic changes in the characteristics of the MUMA, including water quality	Disaster management protocol	2015	M	Bigi Pan stakeholders

	BIO3 To determine the impacts of external influences on the MUMA and manage their impact on biological resources.	Assess the occurrence of alien (plant and animal) species within the MUMA and incorporate the monitoring of these species, if any.	Alien species assessment report/list Alien species monitoring program implemented	2013	M	Adek / Bigi Pan Management foundation
		Compile a crisis/disaster management protocol to deal with drastic changes in the characteristics of the MUMA, including water quality	Disaster management protocol	2015	M	Bigi Pan stakeholders
	BIO4 To determine impacts of oil exploration on MUMA	Examine the impacts of explosive blasts on breeding bird colonies	Research reports	2014-2015	M	Bigi Pan Management foundation / Adek
Fisheries (marine and inland) (FIS)	FIS1 To encourage the conservation of native fish, shellfish and bait stocks and to minimize the environmental impact of their exploitation.	Implement monitoring of the fisheries harvest for each species of fish or crustacean on daily basis	Fisheries harvest database in place and updated accordingly	2013	H	Bigi Pan Management foundation / Adek
		Establish program to carry out periodic fish and crustacean population analyses (through methods of fish population analysis (2010) by Kevin L. Pope).	Periodic fish and crustacean population analysis	2014	H	Bigi Pan Management foundation / Adek / LVV
		Determine optimum fish harvest (carrying capacity) for economically important fish and crustacean species	Carrying capacity for fisheries harvest determined	2014	H	Bigi Pan Management foundation / Adek / LVV
		Develop and implement a rehabilitation plan to restore declined fishing areas	Improvements in ecological health and aesthetic indices, including fisheries harvest	2015	M	Bigi Pan Management foundation / Adek

		Identify key fish habitat areas (including spawning areas) in the estuary and develop management actions to protect and improve fish habitat.	Research reports	2015	H	Bigi Pan Management foundation / Adek
		Establish ongoing monitoring program to collect information on day visitor (recreational fishermen) to the Bigi Pan MUMA over time	Day visitor database Fish harvest database	2013	M	Bigi Pan Management foundation / Adek / LVV
FIS2 To sustainably manage the fisheries and water management infrastructure for legitimate users		Establish a good equipped facility/ checkpoint office at the entrance to the Bigi Pan lagoon (“sleephelling”)	Checkpoint building in place with necessary equipment	2013	H	NCD / Bigi Pan Management foundation
		Develop and implement minimal requirements of fishermen’s camps and develop carrying capacity	Published and implemented minimal requirements for fishermen camps	2013	M	Bigi Pan Management foundation / stakeholders
		Develop a waste management master plan for the Bigi Pan lagoon	Waste management plan adopted and implemented	2014	H	Bigi Pan Management foundation / Adek
		Develop and implement an integrated communication strategy/system (incorporating GIS technology and used for communicating complaints and other aspects of the MUMA), for management and user/public interaction/participation	GIS communication system implemented	2014	H	Bigi Pan Management and stakeholders
	FIS3 To reduce the	Develop and implement fisheries	Quota limit implemented	2015	H	Bigi Pan Management

	incidence of poaching activities within the fisheries	quota limit for economically important fish and crustacean species.				foundation / Adek / LVV
		Require fishermen to comply with fishing permit rules and requirements by conducting game wardens patrols and inspection of fisheries activities	Patrols reports	2013	H	Bigi Pan Management foundation
Eco tourism \ (ECT)	ECT1 To accommodate and encourage managed recreational use of the estuary at a scale that is appropriate and sustainable to the estuary's environment.	Establish minimum occupancy of visitors and introduce entrance fee.	Database of visitors and collected fees	2013	H	Bigi Pan Management foundation
		Develop a waste management master plan for the Bigi Pan lagoon	Waste management plan adopted and implemented	2014	H	Bigi Pan Management foundation / Adek
		Implement Suriname tourism guidelines in accordance with the precautionary principle related to tourism activities	Rules and regulations, and requirements in relation to tourism activities	2016	M	Bigi Pan Management foundation / stakeholders
		Develop and implement minimal requirements for tourist camps/lodges and implement permits for tour operators	Publish and integrate minimal requirements for camps	2016	M	Bigi Pan Management foundation / stakeholders
		Encourage continuously improving environmental friendly tourism activities and promote green technology and strategies to enhance visitor experience	Visitor awareness folder	2017	M	Bigi Pan Management foundation / stakeholders
		Develop and implement polluters pay principle and administer	Established by ministerial decree	2016	M	Bigi Pan Management foundation / NCD

		<p>finer for trespassing waste/pollution rules</p> <p>and implement a monitoring plan for the visitor impact on the ecosystem, including trail erosion, canal or bank erosion, and e-coli levels</p> <p>Determine and integrate tourism carrying capacity</p> <p>Regulate boat traffic on the estuary to minimize impacts (water turbidity), enhance safety, and reduce pollution and nuisance by permitting boats with 6 persons maximum and 15 HP engine</p> <p>Develop signage and infrastructure to maintain approach limit of 50-60 meters to breeding bird colonies to prevent nesting disturbance and disruption</p> <p>Develop appropriate nature friendly infrastructure and facilities for visitors including wooden trails, piers, bird hides/watchtowers to manage visitor activity</p>	<p>Pollution fines administration in place</p> <p>Visitor impact database</p> <p>Tourism carrying capacity determined</p> <p>Publish and integrate boat traffic requirements</p> <p>Nature friendly and esthetic signage and infrastructure placed approximately 50 meters from nesting site</p> <p>Visitor infrastructure and facilities:</p> <ul style="list-style-type: none"> • Pier at “sleephelling” and afdamming • Watchtowers at Bigi Pan Lagoon and Afdamming • Wooden trails 	<p></p> <p>2013</p> <p>2015</p> <p>2014</p> <p>2014</p> <p>2016</p>	<p></p> <p>H</p> <p>M</p> <p>H</p> <p>H</p> <p>M</p>	<p></p> <p>Bigi Pan Management foundation / Adek</p> <p>Bigi Pan Management foundation / Adek</p> <p>Bigi Pan Management foundation</p> <p>Bigi Pan Management foundation / NCD</p> <p>Bigi Pan Management foundation</p>
Hunting	HNT1 To conserve the	Establish a good equipped	Checkpoint building in place	2013	H	NCD

(HNT)	genetic diversity of game species and permit wildlife stock harvest of the estuary at a scale that is appropriate and sustainable to the estuary's environment.	facility/ checkpoint office at the entrance to the Bigi Pan lagoon ("sleephelling")	with necessary equipment			
		Develop a waste management master plan for the Bigi Pan lagoon	Waste management plan adopted and implemented	2014	H	Bigi Pan Management foundation / Adek
		Implement monitoring of the game yield from the MUMA for each species of game on daily basis	Game yield database	2013	H	Bigi Pan Management foundation
		Establish program to carry out periodic game species population assessments	Game population assessment reports	2015	H	Bigi Pan Management foundation / Adek
		Determine optimum game harvest (carrying capacity) for game species	Hunting carrying capacity determined and updated accordingly	2015	H	Bigi Pan Management foundation / Adek
		Develop and incorporate game quota limit for every game species (in accordance with the carrying capacity); review and adjust the hunting law for the MUMA and replace the bag limit with the quota limit (adjusted according the carrying capacity)	Adjusted hunting law for the MUMA(s) by ministerial decree. Game quota and hunting season determination subjected to changes in game populations dynamics	2016	H	Bigi Pan Management foundation
		Require hunters to comply with hunting permit rules and requirements by conducting game wardens patrols and inspection of hunting activities	Patrol reports	2013	H	Bigi Pan Management foundation
		Develop and execute awareness	Program reports and	2013	H	Bigi Pan Management

		program concerning the effects of poaching (game and protected species) on the MUMA in relation to the international importance of the MUMA (occurrence of birds of international importance, IBA and Hemispheric Reserve)	pamphlets, signage delivered			foundation /NCD
	HNT2 To encourage the conservation of protected species and their habitats	Facilitate the adoption of poachers into the MUMA management system and enroll in game warden training in order to enhance their livelihoods and contribute to the overall management of the area	Poacher adoption program in place	2016	M	Bigi Pan Management foundation
		Establish program to carry out periodic population assessments of protected species, including Jaguar and Scarlet Ibis	Protected species population assessments reports	2013	H	Bigi Pan Management foundation / Adek / NZCS
		Develop and execute awareness program concerning the effects of poaching (game and protected species) on the MUMA in relation to the international importance of the MUMA (occurrence of birds of international importance, IBA and Hemispheric Reserve)	Program reports and pamphlets, signage delivered	2014	H	Bigi Pan Management foundation
Research (RES)	RES1 To encourage the highest standards of	Identify information gaps (for instance mammal and amphibian	Research projects Scientific reports, papers and	2013-2018	M	Bigi Pan Management foundation / Adek

scientific research and monitoring surveys, with minimal environmental impact, that are of value to the conservation management, understanding of the estuary and/or its ecological processes.	species list; game, fish and crustacean populations) and develop research programs aimed at gathering/consolidating data on biodiversity and exploited species (including carrying capacity)	publications.			
	Determine optimum fish harvest (carrying capacity) for economically important fish and crustacean species	Carrying capacity for fisheries harvest determined	2014	H	Bigi Pan Management foundation / Adek / LVV
	Develop and implement a rehabilitation plan to restore declined fishing areas	Improvements in ecological health and aesthetic indices, including fisheries harvest	2015	M	Bigi Pan Management foundation / Adek
	Establish program to carry out periodic game species population assessments	Game population assessment reports	2015	M	Bigi Pan Management Foundation / Adek
	Determine and integrate tourism carrying capacity	Tourism carrying capacity determined	2015	M	Bigi Pan Managent Foundation / Adek
	Assess the occurrence of alien (plant and animal) species within the MUMA and incorporate the monitoring of these species, if any.	Alien species assessment report/list Alien species monitoring program implemented	2013	M	Adek / Bigi Pan Management foundation
	Develop and implement a rehabilitation plan to restore declined fishing areas (like Merki, Middenstandspolder and others)	Improvements in ecological health and aesthetic indices, including fisheries harvest	2015	M	Bigi Pan Management foundation / Adek
	Develop and integrate paying	Volunteer program	2014	M	Bigi Pan Management

		volunteers program to assist in the execution of research and monitoring projects	implemented			foundation
		Compile and execute pilot project beekeeping within the MUMA	Apiculture project reports	2016	M	Bigi Pan Management foundation / Adek / LVV
Public participation (PPT)	PPT1 To manage the Bigi Pan MUMA in a way that is sustainable to the estuarine environment and actively involves the local community, recreational users and commercial interests	Develop and implement an integrated communication strategy/system (incorporating GIS technology and used for communicating complaints and other aspects of the MUMA) to the management foundation, for management and user/public interaction/participation	GIS communication system implemented	2014	H	Bigi Pan Management foundation
		Maintain stakeholder database	Stakeholder database	2013	H	Bigi Pan Management foundation
	PPT2 To involve all those with an interest in the estuary in the conservation management activities by including them within the program of conservation – monitoring, interpretation and enhancement.	Develop and incorporate master plan to incorporate users and all others with an interest in the estuary in active management of the MUMA (including input via website)	Public participation plan/strategy implemented	2014	M	Bigi Pan Management foundation and stakeholders
Education and	EAA1 To increase the community's awareness	Compose educational and informative material including	Posters, signage, pamphlets, literature	2013	M	Bigi Pan Management foundation

awareness (EAA)	regarding the MUMA, its ecology, and about the Management Plan itself, its aims and objectives and the responsibilities of the community towards the continued conservation efforts of the estuarine ecosystem	signage, posters, pamphlets and relevant info to enhance visitor experience				
		Compile booklet for general public, highlighting the importance and resources of the MUMA, how to utilize them, the importance of conservation measures taken, and the revenues generated	Publish booklet every 2 years concerning the importance of the MUMA, using monitoring data	2014	M	Bigi Pan Management foundation
		Compile and execute awareness program concerning the effects of poaching (game and protected species) on the MUMA in relation to the international importance of the MUMA (occurrence of birds of international importance, IBA and Hemispheric Reserve).	Program reports and pamphlets, signage delivered	2013-2018	H	Bigi Pan Management foundation / Adek
		Make MUMA information and data readily available to the general public through information management system and internet (also for easily incorporating data into next management update)	Updated website and information management system	2013	M	Bigi Pan Management foundation / stakeholders
		Promote world wetlands day as a public event and organize special activities on this day which highlight the importance of the	Activities executed on wetlands day	2014	M	Bigi Pan Management foundation

		MUMA				
		Mark boundaries of MUMA and generate billboards/signage communicating the size, importance, resources and revenue	Signage placed	2013	H	Bigi Pan Management foundation
		Encourage field excursions to the estuary by local schools, community groups and other stakeholder groups	Reports	2014	M	Bigi Pan Management foundation